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IRON SMELTING AMONG THE BA-USHI,¹

[WITH PLATE XV.]

By THE REV. H. B. BARNES.

FIRST, a suitable place is selected. This need not be close to the place where the iron ore is found, but must be some place used for the same purpose by the iron-workers of old time, and seems likely to have been near a village without being actually within it or close to its bounds. To-day the site may be quite far from any existing village, as it is the custom of the people to change their sites every few years for reasons connected with their gardens. The sites are always adjacent to ant-hills, possibly for the practical reason that in such a place there is no difficulty in getting the necessary clay for making the furnace.

The site selected, a new furnace is built near the ruins of one of the old ones. The furnace is about 7 feet in height, big at the base and tapering irregularly to the top, which is circular. The one I saw being made was quite roughly built of clay with a stiffening of poles, and with some poles on the outside about 4 feet 6 inches up, which were used as steps for mounting to the top when the furnace was being filled. There was a main entrance on the lowest side through which a man could creep into the inside of the furnace; this is the blocked entrance which shows in the front of the furnace in the picture (Pl. XV, Fig. 1). Opposite this was a sort of back door of smaller size, and between these two principal openings there were four smaller ones on the west side and three on the east side. When the bare furnace was complete, and while other things were being prepared, a small length of an old clay pipe of the kind used in bringing ventilation to the furnace was hung from the pole above the main entrance (*see* picture, where it is seen in place), and was used as a charm by anyone having occasion to enter the furnace or to go close and look in. The charm was taken down from the place where it hung and was hung on the arm till the inspection or visit was over and was then replaced on its pole. The danger said to be averted by wearing the charm was a dimness of the eyes. This main entrance is called *chabwilo*, the back door opening *yaya*, and the smaller openings between these are called *kamba*.

The iron ore, as it is brought from the hills where it is quarried, is called *lubwe*; the kiln or furnace in itself is called *muchelo*, and the resulting iron *chela*.

When the *muchelo* is complete and ready for packing, the firewood for the smelting is cut and prepared in suitable lengths. For the base, stout stakes of about 3 feet

¹ The Ba-Ushi inhabit the district S.W. of L. Bangweolo. *See* E. von Rosen, *Trüskfolket*, ch. xii.—[ED.]

in height are cut and sharpened slightly at one end so that they can be set up vertically as close together as they can be packed. Thinner stakes of the same height are cut to fill the spaces between these larger ones. All these are called *fiyandu*. Charcoal, which has been got ready elsewhere, is poured over these so as to pack the interstices still more closely. Above these, stout short lengths of round timber, about a foot in length, are laid horizontally in layers up to the top of the *muchelo*. These also have charcoal poured over them and above them when the kiln is packed. They are called *manchili*.

The charcoal was burnt elsewhere, presumably where the convenient wood was plentiful. The wood was heaped up loosely and burnt for several hours in the open without any shutting of it up in a closed furnace. It was carried to the *muchelo* in large loosely woven baskets made for the purpose. The ore was carried from the far-off hills in small, roughly made baskets of bark-rope.

Before packing the *muchelo* it is necessary to make the clay pipes for ventilation. These are about 2 feet long, and the inside measurement tapers from 2 inches diameter at the big end to 1·3 inches at the smaller end. The thickness of the clay in the specimen measured varies from 0·75 inch at the big end to 0·25 at the small end. The making of these is a special art which the iron-workers have to acquire. All ordinary clay working is the business of women, but this is done by the expert men of the iron-smelters, who are called *ba-shimalungu*. The process is as follows:—First, a flat space is cleared and a screen of slender poles about 3 feet high and 6 feet long is made. This is set up at a slight angle from the vertical, so as to provide not only a screen but also a sloping support against which to rest the pipes (*nchelo*) as they are made. The space in front of this screen (that is between it and the operators) is carefully cleared and levelled, and is strewn with chaff of the red millet, which is the staple grain grown in these parts. Two forked sticks about 18 inches high are set up, also at a slight slope away from the operators, at the edge of this clearing. Between them is a heap of white wood ash. The two experts sit each behind his forked stick, and on the fork rests a straight, smoothed pole about 3 feet 6 inches long, so that it comes readily to his left hand. This stick is called *mubumba* (*kubumba*, to mould in clay), and on it the *nchelo* are moulded. At the side of the two experts is a long wooden box, either actually part of an old dug-out canoe or of identical pattern, and in this the clay is mixed and well pounded by assistants standing upright and using long pestles slightly sharpened at the lower end (Pl. XV, Fig. 4). Close by, another man is mixing in a small horizontal mortar, also of hollowed wood like a canoe but much smaller and not fixed in the ground as the clay-mixing box is, a reddish slimy-looking liquid with which the *nchelo* are smeared on the outside as they are being moulded. This mixture, which looks like crushed strawberries, is composed of *ntombolyo*, a wild tuber or root dug up in the bush and pounded in the mortar with hot water.

When the clay is sufficiently pounded in the mixing box (called *mutiba*), it is made by assistants into round lumps the size of a man's head, and these are handed to the two experts. The expert flattens them slightly and makes a hole through them with his hand, and through this hole he thrusts the moulding-stick, *mubumba*. This stick has first been smeared with the white wood ash, and more of this ash has been put into the hole in the clay so that the clay shall not cling to the stick. The expert rolls and pulls out the ball of clay, shaping it with his hand so that it shall be smooth externally and of the required thickness. At this stage also he smears it with the *ntombolyo* on the outside. This is said to be in order to make the clay strong, and it has possibly the effect of giving a glazed appearance to the burnt pipes as they come out of the furnace after the firing. The clay seemed extraordinarily plastic, and this plasticity may have been due in part to the smearing with *ntombolyo*.

A second round lump (these are called *chilubi*), and possibly a third, may be added till the *nchelo* is long enough. The moulding-pole, with the clay on it, is frequently put down while the process of moulding proceeds, with the small end resting in the fork and the other end on the ground. When the *nchelo* is long enough and firm enough it is removed from the moulding-pole, rolled in the chaff and set up on the larger end, resting against the screen (*lubanda*), which has by this time had a layer of grass laid and tied over the bare poles. Plenty of these *nchelo* are made and set up in the same way against this *lubanda* (Pl. XV, Figs. 3 and 4), and when there are enough they are covered with another layer of grass and left to dry hard.

At an early stage in the proceedings a small shrine or spirit-house (*lyfuba*) is made near the furnace or kiln. This is a bare round roof set on poles without a wall, and is not more than about 3 feet high (Pl. XV, Fig. 2). The point of the roof is decorated, as is usual with the ordinary native houses, and in front of the house, on the side towards the kiln, is set up a post coming just above the eaves of the grass roof. This post has leaves tied round the top which give it a knobbed appearance (see Pl. XV, Fig. 2, on the right of the house and in front of the nearer man). These leaves are a charm or medicine. The foot of the post is set in what looks like a mud pincushion with pointed sticks (*mpopo*) radiating from it like the spines on a sea-urchin's back. These pegs are also "medicine," but I was told on the spot that they were simply put there to keep the post firm. I was also told that the shrine was called *muchinshya* and the post set up in front *lukeshi*, which ordinarily means a "verandah post." I think the experts practised a little reserve in answering my questions on these points and on everything connected with the shrine. I have corrected their statements by reference to other natives with the aid of the photographs.

While the *nchelo* are drying, the experts turn their attention to the iron ore and prepare it for the kiln. It must be broken up into small pieces about the

size of walnuts. This is done by heating the lumps of ore in a good fire, throwing the hot stones into a shallow hole and pouring water over them. The water boils for some time and the stones are then removed and are easily cracked on big stones used as an anvil, with another stone for hammer.

The process of breaking up the stones is called *ukusantaula*. The ore, after it has undergone this, is carried and placed in a heap before the shrine (Pl. XV, Fig. 2).

The kiln is now packed, the *figandu* at the base, the horizontal layers of *manchili* next, the charcoal between and over all, and at the top the iron ore, with a covering of charcoal and *manchili* not laid horizontally but sloping up cone-wise above the top lip of the kiln. Crowning the whole is some charm (*bwanga*) in what looks like a nest of grass and leaves (Pl. XV, Fig. 1).

When the kiln is built and ready for the ore to be added on the top a fowl must be killed at the shrine. The head of the fowl is stuck on a stick in the *chisonti* (peak) of the roof; the blood is sprinkled direct from the body on to the ore, and the flesh is eaten with *bwali* (porridge) by the *ba-shimalungu*. The following prayer is uttered to the spirits of the men of old who smelted on the site: *Mwe bankala yalobe bene baleposele fyela muno, twafweni ne nomba*, "O ye smelters of old who smelted in this place, help us now too," *lubwe lupyé lusanguke ifyela*, "that the ore may burn and become iron."

When the ore has been placed in the kiln the entrances are closed with clay plastered over them, leaving only the *nchelo* showing like the gun-muzzles in an old-fashioned wooden ship-of-war. Each of the openings or entrances has a number of these showing, not projecting more than an inch from the clay with which the openings are closed up. They all seem to point inwards to the centre, but are not long enough to meet those on the opposite side.

The kiln burnt for thirty-six to forty-eight hours. The result was a slag of no value called *malamba*, and a mixture of dross and the metal which was called *mutanda*. This *mutanda* was broken up into small lumps and carried to another ant-hill for further reducing in a furnace of much smaller size, which treated only a small quantity at a time. More charcoal had to be prepared for this. The furnace of clay was made for each small basketful that was treated, and was so made as to narrow towards the open top.

The feature of this furnace was that it was like a closed forge, having bellows on the higher side connected by a clay pipe—one of the fired *nchelo* in fact—with the centre of the furnace. A man sat on the slope of the ant-hill above the furnace and worked the bellows of skin for forty minutes on end without a rest. The bellows were double, consisting of two good-sized skins loosely sewn at the large end and tied firmly to nozzles of clay at their small ends. These nozzles both led side by side into the hole at the back of the furnace where the single central nozzle of clay led direct into the furnace. The point of entrance of the two nozzles into the furnace hole was not closed up around the nozzles; both were tied to a firm stake set up



FIG. 3.—CLAY VENTILATING PIPES IN PREPARATION.



FIG. 1.—IRON-SMELTING FURNACE.



FIG. 2.—SHRINE (*bufaba*).



FIG. 4.—PESTLES FOR POUNDING CLAY.

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in the ground, and were further secured in position by a heavy stone tied to the stake and pressing with all its weight on the nozzles. Fire was laid at the bottom of the furnace, and it is noteworthy that the experts, sticklers for the ancient ritual as they were, did not disdain the modern contrivance of the safety match which their forefathers knew not. Charcoal was laid on the fire to some depth, and the bellows gradually worked the fire into a lively condition. Then the *mutanda*, now broken up into small lumps and called *mbulo*, was added little by little in the centre of the fire, and was surrounded and covered with charcoal. As the fire sank more *mbulo* was added and covered again with charcoal till a small basket of the stuff was under treatment in the furnace. The man who added the *mbulo* had by him a small bowl with water and some charm, *bwanga*, with which he sprinkled at intervals the fire, the ore, and the charcoal, and into which he dipped his fingers when the flames were fierce. This whole operation took place under a good shelter of leafy boughs with only one entrance, no doubt to keep all the draught from the flames which rose from the glowing furnace. The operation of treating one small basket of *mbulo* lasted about three-quarters of an hour from the constructing of the furnace to the breaking down of one side to let the metal out. This was done when the fire, after the last additions of *mbulo* and charcoal, had sunk half-way down inside the furnace. The expert first took water into his mouth and squirted it over the glowing fire to reduce it somewhat, then the front side opposite the bellows was broken down, and with a stick the expert foraged in the glowing charcoal for the white-hot lump of metal. This rolled out from the centre of the fire in a conical lump of irregular, knobbly sides, and was rolled away to the side of the shelter to cool.

When the basket of *mbulo* was emptied the leading expert took it up and waved it in what seemed meant to be a significant manner over the furnace, then just brought it to his own forehead and then set it down.

The lump of iron just as it leaves the furnace is kept till the smith wants it for his work. The smith is not, I think, generally a smelting expert, but in the case of the operation I witnessed at least one of the two experts is also a smith.

My experts tell me that formerly the smelters were sent by their chief to smelt iron; then the smiths made hoes, spears, and axes from the metal provided by the smelters; then the chief sent these manufactured articles to other places to be bartered for other things, such as cloth, ivory, goats, slaves. The rates of exchange are given as follows:—20 hoes for a tusk of ivory; 15 hoes for a slave (female); 10 hoes for a she-goat; 2 hoes for a he-goat.

This is, of course, merely an approximation but throws an interesting light on the relative values of coveted goods. The idea of doing this skilled work for regular pay, like the hired men of the European, was quite repugnant to the natives. The old custom was for the chief to give them a generous share of the fruits of their labour in the shape of the goods obtained by barter. There was no thought as to

the purpose of the different steps in the process, at least no scientific consideration of the why and wherefore. The experts had received a tradition and they clung to it faithfully, making no discrimination between essentials and non-essentials. Every detail of the ritual was apparently equally essential.