Ingot casting and wire drawing in Iron Age Southern Africa

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SYNOPSIS

This paper describes the experiments that were conducted in 1974/1975 on two related aspects of Iron Age copper technology in Southern Africa: ingot casting and wire drawing. Three types of ingot were successfully cast: the St Andrew's Cross ingot, the marale ingot, and the musuku. It is suggested that the 'studs' on the musuku are not the remains of broken-off rods as previously proposed by other investigators, but that the ridged pattern is an ornamental feature.

Copper wire was successfully drawn with similar tools and according to the procedures described in the literature on African Iron Age wire drawing. It is concluded that these accounts are generally accurate and that the pre-European metal workers are worthy of respect for the results they achieved with primitive methods.

INGOT CASTING

The copper ingots found at archaeological sites in the Northern and Eastern Transvaal have been the subject of much discussion. The unusual shapes of some of the ingots, especially of the musuku—the 'miniature top hats' of the Soutpansberg (Figs. 1 to 3)—and the marale—'the miniature golf-clubs' of Palabora (Fig. 4)—have often intrigued collectors and archaeologists. The literature suggests a number of explanations, which ascribe the following to such ingots:

1. a religious, mythical, or ceremonial aspect (Thompson1),
2. a trade and currency value (Van der Merwe and Scully2), and
3. an unusual shape due to casting methods (Stanley3).

I believe that the rod and stick-like ingots, as well as the musuku, were used for trade if they were of solid copper. Some musuku are filled with sand, and this type, according to Thompson1, was always used for ceremonial purposes.

Between October 1974 and February 1975, we conducted experiments to test the conditions and the results of casting copper into moulds patterned to the shape of the original ingots. We obtained some of the required copper from malachite-azurite ore that we

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smelted in an experimental smelting furnace similar to that of the Venda described by Stayt. The balance of the copper used was refined commercial copper. In each case, the copper was re-smelted in a crucible defined the size of a marale. We tried to fill a larger mould by successive pourings from two separate smeltings, but, once the first charge had solidified, the second charge did not join it.

3. A musuku (Fig. 2) was used to obtain the musuku mould. At the bottom of the mould, equally spaced holes were pressed into the ground with pencil-shaped wooden rods (20 mm long by 5 mm in diameter). After the copper had been poured and the cast had solidified, the copper rods formed a continuation of the studs on the ridges of the musuku head. These 'studs' were supposed to be the remains of the copper rods that were broken off to be used for wire drawing. The casting of the musuku was only partly successful, as a section of the head broke off. There is a feature of the musuku that still needs explanation. On most musuku preserved, one or two pouring lines can be observed, showing that the pouring was effected in several separate stages. Why was that so, if the copper rods were the primary products desired? A fairly thin overflow slab would have been sufficient as a head. It has also been observed that, on several musuku ingots (Fig. 2), no breaking-off marks have been preserved. For these musuku, we are inclined to think that the 'studs' were not the remains of broken-off rods and that the cylinder-shaped musuku ingot as we know it was the only product manufactured. The ridge-stud pattern on the top of the musuku is probably just an ornamental feature whose meaning is unknown to us at present.

IRON AGE WIRE DRAWING

Wire drawing appears to have been a craft practised by African metal workers for a very long time. The Kikuyu of East Africa believe that this craft is indigenous in their tribal lands, but it is probable that wire drawing, like other aspects of African metal technology, is part of the cultural heritage of the Iron Age people who migrated southwards, bringing with them the technological knowledge they had acquired by diffusion from Mediterranean seafarers or by trade contacts with the East Coast.

The technique of copper wire drawing demands, besides the copper sticks and copper rods used as raw materials, two essential tools: a drawing plate and a vice. Such tools have been found at a number of sites in Central and Southern Africa, and were seen still in use by travellers of the 19th Century.

The drawing plate (Fig. 6) appears to be a simple implement—just a flat iron bar punched with holes of various sizes. However, we found that the punching of the holes is not quite so easy as one might imagine. To draw wire properly, the hole (the die) should have a smooth conical entrance and a similarly shaped exit. It seems that holes punched with an awl-like tool into heated iron plate and reamed in are just as suitable for wire drawing as those drilled and reamed in the modern way.

The Iron Age vice (Fig. 6) that clamps and holds the wire is actually a fairly indigenous tool. It is a strong band of iron, bent back onto itself to form a fork resembling a tuning fork with the prongs pressed closely together. A coiled iron ring is slipped over the open end of the fork after the wire has been clamped in, and is hammered upwards with a stone, being finally kept in position just below the wire by an iron wedge forced between the prongs and rings. A number of such wire vices that have been described and pictured in the literature come from places as far distant as Kikuyuland, Katanga, the Zambesi Valley at Ingonbe Ilede, and the Northern Transvaal. The similarity of pattern and design of the vices is an indication of the basic uniformity of Iron Age metal technology.

EXPERIMENTAL WIRE-DRAWING

We made some experiments to demonstrate working with a drawing plate and a vice for drawing wire. We ordered a vice to the size and
shape of a vice found at Ingombe Ilede to be made in a Johannesburg workshop, and this vice was used for the drawing of copper rods that had been cast at the Department of Archaeology of the University of the Witwatersrand (Fig. 7).

One end of a copper rod (approximately 5 mm in diameter) was ground to a point small enough to pass through the appropriate hole in the drawing plate, which was fastened to a stout pole. The point of the rod was clamped into the vice as described above, and the vice was drawn away from the plate, pulling the wire through the die. This process was repeated a number of times, successively smaller plate holes being used until the rod was reduced to the required thickness (2 to 3 mm in diameter). Not all the experimental runs were successful, since the wire had a tendency to break when pulled too strongly, or to seize up in the drawing plate. The results became better when, after each stage, the drawn wire was softened by annealing (heating up in a small fire for half an hour). Lubrication of the plate holes with fat also facilitated the process.

Our lack of experience and traditional knowledge made our experimental wire drawing rather slow and cumbersome—quite different from the efficient and apparently easy working of the Iron Age metal smiths described in the reports of the early travellers and explorers. However, we were successful in repeating the Iron Age method of wire drawing.

The reports on copper casting and wire drawing found in the literature have been proved to be generally accurate. Our practical experiments
on the smelting and extraction of metal from ores have increased our respect for the pre-European metal workers, who achieved excellent results with primitive technical methods, and have confirmed the opinion of other investigators in this field, who, like the famous archaeologist, G. Caton-Thompson\(^a\), recognize the 'inmate and receptive metallurgical talent of African peoples'.

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