

A NOTE ON THE NATIVE METHOD OF BAR IRON PRODUCTION IN SOUTH INDIA (SALEM REGION)

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Salem region in the Madras State is rich in iron ore deposits of high grade and, from time to time, several attempts have been made to exploit these deposits. As early as 1833, an erstwhile civil servant of the East India Company, Josaiiah Marshall Heath, sacrificed his lucrative career in the Civil Service and spared no efforts to establish an iron manufacturing works at Porto Novo near this area. The authors, while studying the records relating to this enterprise which ended in a dismal failure leaving behind a broken-hearted adventurer, came across a report on the manufacture of bar iron in India by J. Campbell, Assistant Surveyor-General, Madras Establishment (PUBLIC: *Consultations*, 16th August, 1842, pp. 4160-84, at the Madras Records Office). The data given in the report constitute the basis of this note as well as the reconstructed diagram indicating the possible form of the furnace used by the natives to produce bar iron in considerable quantities in South India.

Construction of the furnace

The material used for the construction of the native furnaces is the common red potters clay of India (which unless carefully selected is not generally very refractory and will hardly stand heat sufficient to fuse cast iron). However, by mixing it with sand and concentrating the heat in the centre of the furnace as much as possible by projecting the blast pipe, the reduction of the ore is effected before the furnace becomes much more than red hot; and the operation is completed in about a couple of hours.

A platform about 2 ft. in square and 5" thick is first made, with a hole in the centre 9" in diameter—a half cylinder or curved piece is then formed also of the red clay 18" high, 4" thick and 13" diameter inside, and also a cone about 2" thick of the same height and the same diameter at bottom and 7" at top. When these are quite dry, a little wet clay is put round the hole in the platform, the half cylinder placed upon it and the spent front built up with clods of clay. The inside part is plastered (thickness 2") until a hollow cylinder is produced, about 23" deep and 9" in diameter inside and a thickness of about 6". When nearly dry, an arch is cut out in front at bottom, about 9" high, to form the door of the furnace. The cone is then placed on the top, and inside plastered with clay to correspond with the bottom part, and the neck or throat reduced in the same way to about 5" in diameter. The upper part of a *chatty* (?) with the neck is then placed inverted on the apex of the cone, to form a funnel so as to conduct the charge into the throat. The *chatty* and the whole of the outside of the furnace are then plastered over with clay, about 2"

thickness. When finished the height inside from the bottom to the neck is about 3' 10", and the whole operation takes about a week to finish before it is quite dry. The blast pipe is a cylinder of dry clay 14" long, about 4" thick, pierced with a hole of one inch in diameter. It is introduced into the furnace at the bottom of the door with its point about the centre of the furnace and about 5" above the bottom. The door is then closed with a tile of dried clay, and the outside is built up and seamed with wet clay, and plastered over; a layer of charcoal dust about 2" thick having been first placed at the bottom of the furnace to prevent the reduced oxide adhering to it. The blast pipe is connected to the bellows made of two whole goat skins.'

(Slightly abridged)

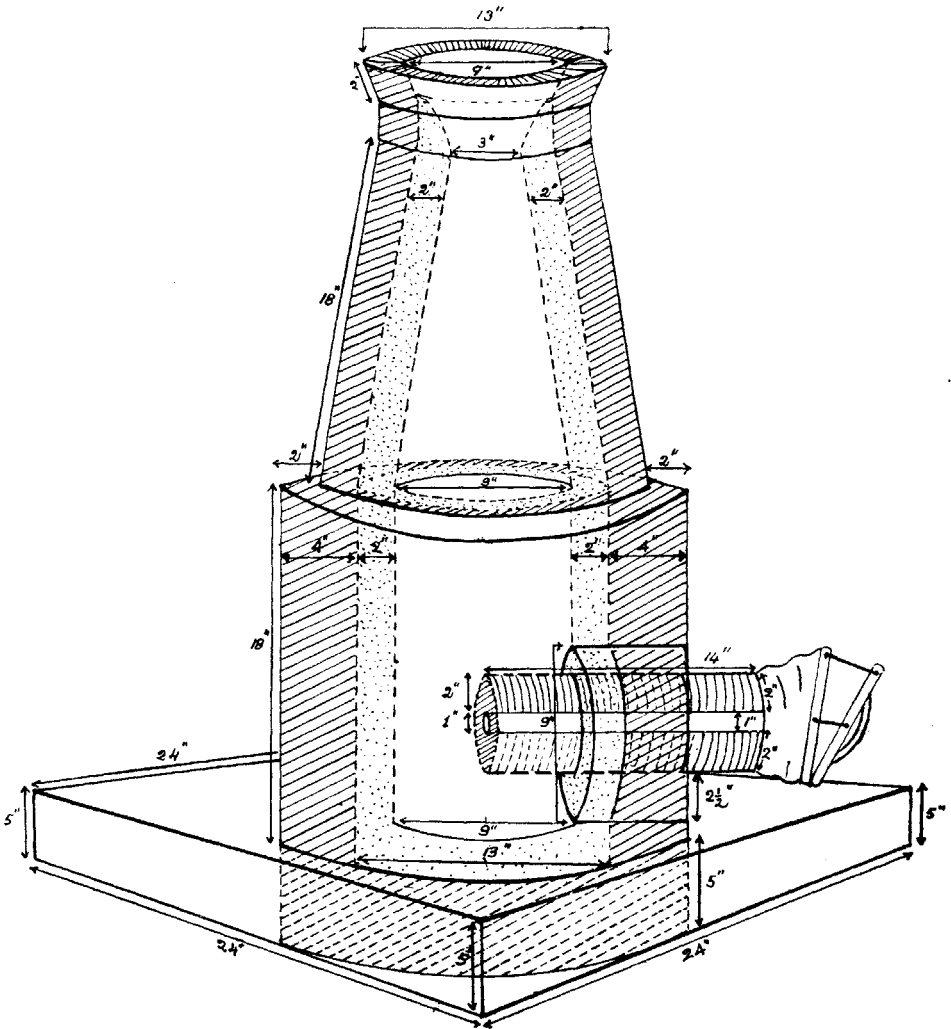


FIG. 1. Possible form of the furnace used by the natives to produce bar iron in South India.

—drawn to scale by A. C. Basappa

OPERATION

The ore used principally was, as stated in the Report, either the 'common magnetic iron sand found in the *nullah* or pounded magnetic iron ore separated from the ferruginous granite'. To start with, a small quantity of charcoal was thrown into the furnace, the fire introduced, and the blast commenced. The furnace was filled to the neck with charcoal (quantity: about 26 pounds). In about half an hour as the flame issued forth from the throat and the fuel began to sink, the charge, i.e. the ore and the charcoal in the ratio of 1:2 (about 5 lb. of ore and 10 lb. of charcoal), was introduced. Earlier, the ore was wetted with a view to preventing it 'from getting down too fast'. The charge was repeated several times and the furnace allowed to burn down. In about 2½ hours when the sparks were seen to come out with the flame, the bellows were removed and the door broken open. The product, now in the form of a lump, was removed and cut open while hot with a hatchet to examine the quality.

YIELD AND QUALITY

The weight of the lump generally was about 11 lb., but not all of it was iron. In a forge, a large portion of it would go away and, on an average, about one-fourth of it was iron. The best lumps, however, would yield about 50 per cent of iron.

'As regards their quality,' in the words of Campbell, 'the worst of them is as good as the best English iron and its supposed defects arise from its almost always containing a considerable portion of steel. Good native iron bears almost all tests. A fractured end of a bar of iron presents a very different appearance—no glistening portion like English bar iron: it is granular or an aggregation of crystalline grains.'

Cost

Four men (one superintendent and three labourers) would operate the furnace and work for 12 hours in a day to produce three lumps. At that time, the selling price of one lump was about two annas, and including the expenses for forging the lumps into rough iron bars, the bar iron was being produced at an expense of Rs.80 per ton. It is recorded that even that was still less than the market price at Madras of the cheapest English bar iron.

The number of such furnaces in South India was legion and the aggregate manufacture of iron was indeed considerable.

Primitive bloomery hearths with alternate layers of charcoal and ore heated on a circular platform assembled of stone and covered with clay (with bellows for blast) were in use in the ancient Near East. The product was a bloom of crude iron, perhaps similar to the one obtained by the type of furnace under reference.

It is well known that in the megaliths of South India (c. 700 B.C-300 B.C.) have been discovered a large number of iron objects of the types used in warfare and for domestic or agricultural purposes. The discovery of the iron objects, however, has given little or no information on the technology associated with their production. Even elsewhere in India, there has been practically no archaeological evidence which throws light on either the smelting of iron ore or forging iron objects.^{1, 2} At present, the history of iron technology in India is a story of many a missing link, disjointed and incomplete.

REFERENCES

- ¹ Banerjee, N. R., *The Iron Age in India*, New Delhi, 1965.
- ² Wheeler, M., *Early India and Pakistan*, 1959, pp. 146, 163-4.