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## **An ethno-archaeological study of pre-industrial metallurgy**

*– Perspectives and models for research on cognition of outfield activities*

Based on ethno-archaeological and ethnographic research among the Pangwa of South-western Tanzania, I will illustrate how proto-industrial or pre-modern iron metallurgy was associated with local concepts of morality. Ritual, technological and mundane everyday activities are viewed by the Pangwa of Tanzania as *moral stages* where people perform and negotiate over right and wrong or good and bad in line with an overall bodily based metaphoric scheme. With a *thermodynamic way of thinking* in which the body must be in balance, people operate in technological activities, in their daily lives, at home or when out in the wasteland.

### **Introduction**

One of the greatest characteristics of Modernism has been its efforts to divide and classify all sorts of phenomena into specific and separate categories (Latour 1996, 1999, Barndon 2001a:47). The most common distinction that has been made is between objects and subjects, or humans and non-humans, while social sciences and archaeology, have faced the distinctions between functional and symbolic, practical and ritual (Olsen 2000). In line with Western science, iron smelting was classified as a metallurgical phenomenon that missed the human component, human activity, and meaning (Bugliarello and Doner 1979, Kriger 1999:30). However, we have to reject the modern false concept of iron working, because technological activities and techniques are not only mundane or trivial; they are full of cultural messages. Today africanists studying iron working are concerned with exactly this dualistic relation between technology and ritual (i.e. Schmidt 1978, Collett 1985, Childs 1991, Childs and Killick 1993, Herbert 1993, Rowlands and Warnier 1993).

The Pangwa of South-western Tanzania are a Bantu speaking people in a region consisting of numerous smaller kingdoms and chiefdoms (cf. figure 1). Most of them

claim that they once were famous iron workers and blacksmiths. Although there were variations in both technological and other aspects of the smelting and blacksmithing traditions (cf. Barndon 2001a), they all belong within the same cluster of cultures. Among the people in the Tanganyika-Nyassa Corridor region, iron smelters had a high social status, and even the kings or chiefs claimed that they knew how to make iron (Lechaptois 1913, Willis 1962, 1981, Barndon 1996). Thus, they were very similar to the King-Smith, *le Roi Foregeron* of central Africa, discussed by Pierre de Maret (Maret 1980, 1985).

Most of the Corridor people abandoned iron smelting in the late 1950s or early 1960s when imported iron objects and scrap metal became increasingly available (Kjekshus 1976, Koponen 1988). A few elders still remember the smelting techniques, and based on *their* skills and knowledge, I have carried out numerous re-enactments of iron smelting among two different ethnic groups; the Fipa and the Pangwa (cf. Barndon 1992, 2001a).

Among the Pangwa, whom I will discuss in this paper, two entire re-enactments of smelting were observed, in addition to a third building of a furnace and associated preparations. All observations were combined with numerous interviews and discussions with the smelting crews before, during and after each smelt. Some interviews were conducted with me, my interpreter and the entire group of smelters together, while others were carried out with only one of the smelters,



Figure 1. The research area

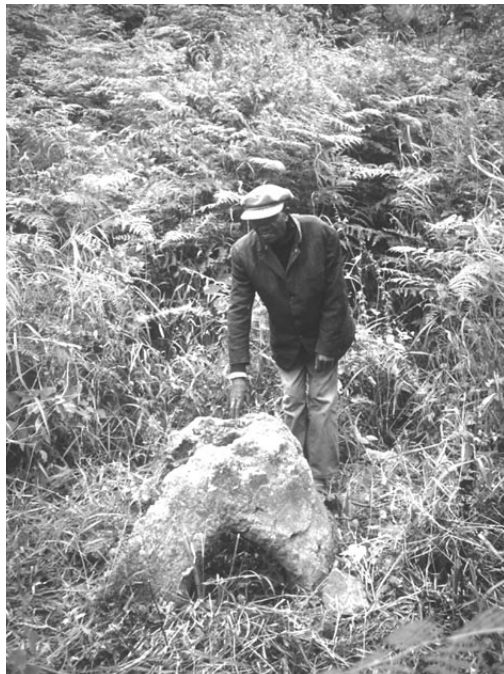


Figure 2. An old abandoned smelting furnace, *liteende*, in Upangwa, Photo by Randi Barndon

in order to countercheck statements made in plenum, and in order to open up for more personal discussions. Every object, action and aspect of the smelting process was discussed, and, especially through the use of etymology, we were able to get information about metonyms and metaphors significant in the smelting process (cf. Barndon 1992). The field situation was similar to anthropological fieldwork since we lived amongst the villagers and lived our lives according to their way of life. Yet, work in the field was also different from 'classical' anthropological fieldwork since, our focus was on iron working and re-enactments of once past-time activities. Peter Schmidt, who has carried out extensive ethnoarchaeological fieldwork of a similar kind among the Haya and Baringo peoples in Northern Tanzania, suggests that the smelters in re-enactments use what he calls *bricolage*, or rather, the smelters are like *bricoleurs* (Schmidt 1997:207, 296). Thus, re-enactments of iron smelting are based both on memory and innovations in the process of stress and crisis management (*ibid.*:75).

### **The Pangwa iron working process**

The major stages in the Pangwa smelting process, according to re-enactments observed in the field, consisted of the various stages listed below:

- the selection of a suitable place for iron production, preferably a location where there were ancestors and spirits who could assist.
- the actual building of a smelting furnace and pre-smelt preparations such as making charcoal, mining ores and transporting ores and charcoal to the site.
- making clay tuyeres and skin bellows.
- collection of magical substances, herbs and traditional medicines necessary for the smelt.
- sacrifice of a goat to the ancestors.
- adding magical substances and medicines to the furnace pit.
- fuelling the furnace with charcoal and ore.
- bellow-working.
- final extraction of blooms produced.

All this was, in the past as well as in our re-enactments, carried out within a coherent tradition in which an overwhelmingly rich symbolism was evoked (Sutton 1971, Stirnimann 1976, Childs 1991:340, Barndon 2001a:94, Barndon 2002:18). In general, one may say that African iron smelting was shrouded in secrecy, magic and taboo, and that the symbols were based on a gendered procreative model in which: 'The smelters were like the 'husbands' of their 'furnace wife' who transformed ores to iron and 'gave birth' to the iron blooms. The furnace 'husband' was the master smelter and taboos against sexual intercourse (seen as adulterous behaviour) were mandated for the participants in a smelt' (Brelsford 1949:28).

In the following, I will look more closely at the exact nature of the dynamic interplay between technology and ritual (cf. also Schmidt 1996, 1997) and more

specifically, bodily experiences in iron smelting technology. Toward my conclusion, I will discuss how this approach might provide a different perspective towards outfield research.

First of all, I will consider how models of the body, its physiology, were (and are) used among the Pangwa in general. How was the practical logic of Pangwa physiology working? And was its logic transferable to the logic in iron working, 'the physiology' of the smelting furnace? For a Pangwa person, the body is experienced as constituting various substances and forces which are vital for living. These forces are bodily fluids such as blood, breast milk and semen. Blood is probably the most vital and most crucial of the bodily substances, but can also be dangerous, depending on its temperature. Balance and control of the body temperature is vital to the character of the blood. When a change in temperature occurs, body fluids change, and the body is transformed (Weiss 1998, Barndon 2001a). Too great a drop in temperature may make a person weak, or a woman infertile. Too much heat, or overheating, as for instance after sexual intercourse, weakens a man and harms the foetus in the womb.

The Pangwa believe in a close procreative force between breast milk and semen. They claim that they originate from or are created from semen and the milk of their mother's breasts (Stirnemann 1967:403, 1979:181). The foetus needs semen as nutrition until the seventh month of pregnancy, and one sexual intercourse is not enough to conceive (*ibid.*). A part of the father's semen remains in the mother's body, in her breasts during her pregnancy. There is, however, a taboo against having intercourse with a breastfeeding wife, because it is also believed that semen can poison the milk. Therefore, husband and wife are apart until an infant can feed himself (*ibid.*:399).

A fact of utmost importance is that when a woman is about to deliver her child she moves out of her house and the village and establishes herself in a hut out in the bush with her midwives and other female helpers. She is then called an *umunyalisitu* 'a woman in the bush'. People who are considered unclean or for some reason with a bodily imbalance, are told to keep away, because their hotness or coldness can harm the child.

Finally, the Pangwa practice an extensive use of herbal and homeopathic medicines in order to keep their bodies in balance. However, in their way of thinking, medicines never work without assistance from the ancestors who again will not assist the medicines without magic and sacrifices. Is this *culturally defined physiology of the body*, or thermodynamic way of thinking, metaphorically transferred to iron smelting? And how does it relate to the topic of the outfield? When the Pangwa iron smelters moved out of the village and installed themselves in the bush in order to make iron, a specific 'micro-cosmos', a moral and material space, was created. This was a specific space where rituals were played out and where metaphors were evoked and used (cf. Barndon 1992, Barndon 1996). The smelting site was then the centre of all activities for a minimum of four days. When the smelters entered the smelting site prohibitions against sexual intercourse were announced, and they were not allowed

to wash themselves, cut their hair, or get angry or violent. Anger could cause a fire to die out because the 'heat' of fire was not compatible with the 'heat' of anger and the heat in sexual activity, while the prohibitions against washing and cutting the hair were connected to the fact that all participants in the smelt had washed themselves in a purifying ritual water, *kiwalasha*, before they left for the bush. The various 'heats' or energies should be kept apart in order to maintain and secure the correct balance of substances within the smelting furnace. A sacrifice of a goat was carried out prior to the actual fuelling of the furnace, and various 'charms', not very different from those used by humans, were hung on the furnace in order to protect it.

At the smelting site, a poisonous plant, *umboocho*, was hung from a stick to ward off intruders. This 'furnace guardian' was, and is, truly dangerous. If someone entered the site without permission, or if one of the smelters was not maintaining the taboos, its odours would come out and give him pain in the stomach (Barndon 2001b:45-46). The fact that this plant or root was used in other contexts made everybody aware of its dangerous poison, something that caused people to stay away from the smelting camp.

The furnace was built in three major sequences, first the pit for magical substances, then its foundation or trench, and finally the furnace shaft. The Pangwa master smelter carefully decorated the furnace, and it was washed in ritual purifying water, *kiwalasha*, (figure 3) similar to the ritual washing of all the participants in the smelt. When asked why, the master said that the furnace was like a woman ready to give birth, an *umnyalisitu*, 'a woman in the bush'. The smelters told me they had to mix two sorts of iron ore, one they called 'female' and the other 'male' (actually a mixture of magnetite and limonite). This mixture of



Figure 3. The Pangwa smelting furnace, liteende (photo by Randi Barndon)

ores was used in order to, again, in their words: ‘make them (the male and female ores) be as one’. And here, it is apparent how the logic in the physiology in the body and the power of the *gender combination* was transferred to the smelting context. The smelters prepared the magical substances that they would use on the bellows and inside the furnace. A goat was sacrificed, and offerings of the heart, the liver and some meat were made to their ancestors and the gods and spirits who inhabited the place where the smelting was to be carried out. The master smelter said: ‘Come towards me, you my forefathers! I greet you and beg you stand by me when I make my iron. Stay with me, all of you that have died!’ The following night, the master smelter and his assistants slept around the furnace in order to protect it against strangers and in order to enter into the role of magicians.

Before the smelting could start the following morning, a special pot, *ing’anjo*, was filled with medicines, herbal and magical substances, and then covered by a ceramic lid perforated with eight holes. The power of the pot and its contents, which during smelting would escape from the pot through the lid, were seen as the forces that divided the impurity of the ores; the slag from the iron. Juice and leaves from a ritual cleansing plant and leaves from a scrub with yellow flowers used for making fire were mixed and placed in the pot. Some of the remaining medicines were sprinkled on



**Figure 4.** Preparing medicines and magic in the pot, *ing’anjo* before smelting (photo by Randi Barndon)

the furnace wall. The pot was then covered with charcoal and more medicines before the fuelling of the furnace.

The furnace was filled with charcoal, and then the actual bellows pumping started. When three double drum bellows were in full operation, the iron ore mixture was added to the furnace from the top. After five hours, the smelters decided to stop the bellow-working and opened the front tuyere inlet. But the slag had not properly tapped through; one big lump of semi-reduced iron was attached to a tuyere and contained several smaller pieces of iron, slag and charcoal. The smelters were disappointed and said the smelt was a failure.

When we discussed the smelting procedures and its final result, they said that perhaps they had not added enough iron ore and

that the furnace, which was made of clay, should have been dryer. However, they also said that someone who was 'hot' after sexual intercourse had participated in the smelt (cf. Schmidt 1997:87, Barndon 2001a:195). Since they were 'hot', the medicines had been overheated and not worked properly. In sum, the balance of substances had not been correct. It is evident that Pangwa technology was very different from modern understanding of technology. According to Schmidt, it is important to be aware of the critical intersection between sex and iron smelting in Africa. He refers to the fact that sex, in many African cultures, including the Haya and the Thonga, is considered to be 'hot' (Schmidt 1997:229, cf. also Heusch 1980, Collett 1985, 1993). In sum 'our' smelters never provided any purely technical or metallurgical explanations for abandoning a smelting site.

### **Iron working in the outfield?**

Finally, let me look at the 'whereabouts' of Pangwa iron smelting sites and iron working as an outdoor and wasteland activity. Which aspects determined the location, and which aspects determined the right to exploit the iron ore as an outfield resource in pre-colonial Upangwa.

First of all, I believe that my discussion above of the Pangwa smelting process and associated rituals has clearly demonstrated the omnipresent dualistic relation between technology and ritual. It is, however, also important to note that values of separation do not necessarily translate into Western understandings of remoteness (Schmidt 1997:191). Although both 'a woman of the bush', a woman in delivery, and the smelting furnace were located out in the bush, the remoteness from the village of the smelting activities was not physical as such.

The locations of iron smelting sites have been commented upon in most descriptions of African iron working. Most observers have emphasised the importance of the camp being outside villages or compounds, and that smelting activities should be in *secret* (Barndon 1992, Childs and Killick 1993, Herbert 1993).

Even if iron smelting was a secret event and most smelting activities were conducted away from onlookers, the smelting season was publicly announced. Women and young men who were not a part of the crew were told to stay away and were warned by the 'furnace guardian', the *umboocha*. Upangwa is a mountainous country, and often, surrounding fields and settlements were visible from the smelting site. The smelting site, on the other hand, was not visible from afar, it was hidden up in the mountains, down in a valley, or deep in the bush. Yet, the smelting activities were not carried out without being noticed. The smoke from the furnace was seen, and, more importantly, the smelting process could be heard.

In the past, the men who were blowing the bellows had numerous iron bells, *mangala*, fastened around their feet. During the bellow working, they made rhythms with these iron bells, and they danced and sang while they blew the bellows. The bellows made sounds like drums. The smelters sang while they worked, to keep up their spirits and ensure a constant rhythm of their work. Thus, smelting activities and

the 'the bells of iron' were heard all over the surrounding country during the smelting season.

Still, if one considers the rituals in the smelting process, the furnace had to be located somewhere in secrecy, out in the bush, in order to control the forces, the male and female powers. Because of fear of these forces, the site was 'sealed' and protected by charms such as the 'furnace guardian', the *umboocha*. In addition, sexual taboos were not to be violated, while medicines and magic needed assistance from the supernatural.

The Pangwa smelting camps were always located within a kilometre from the charcoal production area, fuel, ores, clay tuyeres, and medicines were always transported to the site. Transportation of heavy loads of ore or charcoal was never looked upon as problematic, even if it involved several days of walking with heavy loads. It was believed that the iron ore from a source in the middle of Upangwa, called Manga, was essential for a successful smelt, and numerous smelting crews in the country would walk long distances to obtain some of the ore from this particular quarry. A new smelting camp was not established and built at the beginning of each new smelting season. The Pangwa smelting sites were always near to a small creek or river, and it was close to the termite soil that was used for the furnace building. Furnaces were repaired and reused over several seasons, while new furnaces were built close to the old ones. In our surveys in the Livingstone Mountains, we very often observed two or more furnaces within sight of one another. These furnaces were operated by the same master smelter and his crew for several seasons and over several years.

My informants told me that a furnace and a specific smelting site was only abandoned if, for some reason, the head smelter was not able to produce good blooms or forgeable iron in this location. His forefathers would then tell him to move to a better-suited place. Perhaps, as I was told, the furnace was 'impure' because it had not been properly purified in pre-smelt rituals, such as the use of *kiwalasha* water and the medicine pot. Or perhaps the medicines that were supposed to assist in the purity of the reduction process had failed to combine the magical substances with the medicines, or perhaps 'hot people' had visited the place. More important than the vicinity to raw materials was therefore the quality of the site itself, because sites were selected if ancestors or spirits were known to inhabit the place, and if they had previously demonstrated their willingness to assist.

### **Toward conclusions**

Legends of origins from the Tanganyika-Nyassa Corridor tell of kings or chiefs as *foreigners* who intruded the land of an original people (Stirnimann 1979, Reefe, 1981, Willis 1981). Most commonly, these intruding rulers were known as either good hunters or good iron workers or both. Among many of the people, the king was a so-called *Roi-Foregeron* or King-Smith, claiming that he had superior knowledge of iron production and forging even though he never practised it (Maret 1980). Legends tell



that when taking over the land the intruders also taught the people how to better use the land in hunting and in iron working (Stirnemann 1979). As one of my Tanzanian informants said: 'Once upon a time a piece of a star fell down from the sky and right into the box of magical substances that belong to an ordinary medicine man. From then on, people knew how to make fire and how to make iron. The new people who came and took over the land taught people first how to make fire and then how to make iron. When they became kings, they still knew how to make iron but did not care to do it. Then the master smelters made iron and they always gave one or two iron hoes to their kings as tribute'.

In parts of Eastern Africa, exploitation of outfield resources such as hunting, fishing, and iron working was, as perhaps was also the case originally in parts of Scandinavia in the early Iron Age, not limited by landownership, or joint ownership in the land surrounding a parish. Rather the practical use of outfield resources was shrouded in secrecy designed specifically from a need to control knowledge which often took the form of a combination of know-how, skills and magic.

Within a tribe or a group, knowledge of certain outfield activities controlled wasteland exploitation. Only those who possessed the necessary knowledge to become a 'big lake fisherman', a 'master elephant hunter', or a 'master smelter' were capable of and entitled to extract a surplus from the outfield.

The master smelters (in common with the chiefs and kings) claimed they were the only ones with the specific knowledge needed in order to produce forgeable iron. The skills and knowledge were not limited to practical aspects such as furnace operation or bellows working, but also in particular the use of medicines and magic, sacrifices and ritual performances. Within their boxes of magical substances, the master smelters kept their secrets and knowledge of making the correct mixture of medicines needed to keep the furnace body in balance; which is very similar to how ordinary medicine men treated human bodies. Therefore, the Pangwa case has illustrated how, in this specific pre-modern metallurgy context, there was no ontological distinction between subjects and objects, humans and furnaces.

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