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METAL ARTEFACTS AND SLAGS FROM ARCHAEOLOGICAL SITES ON THE CONGO COAST*

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ABSTRACT

Samples of slag and iron artefacts from six sites on the Congo coast ranging in age from 2310 ± 70 BP to 420 ± 50 BP were analysed. The sparse slag samples were fragments knocked off blooms and droplets produced during forging. The iron, containing typical two-phase inclusions, was produced in a bloomery. The production and fabrication technology did not appear to differ from that employed at Iron Age sites further south.

INTRODUCTION

This paper describes the analysis of archaeological metal artefacts recovered from sites on the Congo coast, collected during the 1990 and 1991 field seasons conducted by teams led by Prof James Denbow, University of Texas, United States of America. Twenty seven samples were submitted to the Archaeology Materials Laboratory at the University of Cape Town for examination and analysis.

The Early Iron Age material in particular was of interest because very little was known about the archaeology of the Congo coast until the beginning of this decade. The tropical west African coastal corridor possibly acted as a route for the introduction of the earliest phase of metal working in southern Africa (Denbow 1990). This makes the comparison of the fabrication technology used to produce the Congo material with that used to produce the earliest known material from Botswana further south (Miller 1996) potentially very interesting.

MATERIALS

Samples of metal artefacts and slag from six sites were submitted. Their descriptions were tabulated along with their label information (Table 1). With the exception of Champ de Tire (for which no date was provided with the samples) and Loubanzi (a Late Iron Age site with a radiocarbon date of 420 ± 50 BP), the sites were known to be Early Iron Age, with dates ranging from 2310 ± 70 BP to 1440 ± 100 BP (Denbow n.d.). The material consisted of very corroded fragments of iron, and small pieces of slag. One sample (Cong 15) consisted of organic remains and ceramic fragments and was not considered further.

ANALYTICAL METHODS

The samples were all described, weighed, drawn and photographed. Selected metal specimens were sampled with a rotary diamond saw. The samples were cold mounted in acrylic resin under vacuum to remove air bubbles. The mounted specimens were ground and polished on rotary laps, with a final ¼ micron diamond polish. All the sections were studied with a Reichert-Jung Polyvar dual metallographic/petrographic microscope using plane polarised light. The grain size and the carbon contents were established by visual comparison with standard charts (ASTM 1981).

RESULTS

Ore and slags

Two lumps of possible smelting ore (not illustrated) were included in the collection. These were lateritic ferrugenous cobbles containing numerous small rounded pebbles of quartz, cemented together with yellowish-brown hydrated iron oxides. It is possible that they may have represented ore material, but without the opportunity of comparing these nodules with locally available rock no firm conclusions could be drawn.

All the slag fragments were small, and none of the sites produced slag in sufficient sizes or quantities to suggest that smelting took place in proximity to the excavated areas. The Early Iron Age slags were irregular broken fragments that could have been knocked off raw blooms prior to forging. Two small rounded nodules of slag from the Late Iron Age site of Loubanzi (Fig. 1,

Table 1. Metal and slag specimens from the Congo coast, 1990 and 1991 field seasons.

NUMBER	LABEL	OBJECT	MATERIAL	MASS (g)
Cong 1	Kayes 1 0n-10w 40-50	nodule	slag, 3 pieces	30,94
Cong 2	Loubanzi 0/1e-10/11s 40-	plate	iron, 2 pieces	0,30
Cong 3	Loubanzi 0-20s 30-40	nodule	slag	1,18
Cong 4	Loubanzi 0-30s 10-20	nodule	slag, 2 pieces	1,80
Cong 5	Loubanzi 0-32s 30-40	bar	iron	1,71
Cong 6	B.P.113 19-20e 40-50	rod	iron	1,19
Cong 7	B.P.113 20w-19n 40-50	wire	ron, 7 pieces	3,37
Cong 8	B.P.113 19-20e 50-60	bar	iron	1,49
Cong 9	B.P.113 20w-19n 30-40	bar	iron, 2 pieces	1,15
Cong 10	B.P.113 20w-20n 40-50	pendant	iron, 8 pieces	6,48
Cong 11	B.P.113 21w-20n 40-50	plate	iron, 2 pieces	2,59
Cong 12	B.P.113 59-60w 10-20	wire	iron	0,14
Cong 13	B.P.113 78-79e 50-60	rod	iron, 2 pieces	1,46
Cong 14	B.P.113 79-80e 4s 70-80	spatula	iron, pieces	10,58
Cong 15	B.P.113 New site, Test #4, 80-	nodules	organics + ceramic	5,16
Cong 16	B.P.113 New site #4, Ext 3, 90-100	bar	iron	1,35
Cong 17	Mvindou 1 Bulldozer feature west 2-20	nodule	slag	0,55
Cong 18	Mvindou 1 Bulldozer feature west 40-60	nodule	slag	9,70
Cong 19	Mvindou 1 Bulldozer feature west 20-40	point	iron, fragments	0,82
Cong 20	Mvindou 1 5n-30w 20-30	arrowhead	iron, 2 pieces	0,96
Cong 21	Mvindou 1 25n-0e 10-70	spatula	iron	3,49
Cong 22	Mvindou 1 15n-0e 45-55	nodule	ore?, 2 pieces	399,09
Cong 23	Fignou 1 South Unit 1, 30-40	plate	iron	1,06
Cong 24	Fignou 1 Unit 2, 20-30	strip	iron	0,59
Cong 25	Fignou 1 SE4 20-30	nodule	iron	0,91
Cong 26	Fignou 1 Sondage 5, 20-30	nodule	slag, 2 pieces	15,68
Cong 27	Champ de Tire 1, B 0-20	plate	iron, 3 pieces	0,33

Cong 4) were similar in external appearance to droplets formed during smithing (*cf.* Miller & Whitelaw 1994). A more detailed analysis of so few fragments of slag from each of these sites did not appear to be warranted, due to the unlikelihood of recovering any technologically significant information from such sparse samples.

METALS

All the metal remains were ferrous, with no items made of copper. The Early Iron Age objects consisted of stout round and square wire or thin rods, fragments of iron sheets or plates, and small pieces of iron strip (see Figs 1-3). There were two fragmented spatulas and the remains of one barbed arrowhead, as well as a point. All the objects were very severely corroded and fragmentary, although one complete spatula or possibly small adze (Fig. 2, Cong 14) and an iron point (Fig. 3, Cong 19) could be reconstructed from their fragments.

Of the five metal fragments sampled for metallurgcial analysis, only the small bar fragment (Cong 5) from the most recent site of Loubanzi had any appreciable amount of metal left. This object (Fig. 1) consisted of relatively clean bloomery iron, forged into a small retangular bar, with a neatly squared-off end (Fig. 4). There were typical strings of transversely fractured two-phase inclusions, consisting of rounded droplets of the iron oxide wüstite surounded by dark glass (Fig. 5). In places these inclusions had been very thoroughly broken up and rounded (Fig. 6), which was indicative of heavy hot working of the metal. Etched with nital (2% nitric acid in ethanol solution), the metal was evidently very homogeneous, with a fine-grained normalised structure of pearlite islands in a ferrite matrix. The former austenite grain size was about ASTM 8 which indicated fairly rapid air cooling from a working temperature in excess of about 900 °C (Brick *et al.* 1965:234). The carbon content varied minimally from about 0,1% C (Fig. 7) to 0,2% C (Fig. 8), with no evident relationship between the carbon content and presence of inclusion bands. This was typical, well worked bloomery iron, which had been forged by a competent smith.

The Early Iron Age materials were all very corroded and consisted almost entirely of corrosion products (Figs 9-13) with very little residual iron, which was present as small isolated grains (Fig. 10). All the corroded samples contained residual strings of transversely fractured, devitrified, glassy and two-phase inclusions, typical of bloomery iron production. Despite the corrosion it was evident that these objects were the products of very competent smithing technique. The square wire fragment (Fig. 1, Cong 7) had a very symmetrical square cross-section (Fig. 9), and the eye of the pendant (Fig. 2, Cong 10) had been skillfully bent over and neatly abutted against the shaft (Fig. 11). The transverse section of the sample from the reconstructed spatula (or possible small adze) (Fig. 2, Cong 14) showed that the original object had been forged with a thin, symmetrically tapering

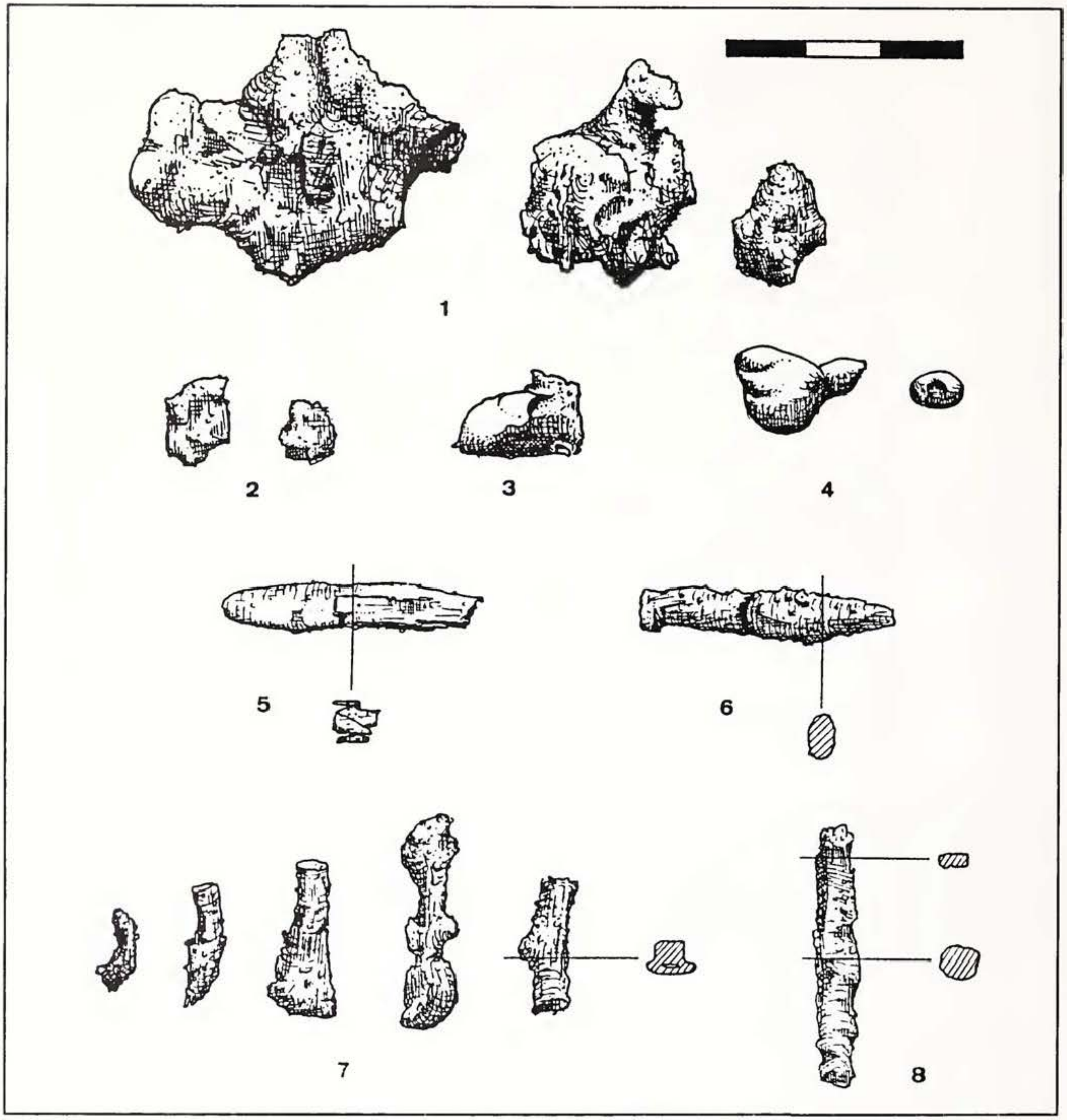

Fig. 1. 1, three slag nodules; 2, two iron plate fragments; 3, slag nodule; 4, two slag droplets; 5, iron bar; 6, iron rod; 7, iron wire fragments; 8 iron bar (scale in cm).

cross-sectional profile (Fig. 12). The sample of the second spatula fragment (Fig. 3, Cong 21) was too severely corroded for the original outline of the metal to be discerned (Fig. 13).

DISCUSSION

It is difficult to drawn any meaningful archaeological conclusions from such sparse collections, except for the obvious one that iron was worked in the vicinity of the archaeological excavations. The method of production was the bloomery, producing characteristic two-phase inclusion strings, and subsequent smithing was carried out in a competent fashion to produce symmetrical and well-shaped small artefacts. There was no sign of any deliberate heat treatment other than annealing and air cooling, which would have happened during normal smithing practice. There was also no sign of any appreciable difference between the Early Iron Age and more recent material, apart from the fact that the latter was less severely corroded.

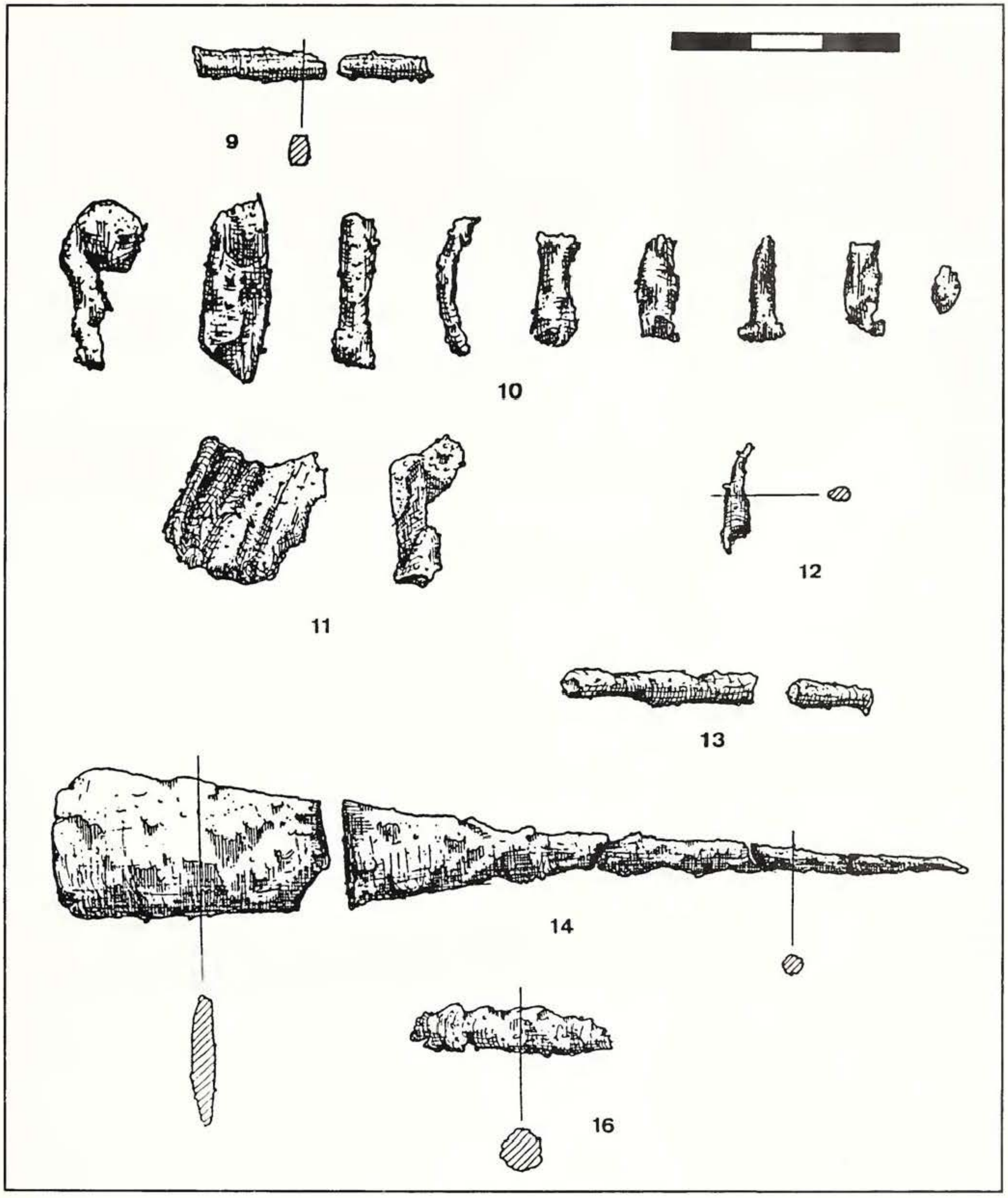

Fig. 2. 9, iron bar; 10, iron pendant fragments; 11, two twisted iron plate fragments; 12, iron wire; 13, iron rod; 14 iron spatula/adze ?; 16, iron bar (scale in cm).

The first millennium AD material from the Congo coast largely predates the occurrance of metal working in southern Africa (Miller & van der Merwe 1994). What material was available for study did not indicate any difference in fabrication technique from that employed at Early Iron Age locations further south. This observation serves to support the hypothesis that the tropical west African coastal corridor acted as a route for the introduction of Early Iron Age metal working to at least the western part of southern Africa (Denbow 1990).

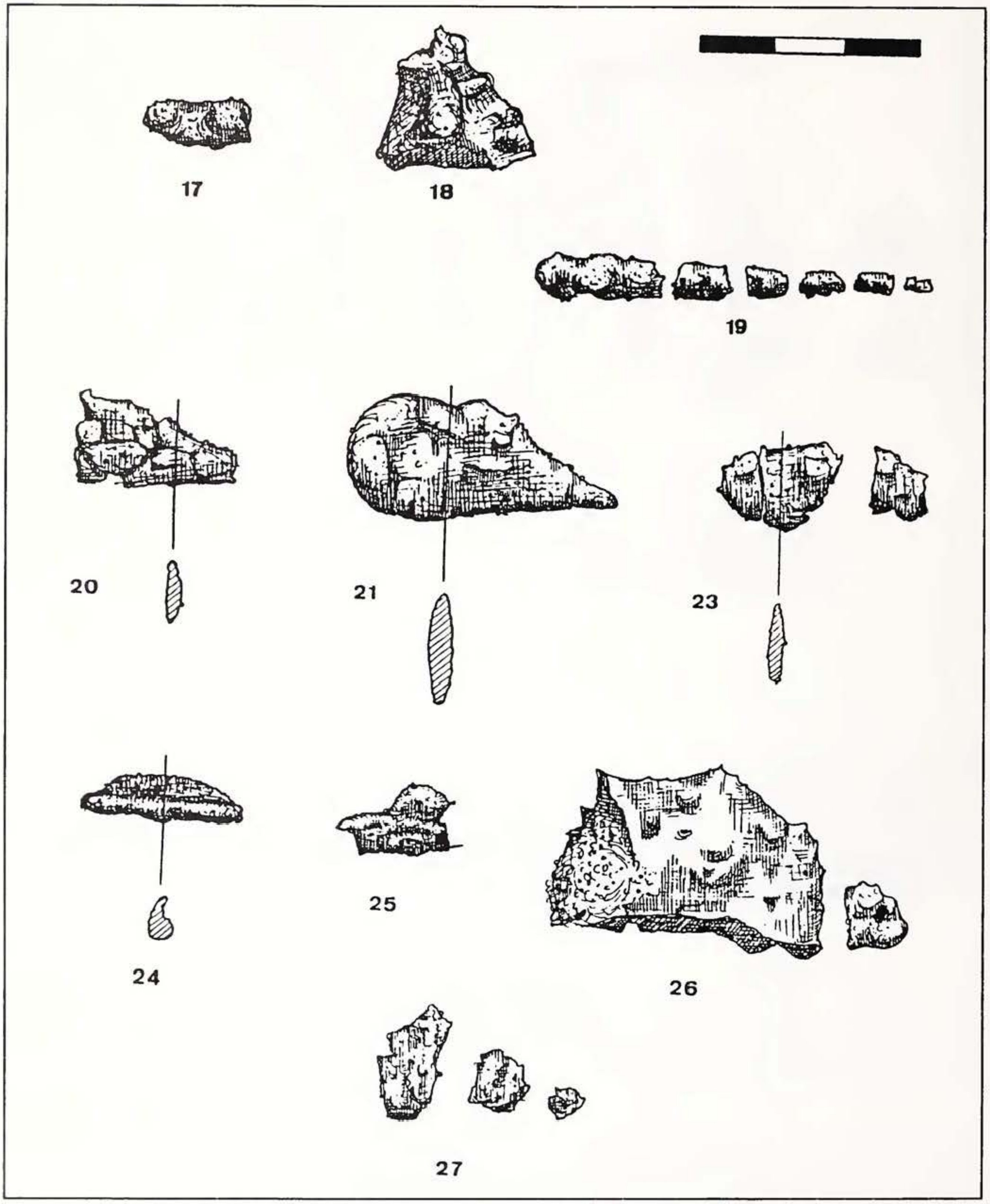

Fig. 3. 17, slag nodule; 18, slag nodule; 19, iron point; 20, iron arrowhead; 21, iron spatula; 23, two fragments of iron plate; 24, iron strip; 25, iron fragment; 26, two slag nodules; 27, three fragments of iron plate (scale in cm).

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Fig. 4. Polished transverse section through iron bar, Cong 5, from Loubanzi, showing the squared-off end (28 X).

Fig. 5. Polished longitudinal section through iron bar, Cong 5, from Loubanzi, showing typical elognated two-phase bloomery iron inclusions consisting of wüstite droplets in dark glass (360 X).

Fig. 6. Polished longitudinal section through iron bar, Cong 5, from Loubanzi, showing fractured and rounded two-phase inclusions indicative of heavy hot working (225 X).

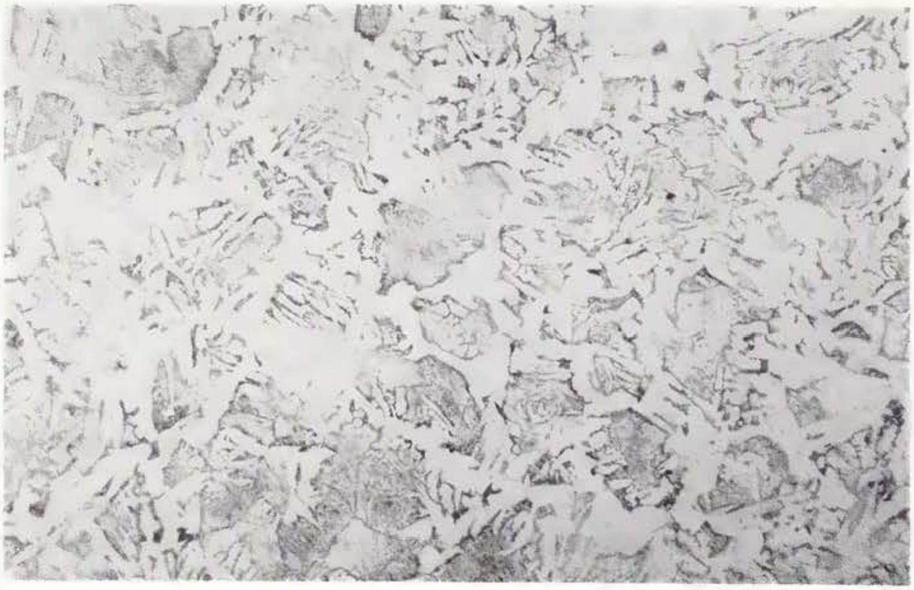

Fig. 7. Longitudinal section through iron bar, Cong 5, from Loubanzi, etched in nital, showing area of approximately 0,2 % carbon composition (450 X).

Fig. 8. Longitudinal section through iron bar, Cong 5, from Loubanzi, etched in nital, showing area of approximately 0,1 % carbon composition (450 X).

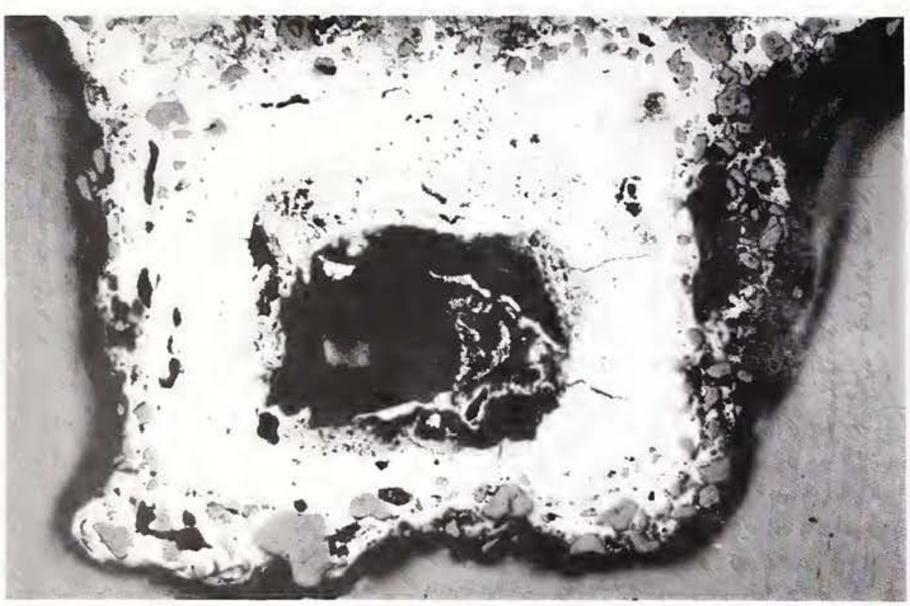

Fig. 9. Polished transverse section through corroded square wire, Cong 7, from site B.P. 113, showing outline of neatly forged square wire preserved in the corrosion product (28 X).

Fig. 10. Polished logintudinal section through corroded iron wire, Cong 7, showing residual iron grains at high magnification (720 X).

Fig. 11. Polished logitudinal section through the eye of pendant, Cong 10, showing neatly forged abutment of folded over end against the shaft (14 X).

Fig. 12. Polished transverse section through corroded iron spatula/ adze?, Cong 14, showing symmetrically forged cross sectional outline preserved in the corrosion product (28 X).

Fig. 13. Polished transverse section through corroded spatula, Cong 21, showing disruption of the structure through heavy corrosion (28 X).

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