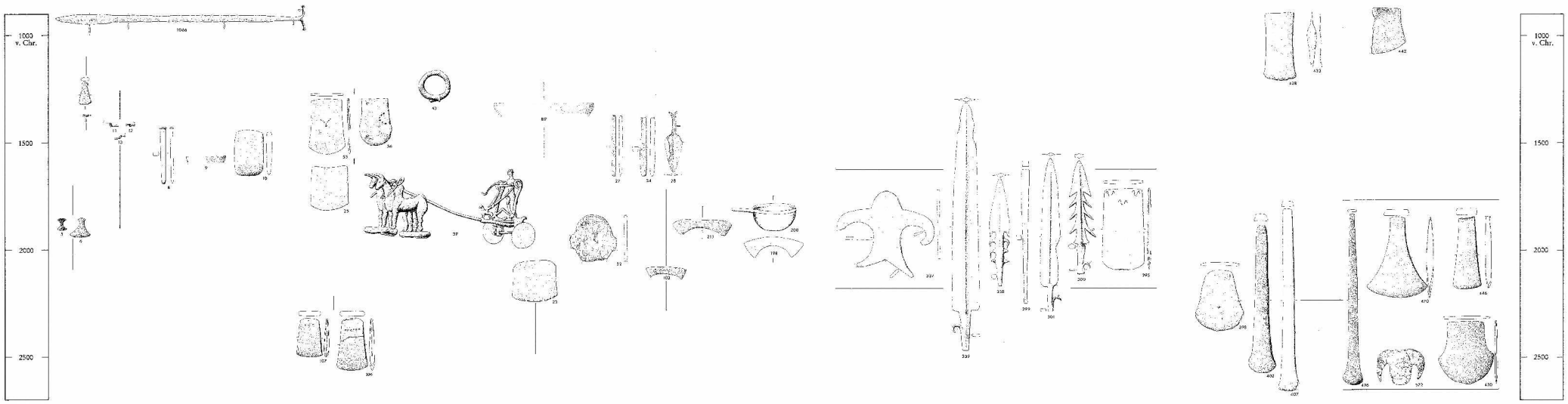


Schematic casing of representative metallic finds from India.

BEILAGE 2
Zu Jahrb. Röm. Germ. Zentralmus. 36, 1989
(Andreas Paul Yule)

PAUL YULE

THE COPPER HOARDS OF THE INDIAN SUBCONTINENT PRELIMINARIES FOR AN INTERPRETATION[1]

WITH APPENDIX I AND II
BY ANDREAS HAUPTMANN AND MICHAEL J. HUGHES

»With the word 'hoard' one usually designates Stone Age or Bronze Age deposits of traders, workshops or votive offerings, without, however, being able to make sharp distinctions between these different categories. The reason for this uncertainty is that we place far too little weight on the composition and find circumstances of the objects. While homogeneous groups of finds found within a settlement of the same date suggests an origin at the hand of traders or smiths, hoards outside the settlements along ancient roads are more plausibly the hiding places of itinerant vagabonds. A deposition, on the other hand, near striking natural wonders (peaks, peculiar rock formations) and in lakes, swamps or other wetlands frequently is indicative of a votive deposition to gods or to the deceased.« (Schumacher 1914, 29, translated).

I. Introduction

With the exception of the weapons, tools, jewellery, and other objects of the mature Harappan Culture of the late 3rd and early 2nd millennia BC in Northwest India, most extant prehistoric Indian metallic artefacts belong to hoards – otherwise the most prominent archaeological manifestation of the early Metals Age in North India. Elaborate, large, and often striking in form, the different hoard objects are particularly enigmatic owing to a near total absence of archaeological evidence for the identity of their creators. Equally scarce are fixed points for the date of the presumably largely second millennium hoards in absolute or even relative terms. Moreover, the relevant studies seldom advance beyond superficial dis-

1 Published in the Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz 36, 1989 [1992] 193–275, ISSN 0076-2741. A generous grant from the Deutsche Forschungsgemeinschaft enabled me to bring to an end the work entrusted to me in 1980 by Prof. Dr. Hermann Müller-Karpe. The sponsors who succeeded him were Prof. Drs. Klaus Fischer and T.S. Maxwell of the Seminar für Orientalische Kunstgeschichte der Universität Bonn who put considerable time, talent and effort into implementing the project. My thanks also go to Prof. Dr. Michael Raith, Codirector of the Mineralogisches-Petrologisches Institut der Universität Bonn, for his advice with regard to material analyses, and to Dr. Andreas Hauptmann of the Deutsches Bergbau-Museum, under whose supervision the quantitative analyses were conducted. H. Scholz made the majority of the final drawings and maps. Margareta Friesen and Steven Kossak recorded the pieces in the Metropolitan Museum. Discussions with Prof. Joseph Schwartzberg of the University of Minnesota saved me from several pitfalls in the mapping. At various points Bridget and F.R. Allchin advised me. I also profitted from discussions with Martin Bemmann and Martin Brandtner, Gerhard Endlich, Dr. Olaf Höckmann, Prof. Dr. Karl Jettmar, Dr. H.-E. Joachim, Dr. R. N. Knox (British Museum), Dr. E. F. Mayer, Dr. Christian Podzuweit, Dr. Ulrich Schaaff, Dr. Gerd Weisgerber, and others. With a strong and steady hand Dr. Peter Schauer supported the publication of this study from my first discussion with him. In India friends and colleagues almost too numerous to mention enabled my work to continue. Advice came from several members of the Archaeologcial Survey of India, particularly its previous Diretor General, Shri B.K. Thapar. Some of the ideas treated below go back to discussions with Shri B.B. Lal and K. N. Dikshit. Shri B.P. Badoria (Dhubela Museum), Dr. H. C. Das (State Museum Orissa), Prof. M. K. Dhavalikar and Prof. V. N. Misra (both Deccan College), Shri L. M. Wahal (Archaeological Survey of India), Dr. S. P. Gupta and Dr. L. P. Sihare (both National Museum), Shri K. M. Malavar (Central Museum Nagpur), Shri R. K. Mohapatra (Baripada Museum), Shri R. B. Narain (Varanaseya Sanskrit Visvavidyala), Shri B. K. Rath (State Archaeology Orissa), Shrimati Mira Roy (Man in India Office, Ranchi), Swami Omanand Saraswati (Mahavidyalaya Gurukul Jhajjar), Shri B. K. Thapar

cussions of the chronology and distribution of the Indian hoards, and for whatever reason the very *raison d'etre* for their deposition has all but eluded the curiosity of the archaeologist despite over a century of research. But even the distribution of the hoards has not been properly appreciated, and much of the information which appears in the literature makes little sense owing to a lack of good maps. Most of the Indian prehistoric hoard material was catalogued in 1985 in the context of the entire prehistoric industry. Financial structures, however, effectively precluded more than a fleeting interpretation of the hoards. Moreover, during the course of subsequent work additions and corrections to this study became necessary. I continued the present emphasis in South Asia because of my conviction that basic recording and study of largely unknown materials would be more rewarding than the reworking of known research objects, which at first glance may seem promising, but actually which yield few new insights. Moreover, during my earlier visits to India I was unable to visit all of the institutions housing prehistoric metallic implements. The following work is a publication of further metallic artefacts and a low-level theoretical explanation of their cultural/historical meaning for students of South Asian prehistory.

1. Previous work

In order to identify and define regional groups of artefacts in 1985, after evaluating the find circumstances, it was necessary to treat the metal finds as two major categories: those, the find circumstances of which were relatively well documented, and the remaining examples – sketchily provenanced purchases, strayfinds, and objects the provenance of which otherwise was obscure or altogether doubtful. The arte-

(Indian National Trust for Art and Cultural Heritage), Salim Uddin (then Mahant Ghasidas Museum, Raipur), B. S. Verma and A. K. Prasad (State Archaeology of Bihar in Patna), and numerous employees of Hindustan Copper Ltd. supported the project. Shri P. K. Ray, superintendent of the State Archaeology Orissa, and Dr. S. C. Mukherjee, superintendent of the Directorate of Archaeology, West Bengal, kindly allowed me to cite radiocarbon dates from their excavations in advance of publication.

The original plan to catalogue all of the South Asian metallic artefacts was interrupted and displaced by other more pressing professional duties. The following study contains results gathered and studied from early 1985 to mid 1986. Given the short amount of time available, an exhaustive evaluation of the bibliography was not possible. The places mentionned are plotted on a Bartholomews World Travel map »Indian Subcontinent...«.

All designations for artefactual types, and where otherwise not provided, bibliography derive from Yule, P., Metalwork of the Bronze Age in India. Prähistorische Bronzefunde XX, 8 (1985), To simplify the citation of artefacts the catalogue continues the serialization of this study. Portions of the following text have been delivered as lectures in Delhi, Bhubaneshwar, Pune, Bonn and Heidelberg between 1985 and 1987.

Where »sampled« appears alone in the catalogue, a metal sample has been removed by unknown persons for which no results are recorded in the specialist literature.

1 Corrections (Yule P. 1985): The finds from Hallur (nos. 5- 6) are on deposit in the State Museum Hyderabad. On p. 28 the Bagor finds are erroneously catalogued as from the Gujarat area. Usually in the case of provenances listed as being unknown, the finds are stored in the institutions which excavated them. Numerous exceptions occur. No. 83 is on deposit in the Archaeological Museum of the Deccan College Postgraduate Institute in Pune. No. 619 is presently stored in the ASl Circle Office in Bhopal. No. 786 from the Shahabad area weighs 514 gm, and no. 787, 900 gm. No. 834 is »sampled« (see note 179). No. 1000 incorrectly is catalogued as a bar celt-ingot; in fact it is a type III axe-ingot. No. 1076 from Bartholi or from Barthola actually was donated by Pater Petrus van der Linden(!) in 1923 (source of the name: List of Reverends Active in Bihar, St. Xavier's College). Omitted in the discussion of tin is D. Chakrabarty's excellent article, »The Problem of Tin in Early India – A Preliminary Survey«, Man and Environ. 3, 1979, 61-74. P. 103: I no longer believe in the hafting of axes at the butt. P. 108: K. N. Dikshit previously listed Chandausi and several other sites in his well-hidden article »The Copper Hoards in Light of Recent Discoveries«. Bull. of Anc. Ind. Hist. and Arch. [Sagar] 2, 1968, 43-50. Without regard to the find circumstances closed deposits have been scattered throughout the layout. Pl. 8, 198-201: made actually of thin sheet metal, and not as thick as drawn. Pl. 8, 205: upside down; broad end is sharpened, narrow end is not. Pl. 9, 121: read 221. Pl. 10, 224: actually not metal, but clay (error following Verma, B.S. 1974, 7). Cross sections upside down: Pl. 26, 357-360; P1. 28, 374, 380, 385, 386; P1. 34, 420-422; P1. 35, 424-426; Pl. 77, 848; Pl. 105 axes VII; Pl. 106 bar celt-ingots. Pl. 39, 456: profile drawing upside down. Pl. 46, 507: after Smith 1905. Pl. 58, 660: profile drawing upside down. Pl. 59, 677: after Lal 1951. Pl. 69, 789: cross section drawn too convexly. Pl. 93: cross section of a tine of no. 1027 erroneously next to no. 1028. Pl. 94, 1029: 2 cross sections switched. Pl. 99, 1061: omit cross section. In the map on pl. 101 the rivers are highly simplified, and the no. 82 on the Jamuna should read 89.

2 Yule, P. 1985, 6-94. Owing to the limited number of metallic artefacts presented below since the closing of the cataloguing in 1983, this organization has not been adhered to in the present study.

facts then were divided in the catalogue by geographical region, and classified taxonomically in order to facilitate their study. Given the great diversity in implement shapes, the otherwise possible proliferation of artefact types would hinder an overview. Thus, particularly the typology of axes consists of broadly defined categories as a first attempt to enable the forming of regional assemblages of related finds. Typologically speaking, the repertoire of artefact types of the Doab, eastern Chota Nagpur, South Haryana/North Rajasthan, and now the Madhya Pradesh Groups form in fact assemblages varying, yet still respectively internally cohesive in their character. Particularly these four regional groups are elaborated on in the present study. That a picture of the different groups emerges most effectively by treating the different geographical areas separately is evident from the strongly regional characters of the assemblages themselves.

2. Goals and Procedure

All available prehistoric Indian non-Harappan metallic artefacts prior to those of the megalithic Iron Age are catalogued. As a further step in dealing with the copper hoards technically and typologically related examples are attributed to the regional groups defined in 1985. At least one refinement was necessary for the admittedly wide-meshed typology. Instrumental for a better understanding of the Indian hoards is the inclusion of the contemporary metallic implements from settlements. Geographical distribution of the typological groups and new information on the chronology of contemporary archaeological complexes help us to estimate the dating of the hoards. Although the chronology of the hoards now also deserves renewed attention, with the help of a typology and finds from well-observed and documented settlements lying within the find areas, given their scarcity, chronology must remain undeveloped, and here a purely secondary research aspect (cf. Beilage 2). An analysis of the types of artefacts found in a given hoard, as well as the sources of the raw metal provide further clues to the chronology and origin of the hoards. Descriptions of the patina are summarized and support some observations of the circumstances of their deposition and as a control on the provenance. The availability of copper – the raw material of the hoard implements – requires renewed attention, this time with the help of recent geological literature. It becomes clear that the availability of copper locally does not correlate well with the distribution of the hoard groups. The mining and smelting technology of the hoards also receives some attention, owing to their intimate relation with the hoards. A necessary aspect of the description includes the chemical composition of a geographically and typologically representative sample of the finds which hitherto was lacking. Armed with this information we can describe in greater detail than previously was possible the technical capabilities of the hoard metallurgists. A rich and manifold literature dealing with the interpretation of prehistoric and early historic hoards has existed in Central Europe for over a century. It provides a source of ideas illuminating the reasons for hoards in general and the Indian hoards in particular.

3. Background

It should be bourn in mind that a nearly insuperable difficulty in the study of archaeological hoards the world over is the generally impressionistic descriptions of find circumstances which otherwise vary greatly in their reliability. All possible degrees of certainty and uncertainty with regard to the provenance of the finds (everything from strays to rare excavated finds) exist between these two poles. Of little use, if not exasperating, are the numerous sketchily documented artefacts and unconfirmed reports of artefacts now destroyed. Suffice it to say that even perfectly clear find circumstances can elicit highly differing, even contrasting interpretations of a given find. In addition, professionals and non-professionals alike seldom take the trouble to collect the unseemly remains of organic materials which at least to judge from the analogous European deposits presumably are important for an interpretation of a given hoard. The well-documented destruction of many or most Indian hoard artefacts is a sad but real fact which further hinders our knowledge of the individual contents of surviving hoards, thereby placing yet another stone in the path between us and an interpretation of this category of finds. This observation, however, should

not lead us to prevaricate from the working principle, especially when in the field, that details of archaeological contexts yield potentially more information than even the artefacts themselves. But in the final analysis the sources available to us preclude any but the most furtive attempts at any reconstruction of underlying behaviour or societal structures in India – otherwise a worthy archaeological objective. That we even speak of Indian hoards at all is because over the years groups of metal objects repeatedly came to light the reported find circumstances of which, while not completely clear, still left little doubt that they originally belonged to hoards, *(e.g.* Aguibani, Bahadarabad, Bhaktabundh, Ghangharia, Mainpuri, Pondi), and were not just strays, grave, or settlement finds. In Haryana, where since World War II metallic artefacts have been collected in considerable numbers, it is possible to point to groups of artefacts (for example, most bangles from Rewari) which belong to homogeneous typological groups, which in addition often share the same kind of patina. Many of these same objects reportedly were acquired in lots, as hoards, parts of hoards, and strayfinds. Moreover, typologically speaking Indian hoard artefacts have prehistoric parallels (especially in Europe), albeit geographically distant, but not early historical or recent ones. For all of the preceeding reasons »hoard« objects, despite their scant provenances are treated below as prehistoric.

Not entirely unexpectedly, neither Sanskrit nor later Indian texts cast much light on the customs surrounding the prehistoric deposits. Nor have the hoards in and of themselves, purchased and salvaged in India, hitherto revealed much as to their purpose and origin. But if the lack of well observed contexts is an obstacle to us, then equally as serious is the near complete lack of theoretical models in the specialist literature on India to explain them. More penetrating and clearer insights require new models, if only to shed light on the functions of otherwise puzzling implements, as well as a readiness to think in terms of theories and analogies, even ethnological ones beyond the pale of archaeology . Many relevant studies are by no means new, even if they are not universally known. Only the more relevant ones are mentioned. These certainly can point out theoretical directions for an interpretation of the Indian hoards, even if they cannot be tested or otherwise validated empirically. The reason that this literature has not yet come to bear is that most of it is written in German or in a Scandinavian language, and the journals in which it appears are little known outside of Europe. In mentioning them below the main focus lies less in original

3 Hildebrandt, A. 1897. – Rau, W. 1973. – Yule, P. 1985, 105. – Here I intentionally have concentrated on the archaeological and not the philological evidence.
4 Watson, P. J. 1979, Z77.

5 For an excellent overview of this literature see Stjernquist, B. 1963; v. Brunn, W. A, 1968, 2-19, Z30-239; Geißlinger, H. 1984; Willroth, K.-H. 1985, 9-20; Pauli, L.1985, 195- 206.

->1 Aguibani.- 2 Ahar.- 3 Akhuldoba.- 4 Amroha.- 5 Andhari.- 6 Bagor.- 7 Bahadarabad.- 8 Baharia.- 9 Balpur.- 10 Bamanghati.- 11 Bandua.- 12 Bargaon.- 13 Bardangua.- 14 Bareilly.- 15 Barrajpur.- 16 Bartola.- 17 Bhagada.- 18 Bhaktabundh.- 19 Bhiwani.- 20 Bisauli.- 21 Bithur.- 22 Brahmagiri.- 23 Chandoli.- 24 Chansar.- 25 Chatla.- 26 Chirand.- 27 Dadari.- 28 Daimabad.- 29 Dargama.- 30 Debakia.- 31 Deoti.- 32 Dhaka.- 33 Dimiria.- 34 Ekalsimgha.- 35 Elana.- 36 Eran.- 37 Etawah.- 38 Fathgarh.- 39 Gandhauli.- 40 Ganeshwar.- 41 Ghangharia.- 42 Hallur.- 43 Hami.- 44 Hansi.- 45 Hardi.- 46 Harra Chowra Darh.- 47 Inamgaon.- 48 Indilapur.- 49 Jabalpur.- 50 Jajmo.- 51 Jamboni.- 52 Jokha.- 53 Jorwe.- 54 Kallur.- 55 Kamalpur.- 56 Kamdara.- 57 Kankasa.- 58 Karharbari.- 59 Katmandu valley.- 60 Kayatha.- 61 Kesli.- 62 Kesna.- 63 Khera Manpur.- 64 Kindhaulia.- 65 Kiratpur.- 66 Kosam.- 67 Kota.- 68 Kulgara.- 69 Kulhade-ka-Johade.- 70 Kurada.- 71 Kushaya.- 72 Lal Qila.- 73 Langnaj.- 74 Lothal.- 75 Ludurapada.- 76 Madnapur.- 77 Mahisadal.- 78 Mahuadanr.- 79 Mainpuri.- 80 Mallah.- 81 Maski.- 82 Mathura.- 83 Mitathal.- 84 Moongalaar Tea Estate.- 86 Nagar.- 87 Nakrahiya.- 88 Nandlalpura.- 89 Nankom.- 90 Narnaod.- 91 Narsimhapur.- 92 Nasirpur.- 93 Navdatoli.- 94 Nevasa.- 95 Niorai.- 96 Pandu Rajar Dhibi.- 97 Pariar.- 98 Parihati.- 99 Pauli.- 100 Perua.- 101 Piklihal.- 102 Pind.- 103 Pondi.- 104 Prakash.- 105 Rajpur Parsu.- 106 Ramapuram.- 107 Ramjipura.- 108 Rangpur.- 109 Resgavaon.- 110 Rewari.- 111 Sabania.- 112 Saguni.- 113 Saipai Lichchwai.- 114 Sanchan Kot.- 115 Sandhay.- 116 Sanghol.- 117 Sankarjang.- 118 Sarthauli.- 119 Sastevadi.- 120 Shahabad.- 121 Shavinipatti.- 122 Sheorajpur.- 123 Somnath.- 124 Sonpur.- 125 Tamajuri.- 126 Taradih.- 127 Tekkalakota.- 128 Terdal.- 129 Viratgarh.

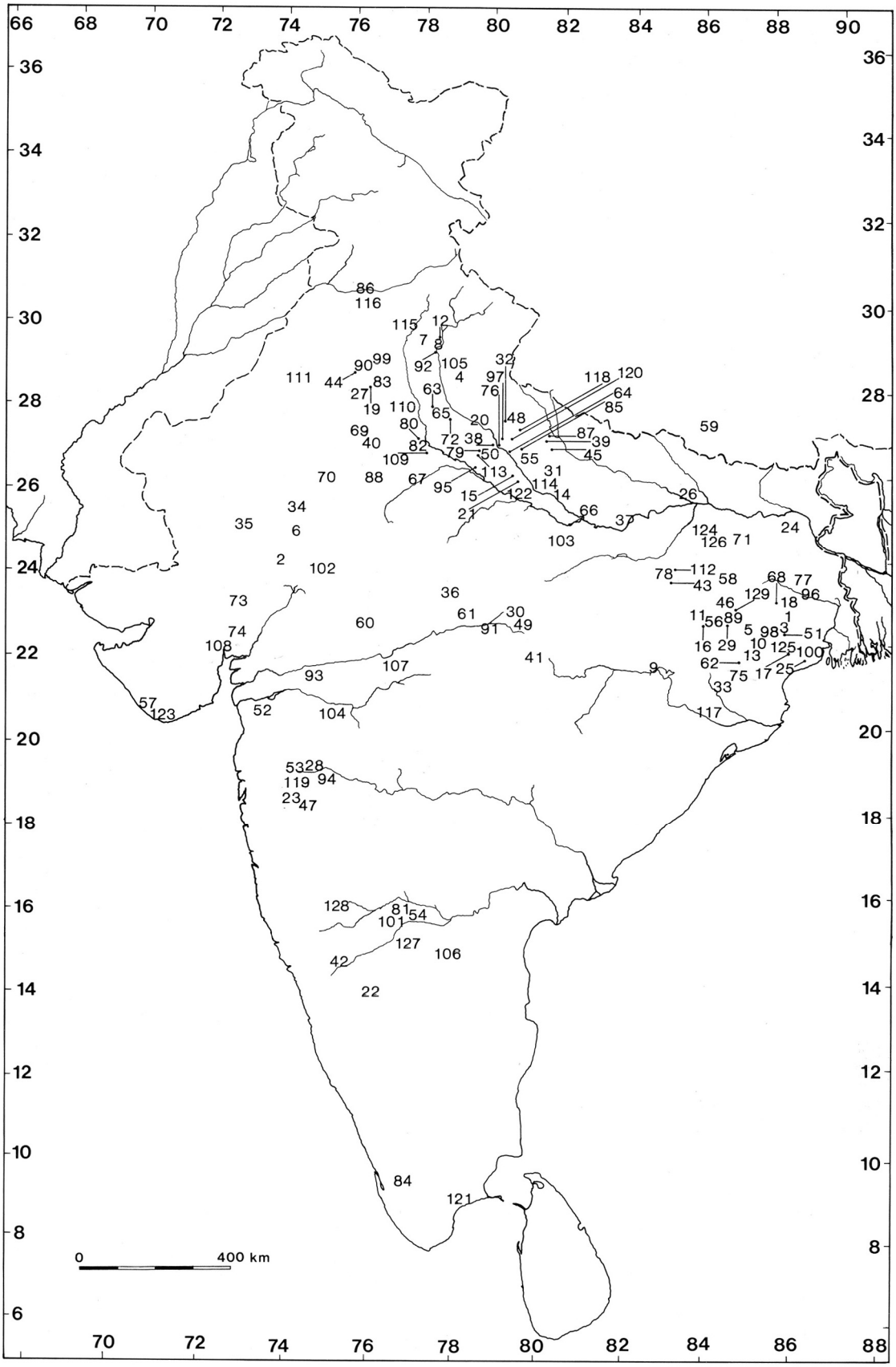


Fig. 1 for the sites see the preceeding page.

research, than in making this key source of theory selectively accessible to an English-reading specialist public. At the present stage of research an ethnoarchaeological approach is one of the few available to us unless we are satisfied with a purely catalogue approach for the hoards. In addition, a study of the condition of the artefacts *(i.e.* whether finished or unfinished, used or unused, damaged or undamaged artefacts were entrusted to the earth) is of crucial importance for an interpretation. For example, the patina occasionally provides a hint if a particular hoard was buried in the earth, in a swamp, or deposited in a river. The prehistoric European hoards, resemble in certain key respects those in India. Particularly striking are certain shared types of arm spirals, flat axes, axe-ingots' and bar celts. These correspondences need not be purely accidental, and may shed light on the background, especially the function of the Indian hoard objects. Contact between the two areas is of course out of the question for geographic, if not for chronological reasons. Both share a propensity for a deposition in swamps, fields, forests, and river banks. The majority of the several thousand kilogrammes of European hoards', ranging from Hungary to Spain and from Italy to Scandinavia, unfortunately, as in India, also are spottily provenanced, although a large number of metallic artefacts from well-observed settlements and burials, provide clear indications for their relative dating. But whereas in Europe metallic artefacts from settlements and burials predominate, in India the hoards as such are more numerous. In addition, whereas many Indian hoards occurred in swampy or previously swampy areas, here telling so-called »moor finds«, implements with a moor patina or even peat bogs are unknown.

II. Provenances of hoard objects and newly recorded finds" (Map Fig. 1)

1. South India

Ramapuram village[2], Taluk Bangalpalle, Dist. Kurnool, A.P. (15° 5'N; 78° 5'E). – The students of the School of Archaeology of the Archaeological Survey of India investigated this settlement and burial site extensively in 1980-81. Thus far only preliminary reports have appeared. The excavations describe the 85 to 95 cm thick habitational level as indicative of a single culture which is divisible in three phases. The lowermost layer (I A) contained handmade burnished red, grey, and black ware in association with a microlithic tool industry, as well as pecked and ground stone tools. Some of the vases are slipped and burnished. Such examples occasionally show painted linear designs in black and violet. The designs include horizontal bands, groups of vertical lines running all over the body, oblique strokes, cross hatching, wavy lines and concentric semicircles. Key shapes during this phases include vases with a plain rim, constricted

6 (Yule, no. 1104): *cf.* Richter, I. 1970, nos. 251-Z84 (Bronze Age); Blajer, W. 1984, nos. 1-12 (Bronze Age I).
7 Flat axes, type IIIa: *cf.* Schmidt, P. K./C. B. Burgess 1981, nos. 1-18 with Yule, P. 1985, nos. 443-446; Chardenoux, M.-B./J.-C. Courtois 1979, no. 56. Flat axes, type Vb: *cf.* Harbison, P. 1969, pls. 1-14 (type Lough Ravel, *c.* 1750-1650 BC). Flat axes, type Vll: *cf, ibid.,* 82, pls. 19-36 (type Killaha, *c.* 1650-1500 BC); cf. Abels, B.-U. 1972, no. 605 (Hochstein, Landkreis Karlsruhe, Chalcolithic); *cf.* Monteagudo, L. 1977, nos. 688-702 (type 11B, central Portugal D, *c.* 1600 BC); *cf.* Schmidt, P.K./C.B. Burgcss 1981, nos. 56-190c (type Migdale, Scotland/Northern Ireland); *cf.* Kibbert, K. 1980, no. 69 (findspot unknown); *cf.* Chardenoux, M.–B./J.-C. Courtois 1979, no. 76 (findspot unknown, northern France); *ibid.,* nos. 119–144 (various findspots).
8 Axe-ingots in general: *cf.* Schmidt/Burgess 1981, nos. 40-41. – Axe-ingots, type III: *ibid.* no 36 (Invernesshire ?).
9 Bar celts: *cg.* Abels, B.-U. 197Z, no. 224 (type Sion I, Bronze Age B) + many »spoon axes«. – Bar celt-ingots: *cf.* Patay, P. 1984, no. 72 (findspot unknown, Chalcolithic); Gaitsch, W. 1980, 259; this is also clear from a perusal of Deshayes, J. 1960.
10 To the largest deposits belongs that from S. Francesco in Bologna *(c. 700* BC); 15000 pieces, 1400 kg. – Hammersdorf/ Guşteriţa in Transylvania (c. 1200 BC): more than 5000 pieces, *c.* 800 kg. Müller-Karpe, H. 1975, 55.
11 Owing to the mixed nature of the maps available for study, throughout I have cited geographic coordinates, and neither those of the Indian Grid Zones, nor of the Universal Transverse Mercator system. Map 1 updates that which I published in 1985 (Yule, P, 1985, 506).
12 *Cf.* Narasimhaiah, B. *et al.* 1983, 4; *ibid.* 1985. Not all of the metal objects are published in the preliminary reports.

neck, and a globular body; a deep plain-rimmed bowl; lipped bowl; channel-spouted bowl; spouted vessels; basin and open bowls. Characteristic of the microlithic industry include parallel-sided blades, backed blades, penknife blades backed with a notch, bladelets, blade-scrapers, and others. Some scraps of metal also occurred (nos. 1084-1085)[13].
Period IB is a continuation of the preceeding phase with the disappearance of the microlithic industry. Also different is the appearance of a handmade burnished grey-and-brown ware, as well as an increase in the frequency of the occurrence of painted red ware. Other important finds include terracotta, beads, the copper tongue of a bell (not reproduced), and gaming pieces.
The subsequent IC period witnesses the introduction of iron and remarkable technical improvement with the brown ware which gradually is replaced by a black-and-red ware.
In all three phases the dwellings are huts built of perishable materials. Those which are circular in plan range in diameter from 2.2 to 8.2m. The oval huts range from 9.1x11.1 to 2.2x3.15m in diameter. The faunal remains included bones of *Bos indicus* (cattle), *Bubalus bubalis* (buffalo), *Capra aegagnms* (goat), *Oris aries* (sheep), *Sus scrofa cristatus* (pig) as well as non-domesticated animals: *Cervus unicolor* (sambar), *Gazella gazella* (chinkara), and birds.

1084. Level IA6 (settlement?). – Miscellaneous curled band. C. 8.9x0.2x0.1cm (Fig. 7,1084).– ASI Nagpur. – Narasimhaiah, B. et al. 1983, 4-6 fig. 3.

1085. Level IB (settlement ?). – Miscellaneous wire implement with looped end. C. 5.9x0.7x0.7cm (Fig. 7, 1085). – ASI Nagpur. – Narasimhaiah, B. et al. 1983, 4-6 fig. 3.

Shavinipatti village, Taluk Tirupattur, Dist. Ramana-thapuram, T. N. (9° 20' 30 "N; 78° 51' 31 "E) "". – In 1982 while laying a road near the village of Minnalkudi, local workers accidentally turned up a presumably ancient copper sword. This artefact is presently on deposit in the Government Museum Madras.

1086. Sword, type IIa. 73x9.4 (butt) x0.8 cm, 685 gm (Fig. 7, 1086). – Gov't. Mus., Egmore Madras (3/84). – Devashayam, N. 1983, 128.

13 *Ibid.* 1983, 3-7, pls. 1-8.
14 Devashayam 1983, 128, citing a letter from the collector from the Ramanathapuram district, addressed to the director of the Government Mus. Madras (28.06.1982).

2. South Haryana-North Rajasthan

»**Ambala**«[15], see Sandhay.

Hansi town, Dist. Hissar, Har. (29° 9' 24 "N; 75° 57' 30"E). – A type IVA and a IVf axe (nos. 1087-1088) were sold to the Mahavidyalaya Gurukul Museum in Jhajjar from a dealer of scrap metal in Hansi, thus adding to the list of various metallic artefacts acquired here during the past 30 years[16]. Part of a hoard obtained in Hansi is said to derive from the neighbouring town Narnaond, some 23 km to the northeast.

1087. Axe, type 1Vf. 13.8x5.6x1.7cm, 812gm, recently all surfaces filed, hacking on the reverse (Fig. 7, 1087). – Gurukul Mus. Jhajjar (284). – Unpub.

1088. Axe, type IVa. 18.4x6.2x0.4cm, 280gm, recently bent (Fig. 7,1088). – Gurukul Mus. Jhajjar (285). – Unpub.

Near **Mallah**, 900 m NNW of Mallah town/hill on the roadside, at thc outer wall of the Dalmia dairy plant, Tehsil Bharatpur, Dist. Bharatpur, Raj. at 200m altitude (27° 11' 42 "N; 77° 29' 36" E). – »16 harpoons, 7 celts, 2 chisels, 7 swords and a hooked rod all typical of the Gangetic valley specimens. These were acquired in November 1982...« for the Directorate of Archaeology and Museums in Jaipur[17] *(cf.* nos. 1089-1090). This hoard was discovered inadvertently by local people digging for clay. The Mallah hill is a PGW site, and is the most likely location for the earlier settlement associated with the hoard[18].
The low-lying Ghana area becomes a lake during the rains. It supports a different kind of duck-weed and various fish, thus providing food for the water birds[19]. Many different aquatic birds migrate here during the monsoon for breeding. When the water dries up in the summer cheetal, black buck, sambar, nilgai and other animals take advantage of the excellent pasture. Typical of this swampy forest are babul *(acacia nilotica)* which flourish in the moist, alluvial and aeolic soil.

1089. Chisel. C. 25 x *c.* 3.5 cm, ancient hammering of the butt end (Fig. 7, 1089). – Directorate of Archaeology and Museums Rajasthan, Jaipur. – Unpub.

15 P. Yule1985, 7. no. 538.
16 P. Yule 1985, 14.
17 M. Lal, 1983, 76.
18 I thank Shri R.C. Agrawal for discussing this and other findspots with me (16.09.1986 and letter 29.10.1986).
19 Census 1971 Bharatpur, 13.

1090. Miscellaneous harpoon. C. 26x4.7x2 cm, hooks damaged by corrosion, recent (?) damage to the blade (Fig. 7, 1090). – Directorate of Archaeology and Museums Rajasthan, Jaipur. – Unpub.

Nandlalpura village, 9 km east of the centre of Chaksu, Tehsil Chaksu, Dist. Jaipur, Raj. (26° 33' 45" N; 76° 01' 34" E). – Situated on the Dhanda river, this village reportedly yielded a hoard consisting of six »bar celts«, which actually are typ IVc axes, one of which is recorded here. The find was made during the course of road repairs[20].

1091. Axe, type IVc. C. 27.5xc. 6.3cm (Fig. 7, 1091). – Directorate of Archaeology and Museums Rajasthan, Jaipur. – Unpub.

Narnaond town, Dist. Hissar, Har. (29° 13' 05" N; 76° 08' 48" E). – In 1969 Swami Omanand Saraswati acquired 18 hoard objects in Hansi which reportedly belonged to a hoard from Narnaond which weighed three quintal (= 300kg). Repeated attempts to acquire further pieces from this hoard were unrewarded until two years following the original purchase, when a last type IVb axe (Yule no. 723) suddenly became available. The remaining hoard objects reportedly were melted down or disposed of in some other way. The first acquisition includes type IVb flat axes, bars, and type III harpoons[21]. Certain peculiarities distinguish the objects of this hoard which indirectly corroborates the provenance: 1) Only the IVb flat axes show the engraved snow flake-like signs. 2) The artefact types are limited to three. 3) the objects of each type are unusually similar to each other. 4) Type II harpoons are known only from this hoard.
Rewari town, Dist. Mahendragarh, Har. (28° 12' 16" N; 76° 36' 18"E). Metallic artefacts continue to turn up in Rewari, presumably from the nearby surrounding area. Recently acquired objects, including several types of axes, and a fragment of a type III sword are presently housed in the Mahavidyalaya Gurukul Museum in Jhajjar.

1092. Axe, type II. 9.9x7.8 (pres.) x0.9 cm, 340 gm, both corners of the lead edge recently damaged (Fig. 7, 1092). – Gurukul Mus. Jhajjar (272). – Unpub.

1093. Axe, type II. 7.4x5.2x0.7 cm, 158 gm, heavy incrustations, blade recently sharpened (Fig. 7, 1093). – Gurukul Mus. Jhajjar (273). – Unpub.

1094. Axe. type II. 12.7 x 9.5 (pres.) x 1.1 cm, 816 gm, four indentations on obverse, rough surface, ancient retouching (?), recent damage to the lead edge (Fig. 7, 1094). – Gurukul Mus. Jhajjar (274). – Unpub.

1095. Axe, type IIIa. 15.3 x 10.8 x 0.8cm, 700 gm, side edges slightly flattened, cutting edge recently sharpened (Fig. 7, 1095). – Gurukul Mus. Jhajjar (275). – Unpub.

1096. Axe, type IIIa. 12x7x0.5 cm, 224 gm, corner of the butt broken off (Fig. 7, 1096). – Gurukul Mus. Jhajjar (276). – Unpub.

1097. Axe, type IIIa. 9.6(pres.) x6.7x1.1 cm, 458 gm, front half preserved, old break? (Fig. 7, 1097).– Gurukul Mus. Jhajjar (277).– Unpub.

1098. Axe, type IIIa. 18x10.2x1.1 cm, 1150 gm, sharp cutting edge now damaged, heavy incrustations (Fig. 7, 1098).– Gurukul Mus. Jhajjar (278).– Unpub.

1099. Axe, type IIIa. 16.8x12x1 cm, 1004 gm, sharp cutting edges, three indentations near the butt on one face (Fig. 8, 1099).– Gurukul Mus. Jhajjar (279).– Unpub.

1100. Axe, type IIIa. 14.1 (pres.) x12.1x 0.8 cm, 696 gm, cleaned, front edge recently cut off (Fig. 8, 1100). – Gurukul Mus. Jhajjar (280). – Unpub.

1101. Axe, type IVf. 18.1x6x1.6 cm, 948 gm (Fig. 8, 1101).– Gurukul Mus. Jhajjar (282).– Unpub.

1102. Miscellaneous axe. 20. 2 x 16.1 x 0.9 cm, 1700 gm, both butt corners recently bent, one also cut off (Fig. 8, 1102).– Gurukul Mus. Jhajjar (281).– Unpub.

1103. Sword blade fragment, type III. 13.2(pres.) x4.9 (pres.) x1.7 cm, 222 gm, broken off above and below, rough surfaces, battered (Fig. 7, 1103). – Gurukul Mus. Jhajjar (283). – Unpub.

1104. Misc. Wire spiral. 8x14, wire D. 0.3 cm, 32 gm, drawn wire circular in section, badly bent out of shape (Fig. 8, 1104). – Gurukul Mus. Jhajjar (284). – Unpub.

20 Agrawal, R. C. 1980, 9Z, pl. 3. – *Idem*. 1981a, 30-31 n. 21. – *Idem*./V. Kumar 1982, 139. – Yule, P. 1985, 20, 110.
21 Personal communication with Virjanand Devakarni 17.08.1986, who personally was instrumental in the transaction. The pieces from this hoard: Yule nos. 715-722, 958-960, 1032-1039. The unusual surface of all of the objects of this hoard results from a harsh cleaning with caustic soda. The exception, no. 1038, shows a thin, dark green patina.

Sabania village, Tehsil Lunkaransar, Dist. Bikaner, Raj. (28° 58' 22"N; 74° 2' 47"E). – From this village two type IVb axes came to light in 1966[22].

Sandhay (Sindhai) village, Tehsil Jaghadhari, Dist. Ambala, Har. (30° 11' 50" N; 77° 17' 04" E). – In 1982 or 1983 a local resident obtained four objects which formed a hoard of which another piece (a fragment of a type II anthropomorph) is known[23]. The hoard is said to have consisted of two type I anthropomorphs, two type II harpoons, as well as a lance head (nos. 1105-1108).

1105. Anthropomorph, type I. Dimensions and weight unknown, pattern gouging visible despite a heavy coating of corrosion products and dirt (Fig. 8, 1105). – Priv. Coll. Ambala (no no.). – Unpub.

1106. Harpoon, type II. Dimensions and weight unknown, double lugs at the tang, hole does not pierce the lug (Fig. 8,1106). – Priv. Coll. Ambala (no. no.). – Unpub.

1107. Harpoon, type II. Dimensions and weight unknown, blade battered, barbs broken off and /or bent (Fig. 8, 1107). – Priv. Coll. Ambala (no no.). – Unpub.

1108. Lance head. Dimensions and weight unknown, human face modelled on the shank, tip blunted, shank broken off (Fig. 8, 1108). – Priv. Coll. Ambala. – Unpub.

»**Saunia**«[24], see Sabania.

3. Ganges-Yamuna Doab

Amroha town, Tehsil Amroha, Dist. Moradabad, U. P, (28° 54'N; 78° 26'E). – In 1986 Tarik Ahmed Chisti sold a type IIlb and a IVa axe, as well as a type II harpoon (nos. 1109-1111) to the National Museum in Delhi. The finds reportedly belonged to the same hoard, although whether or not originally others also existed remains unknown[25].

1109. Axe, type IIIb var. 16.5x13.7x1.1 cm, *c.* 1030 gm, slightly irregular in form, dull green patina mixed with heavy accretions (Fig. 9, 1109). – National Mus. Delhi (86.3). – Unpub.

1110. Axe, type IVa, 24.1x6.1x0.45 cm, 344 gm, thick, partially spalted, rough green patina, heavy accretions and dirt, corners recently damaged (Fig. 9, 1110). – National Mus. Delhi (86. 4). – Unpub.

1111. Harpoon, type II, 36.9x5.8x1.7 cm, 798 gm, thick light green patina, barbs recently broken off (Fig. 9, 1111). – National Mus. Delhi (86.2). – Unpub.

»**Balua**«[26], see Etawah, P.S. Balua[27], Dist. Varanasi, U. P.

Near **Bareilly** town, Dist. Bareilly, U.P. (26° 14'N; 81° 14'E.). – Pramad Puri of Argun Nagar, Delhi sold several hoard implements (nos. 1112-1113) to the National Museum in Delhi in 1986 reportedly from a site in this area[28].

1112. Axe, type IIIa. 12.4x8.7x0.9 cm,460 gm, rough surface (Fig. 9, 1112). – National Mus. Delhi (86.6). – Unpub.

1113. Harpoon, type II. 33.6x7x2.15 cm, 844 gm, dark brown patina, lug hole plugged with dirt, harsh mechanical cleaning (Fig. 9, 1113). – National Mus. Delhi (86.5). – Unpub.

Barrajpur village, Tehsil Bilhaur, Dist. Kanpur, U.P. (27° 40' 21" N; 80° 08' 35" E)[29]. – Two harpoons, presumably of types l or II, are said to be in the possession of a villager from here (non-evaluateable).

Bithur town. Dist. Kanpur, U.P. (26° 37'N; 80° 16'E). – In 1967 a dealer sold four hoard artefacts to the

22 Yule, P. 1985, nos. 733 and 739. Further discussions with Virjanand Devakarni of the Gurukul in Jhajjar have redeemed the honour of Sabania as a findspot despite *ibid.* 25 note 182. *Cf.* Anon. 1971 Bikaner, pp. 8, 31. The coordinates used in the present study are taken from a 1:250000 map.
23 Yule, P. 1985, no. 585. The provenance of this piecc is here- with emended. Source: Virjanand Devakarni for the infor- mation and the photos (13.09.1986). Census 1971 Ambala, village no. 80 on p. 74; coordinates read from this source.
24 Yule, P. 1985, 25.
25 Source: Museum accession register and oral information supplied by R. P. Sharma. In fact, the patinas of the three pieces differ greatly from each other which casts some doubt on the provenance. Coordinates read from Census 1971 Moradabad, map oppos. title page.
26 Dikshit, K. N. 1968, 43-50.
27 Yule, P. 1985, 13.
28 Source: Museum accession register.
29 Letter from L. M. Wahal, 6.05.1986. Census 1961 Kanpur, p. vii, village no. 287.

Museum of the Varanaseya Sanskrit Visvavidyalaya (nos. 1117-1120) which bore this nominal provenance[30]. Nothing is known of their find circumstances. Ten years later, the enquiries of Makkhan Lal with regard to hoard artefacts led him to a private temple belonging to Shri Arjun Panda, who lives on the left bank of the Ganges[31]. Some 40 years ago the latter »found« three axes (nos. 1114-1116) and three harpoons in the bed of the Ganges near the left bank[32]. The harpoons have nothing in common with known types, and may well be modern tribal copies of prehistoric harpoons, although at present we can do little more than speculate as to their origin. The axes are of the IIIa type.

1114. This axe was recorded by Makkhan Lal as part of a hoard in 1977. – Axe, type IIIa. 16.4x10. 2x 0.8 cm (Fig. 9, 1114). – Temple belonging to Arjun Panda, left Ganges ghat, Bithur. – Lal, M. 1984, 315-317, pl. 11b, left.

1115. Axe, type IIIa. 23.8 x 17.6 x 1.1 cm (Fig. 9, 1115). – Temple belonging to Arjun Panda, left Ganges ghat, Bithur. – Lal, M., Settlement History 1984, 315-317, pl. 11b, centre.

1116. Axe, type Va. 17x8.5xi cm (Fig. 9, 1116). – Temple belonging to Arjun Panda, left Ganges ghat, Bithur. – Lal, M. 1984, 315-317, pl. 11b, right.

1117. Axe, type II (razor ?). – 7. 5 x 6. 2 x 0. 3 cm, 76 gm, butt damaged anciently (?), dark patina (Fig. 9, 1117). Varanaseya Sanskrit Visvavidyalaya (67. 21). Unpub.

1118. Harpoon, type I. 24.4 (orig. 25)x4.4x1.6 cm, 382 gm, recent gouging and bending, patina spalted in places (Fig. 9, 1119). – Varanaseya Sanskvit Visvavidyalaya (67.18). – Unpub.

1119. Sword, type II. 36.5 (pres.) x5.2 (pres.) x0.6 cm, 226 gm, recently bent and broken, light green patina spalted at the bent areas (Fig. 9, 1119). – Varanaseya Sanskrit Visvavidyalaya (67.19). – Unpub.

1120. Miniature sword. 21x2x0.25 cm, 49 gm, light green patina, worn in places (Fig. 9, 1120). – Varanaseya Sanskrit Visvavidyalaya (67.20). – Unpub.

30 Personal communication from R. B. Narain, Head of the Museum. Findspot »Chandausi«: Gupta, P. L. 1980, 302. The source of this attributed provenance is unknown.
31 Lal, M. 1984, 315.
32 *Ibid*
33 Orally expressed information L. M. Wahal 22.10.1985 (both »**Chandausi**« town, *supra* note 30 and »Non-evaluateable«.

Jajmo mound, Tehsil Kanpur, Dist. Kanpur, U. P. (26° 25’ 54” N; 80° 24’ 32” E). – A broken type II harpoon and a fragmentary axe of unknown type (non-evaluateable) came to light accidentally around 1955 . Both previously were in the collection of Dr. Raj Kumar Sinha (deceased) of Kanpur.

Provenance unknown

1121. Anthropomorph, type I. 22.5x30.6x0.9 cm, 1075 gm, overall pattern gouging on both faces (Fig. 10, 1121). – Kronos Coll. on loan to the Metropolitan Museum of Art, New York (1985.42.1). – Lerner, M. 1985, 16-17, no. 1a.

1122. Anthropomorph, type I. 21.6x21 (pres.) x 0.6 cm, 947.5 gm, overall pattern gouging on both faces, in a gable-like pattern in the »head«, one arm broken off, recent sawing at the break, right »foot« slightly damaged (Fig. 10, 1122). – Kronos Coll. on loan to the Metropolitan Museum of Art, New York (1985.42.3). – Lerner, M. 1985, 16-19, no. 1b.

1123. Anthropomorph, type I. 21x29.3x0.6 cm 1048 gm, end of right arm broken off (Fig. 10, 1123). – Kronos Coll. on loan to the Metropolitan Museum of Art, New York (1985.42. 2). – Lerner, M. 1985, 16-19, no. 1c.

1124. Harpoon, type II. 34x6.8x1.82 cm, 885.5 gm, heavy incrustations (Fig. 10, 1124). – Kronos Coll. on loan to the Metropolitan Museum of Art, New York (1985.42.7). – Lerner, M. 1985, 16-17, no. a.

1125. Harpoon, type II. 35.6 (pres.)x6.2x1.47 cm, 765 gm, tip recently damaged, heavy incrustations (Fig. 10, 1125). – Kronos Coll. on loan to the Metropolitan Museum of Art, New York (1985.42.6). – Lerner, M. 1985, 16-17, no. b.

1126. Harpoon, type II, 31.8x6.4x1.82 cm, 698 gm heavy incrustations (Fig. 10, 1126). – Kronos Coll. on loan to the Metropolitan Museum of Art, New York (1985.42.5). – Lerner, M. 1985, 16-17, no. c.

pieces non-evaluateable). *Cf.* Lal, M. 1984, 272-273 (earliest remains PGW). Iron artefacts, in fact, bear this same provenance, Anon., 1985, 216. Coordinates read from a 1:250000 map, the large scale of which renders a reading correspondingly inexact here and in a few other cases in the present study.

1127. Harpoon, type II, 26.5 (pres.)x6.9 cm, 817 gm, tip recently broken off (Fig. 10, 1127). – Kronos Coll. on loan to the Metropolitan Museum of Art, New York (1985.42.4). – Lerner, M. 1985, 16-17, no. d.

»**Sadabad**[34]«, see Resgavaon[35]

Saipai Lichchwai village, Tehsil Etawah, Dist. Etawah, U.P. (26° 54' *c.* 57" N; 79° 3' *c.* 45" E). – »Within 72 hours« of their accidental discovery and subsequent dispersal, L.M. Wahal of the Archaeological Survey of India reached the site of Saipai (Saifai) in August of 1969 (18 km NNW of the Etawah rail station), and collected those artefacts which the local finders had not already disposed of[36]. The villagers described the hoard to Wahal as a somewhat disorderly heap of over 200 metal objects lying one atop the other, strewn over a 10x10m area. Interesting is the repertoire of artefact types. In addition to those artefacts originally published, so-called lance heads now seem to dominate *(cf.* nos 1131-1132). Also newly discovered are a large type IIIa and a Va axe, as well as a type I anthropomorph (no. 1128). Reportedly bars also occurred in the hoard. None of the objects show ancient use-wear. Hammers and other implements of ground stone also belong in this same context. While nearly all of the metallic artefacts already had been carried off by the time of the excavation, the patina of many remained, adhering to several now fragmentary impressions which they left in the clay[37]. These impressions, recognized as such in 1986, show the shapes of the artefacts which made them, but are too fragmentary to indicate exactly which types (other than perhaps type Va axes) are represented in this deposit. They are important, however, in that they remove any potential doubt about the accuracy of the find recording.
The excavation covered an area of 400m^2. Four surfaces, 10x10 m in plan, and 3 m deep were excavated in the alluvium down to the virgin soil. The settlement layer measured some 1.5 m in thickness. Despite a lack of obvious dwelling floors, Saipai may be taken as a settlement site. B.B. Lal has taken over the responsibility for the final publication of this important context[38].

1128. Anthropomorph, type I. 26 x 18. 2 x 0. 5 cm, both sides show a herringbone pattern of surface decoration, cleaned (Fig. 11, 1128). – L. M. Wahal Coll., Kanpur (1). – Unpub.

1129. Axe, type Va. 22.8x17.8 (pres.) cm, irregular finish and shape, right lead corner broken off (Fig. 11, 1129). – Present whereabouts unknown, drawing after the photo ASI no. 885/71. – Unpub.

1130. Axe, type Va. 20.2x15.6 (pres.)x0.8 cm *c.* 1300 gm (Wahal), dark green patina, right front corner recently cut off (Fig. 11, 1130). – L. M. Wahal Coll., Kanpur (5). – Unpub.

1131. Lance head? 57x9.3x1.1 cm, hook split off of the shank, rough workmanship, one side of the blade slightly damaged at the shank (Fig. 11, 1131). – L. M. Wahal Coll., Kanpur (3). – Unpub.

1132. Lance head? 67.1x7.4xl cm, hook split off of the shank, rough workmanship (Fig. 11, 1132). – L. M. Wahal Coll., Kanpur (4). – Unpub.

1133. Miscellaneous sword. 54.2x7.4x1.2 cm, two holes bored anciently near the blade hilt, light green patina, edge recently sharpened (Fig. 11, 1133). – L. M. Wahal Coll., Kanpur (2). – Unpub.

Sanchan Kot mound[39], Dist. Unnao. U.P. – A harpoon of unknown type is reported to have come from here (non-evaluateable).

Shahabad area, Dist. Hardoi, U.P. (27° 38' 03" N; 79° 56' 37" E). – A variety of different copper artefacts have been acquired over the years from Dr. Jagdish Gupta of the University of Allahabad which are said to derive mostly from the area of Shahabad town, particularly from a large hill there (nos. 1134-1189)[40].

1134. Axe, type II. 10.5x7.9x0.8 cm, 420 gm, light ovoid smithing indentations, retouched (?) (Fig. 12, 1134). – National Mus. Delhi (71.219). – Unpub.

34 Agrawal, D. P. *et al.* 1974, 17.
35 Yule, P. 1985, 23. Emending this text, in fact, the hoard consisted of 16 (not 14) type V axe-ingots. The two others are presently on exhibit in the Mathura Museum (inv. nos. 75.33 and 75.34: Srivastava. A. K. 1973; Sharma, R. C. 1971, 8, 21. The hoard was first mentioned publicly by K. N. Dikshit (1968, 43-50).
36 Orally expressed information 22.10.1985. *Cf. ibid.* 1971, 24. Some of the objects are said to have been melted down by the finders (Gupta, P. L. 1980, 310). Location of Saipai: Census 1971 Etawah, p. 20, village no. 72. Coordinates read from this source.
37 On study with L. M. Wahal, Archaeological Survey of India Vadodara, who updated my information on Saipai. Photos thereof do not clearly show what is visible to the naked eye; for this reason they are not published here.
38 Supplementary to Lal, B. B. 1972.
39 Letter from L. M. Wahal, 6.05.1986. Site not mapable.
40 Orally expressed information, 6.11.1985 S. P. Gupta. Recently listed by Gupta in the context of a catalogue of the hoard objects in the National Museum in Delhi (1987).

1135. Axe, type II. 6.4x4.4x0.55 cm, 102 gm, ancient surface gouging, mediocre workmanship (Fig. 12, 1135).– National Mus. Delhi (71.222).– Unpub.

1136. Axe, type II. 9.15 x 8. 2 x 1.1 cm, 406 gm, unusually squat profile of the cutting edge taken to be evidence of ancient wear and repeated sharpening, accretions (Fig. 12, 1136).– National Mus. Delhi (86.59/ 11).– Unpub.

1137. Axe, type IIIa. 11.3x7.5 (pres.)x0.75 cm, 290 gm, both lead corners recently damaged (Fig. 12, 1137).– National Mus. Delhi (71. 220).– Unpub.

1138. Axe, type IIIa. 12.7x8.6x0.9 cm 540 gm (Fig. 12, 1138).– National Mus. Delhi (85.21).– Unpub.

1139. Axe, type IIIa. 15.6x10.9x0.8 cm, 714 gm, mediocre workmanship, recently burnt (Fig. 12, 1139).– National Mus. Delhi (85.178/2).– Unpub.

1140. Axe, type IIIa. 5.7 (pres.)x7.6x0.8 cm, 176 gm, clear smithing marks, ancient break (Fig. 12, 1140).– National Mus. Delhi (85.183/A).– Unpub.

1141. Axe, type IIIa. 9.9 (pres.) x10.6 (pres.) x 0.7 cm, 360 gm, broken anciently (?), recent hammer marks at the butt (Fig. 12, 1141).– National Mus. Delhi (85.183/B).– Unpub.

1142. Axe, type IIIa. 16.7x11.2 (pres.)x0.7 cm, 744 gm, 3 circular indentations on the obverse, unpatinated copper colour (cleaned?), butt corners and right lead corner cut off (Fig. 12, 1142).– National Mus. Delhi (86.50/5.).– Unpub.

1143. Axe, type IIIa. 18.9x13.8x0.8 cm, 996 gm; obverse: dark brown, glossy, thin patina, reverse: light green dull patina (Fig. 12, 1143).– National Mus. Delhi (86.59/6).– Unpub.

1144. Axe, type IIIa. 9.9 (pres.)x10.95x0.95 cm, 488 gm, thick dull light green patina partly intact, patina on the break (Fig. 12, 1144).– National Mus. Delhi 86.59/8).– Unpub.

1145. Axe, type IIIa. 9.95x7.61x0.8 cm, 288 gm, rough workmanship, rough surface texture, edges squeezed together from smithing, surface incrustations (Fig. 12, 1145).– N. M. Delhi (86. 59/12).– Unpub.

1146. Axe, type IIIa. 8.4 (pres.)x10.9x1.4 cm, 584 gm, old patinated break, mechanical removal of the patina, recent superficial gouges (Fig. 12, 1146).– National Mus. Delhi (86.59/13).– Unpub.

1147. Axe, type IIIa. 12.5x7.6x1.31cm, 594 gm, thick, waxy, light green patina, partly bruised away on the reverse (Fig. 12, 1147).– National Mus. Delhi (86.59/14).– Unpub.

1148. Axe, type IIIa. 8.5 (pres.)x8.5x1.05 cm, 398 gm, rough dark surface, old (?) break, front half preserved (Fig. 13, 1148).– National Mus. Delhi (86. 59/15).– Unpub.

1149. Axe, type IIIa. 9 (pres.)x7.6x1.6 cm, 524 gm, lead edge dull, surface recently beaten up (Fig. 13, 1149).– National Mus. Delhi (86.59/16).– Unpub.

1150. Axe, type IIIa. 5.6 (pres.)x6.1 (pres.)x0.9 cm, 170 gm, thick, dull whitish patina, old patinated break, butt end preserved (Fig. 13, 1150).– National Mus. Delhi (86.59/17).– Unpub.

1151. Axe, type IIIa. 10.1x6.2x0.79 cm, 256 gm, rough surface (Fig. 13, 1151).– National Mus. Delhi (86.59/19).– Unpub.

1152. Axe, type IIId. 12.9x10.2x0.45 cm, 300 gm, rough workmanship, copper colour, recent damage to one butt corner (Fig. 13, 1152).– National Mus. Delhi (86.59/24) – Unpub.

1153. Axe, type IVa. 13.8 (pres.)x5.8x0.65 cm, 280 gm, cutting edge and left corner of the butt recently damaged (Fig. 13, 1153).– National Mus. Delhi (71. 221).– Unpub.

1154. Axe, type IVa. 7. 9 (pres.) x5.3x0.45 cm, 110 gm, thick green patina, recently bent and broken, front half preserved (Fig. 13, 1154).– National Mus. Delhi (86.59/23).– Unpub.

1155. Axe, IVa. 18.1x5.9x0.42 cm, 224 gm (Fig. 13, 1155). – National Mus. Delhi (86.59/27). – Unpub.

1156. Axe, type IVa var. 16.9x4.05x0.6 cm, 196 gm, thick green waxy patina, fresh breaks (Fig. 13, 1156).– National Mus. Delhi (86. 59/22,/37 and /38).– Unpub.

1157. Axe, type IVa var. 13. 4 x 3 x 0. 4 cm, 114 gm (Fig. 13, 1157).– National Mus. Delhi (86. 59/30).– Unpub.

1158. Axe, type IVe. 21x6.5 (pres.)x0.45 cm, 256 gm, original glossy surface visible in places, sharp cutting edge, left corner recently bent (Fig. 13, 1158).– National Mus. Delhi (85.181/1).– Unpub.

1159. Axe, type IVe. 20.1x6.2x0.35 cm, 172 gm, sharp cutting edge, greyish blue-green patina (Fig. 13, 1159). – National Mus. Delhi (85.181/2). – Unpub.

1160. Axe, type IVe. 24x4x0.3 cm, 168 gm, rough workmanship, thick waxy green patina, recently par- tially spalted, recently burnt (Fig. 13, 1160).– National Mus. Delhi (86.59/31).– Unpub.

1161. Axe, type IVe. 6.7 (pres.)x3.6 (pres.)x0.5 cm, 53 gm, thick light green patina, old break (Fig. 14, 1161).– National Mus. Delhi (86.59.36).– Unpub.

1162. Axe, type Va. 18.9x16.3x0.9 cm, three groups of slight indentations on the obverse, thick green patina, recent mechanical damage at the lead edge (Fig. 14, 1162).– National Museum Delhi (85.20).– Unpublished.

1163. Axe, type Va. 13.9x12.3x0.7 cm, 520 gm, butt corners recently broken off, cleaned with a harsh abrasive (Fig. 14, 1163).– National Mus. Delhi (85.178/1).– Unpub.

1164. Axe, type Va. 18x15.1x1.1 cm, heavily encrusted with a blue efflorescence (Fig. 14,1164).– National Mus. Delhi (85.178/3).– Unpub.

1165. Axe, type Va. 15.6x13.7x0.83 cm, 920 gm, originally symmetrical in profile, thick light green waxy patina, partly spalted by recent hammering, one butt corner recently cut off (Fig. 14, 1165).– National Mus. Delhi (86.59/2).– Unpub.

1166. Axe, type Va. 19.9x16.2x0.7 cm, *c.* 1016 gm, thick waxy light green patina, recent damage to cutting edge (Fig. 14, 1166).– National Mus. Delhi (86.59/3).– Unpub.

1167. Axe, type Va. 18.1 x14.5 (pres.) x1 cm, 1414 gm, thick waxy light green patina, recent hacking of both faces of the two halves (Fig. 14, 1167).– National Mus. Delhi (86.59/9 and /10).– Unpub.

1168. Axe, type Va fragment. 7.7 (pres.)x15.5(pres.)x0.5 cm, 414 gm, front half of blade preserved, thick waxy green patina mostly flaked off, old break?, recently blackened by fire (Fig. 14, 1168).– National Mus. Delhi (86.59/20).– Unpub.

1169. Axe, type Va? fragment. 6.6 (pres.)x13 (pres.)x0.8 cm, 424 gm, butt end preserved, patina recently scraped off (Fig. 14, 1169).– National Mus. Delhi (86.59/21).– Unpub.

1170. Axe, type Va var. 13.2x11.4 (pres.)x0.61 cm, 434 gm, right edge anciently worn, modern damage to the right edge, dull patina (Fig. 14, 1170).– National Mus. Delhi (86.59/4).– Unpub.

1171. Axe, type Va var. 8.8 (pres.) x14x 0.9 cm, 612 gm, traces of the original thick green patina, old patinated break, covered with soot from recent burning (Fig. 15, 1171).– National Mus. Delhi (86.59/7).– Unpub.

1172. Axe, type Vc. 11.9x12.8x2.1cm, 502 gm, dark and light green glossy patina, tips slightly battered recently, cleaned (Fig. 15, 1172). – National Mus. Delhi (85.179/1). – Unpub.

1173. Axe, type Vc. 12 x 11. 2 x 2. 2 cm, 542 gm, smooth dark and blue-green patina (Fig. 15, 1173).– National Mus. Delhi (85.179/2).– Unpub.

1174. Miscellaneous axe. 11.22x13.4x1.14cm, 578 gm, pattern gouging distributed nearly identically on both faces, gold-coloured flecks on one face, thick light green splotchy patina on both faces, slight ancient chipping (Fig. 15, 1174). – National Mus. Delhi (86.59/1). – Unpub.

1175. Harpoon, type I. 15.9x3.5x1.2 cm, 168 gm, very rough workmanship, somewhat asymmetrical, thick waxy green patina (Fig. 15, 1175).– National Mus. Delhi (86.59/33).– Unpub.

1176. Harpoon, type II. 34.4x5.75x1.6 cm, 686 gm, barbs slightly damaged, surface blackened from fire as also with 1177 (Fig. 15, 1176).– National Mus. Delhi (84.387).– Unpub.

1177. Harpoon, type II. 40.4x6.95x1.8 cm, 956 gm, barbs broken off recently, hole at the shank plugged with dirt and corrosion products, traces of burning (Fig. 15, 1177).– National Mus. Delhi (84.388).– Unpub.

1178. Harpoon, type II. 25.9x6x2.2 cm, 552 gm, one barb cut and another bent recently, corrosion products mainly in the area of the barbs (Fig. 15, 1178).– National Mus. Delhi (85.177). – Unpub.

1179. Harpoon, type II. 26.1 (pres.)x7.3x2.04 cm, 746 gm, heavily patinated, heavy incrustations be- tween the barbs, old (?) patinated breaks above and below, recently blackened by fire (Fig. 15, 1179).– National Mus. Delhi (86.59/32).– Unpub.

1180. Fragmentary ingot. 6x3 (pres.)xl cm, 70 gm, spongy structure, fresh copper red colour, obverse rougher than the reverse, sampled (Fig. 15, 1180).– National Mus. Delhi (71.224).– Unpub.

1181. Lance head. 28.4 (pres.)x5.6x1.55 cm 438 gm, two eyelets at the base, right corner bent, tang broken at the base, right corner bent, tang broken anciently (Fig. 16, 1181).– National Mus. Delhi (85.176).– Unpub.

1182. Lance head (?). 25.3 (pres.) x6.5x0.6 cm, 440 gm, squarish edges, recent damage to the point, cleaned (Fig. 16, 1182). – National Mus. Delhi (85.182). – Unpub.

1183. Lance head or dagger. 24.2x6.9x0.9 cm, 316 gm, rough workmanship, irregularly shaped hole pierces the blade, recent damage to tip and edges (Fig. 16, 1183).– National Museum Delhi (86.59/35).– Unpub.

1184. Sword, type II. 19.5 (pres.)x8 (pres.)x c. 3 cm, 382 gm, recently curled, patina spalted therefrom (Fig. 16, 1184).– National Museum Delhi (85.173).– Unpub.

1185. Two fragments of a type II sword. a 17.3x5.2x0.8 cm 164 gm; b 11.4x3.3x0.5 cm, 70 gm, blade badly battered and broken recently, tip missing, one »antenna« broken, recently burnt (Fig. 16, 1185).– National Mus. Delhi (85.175). – Unpub.

1186. Sword, type II var. Original position of the 'antennae' uncertain; 40.9 (extended)x3.9x0.8 cm, 314 gm, upper portion of the blade smithed flat in order to lengthen the grip, blade bent recently (Fig. 16, 1186). – National Mus. Delhi (85.172).– Unpub.

1187. Miscellaneous sword. 52.8x6.8 (blade)xl.l cm, 1142 gm, four fragments recently folded and broken, thick bluish green patina, one »antenna« broken off anciently, patina coats the surface of the break (Fig. 16, 1187).– National Mus. Delhi (85.171).– Unpub.

1188. Miscellaneous blade. 19.9 (pres.)x1.9x0.6 cm, 63 gm, patina covers the presumed (smooth!) break above, tip recently broken off, blade also bent recently (Fig. 17, 1188). – N. M. Delhi (85.182). – Unpub.

1189. Dagger? 26.9 (pres.)x6.3x0.4 cm, 258 gm, heavy coating of dirt, recent damage to the edges (Fig. 17, 1189). – National Mus. Delhi (86. 59/34). – Unpub.

4. Eastern Chota Nagpur and Surrounding Area

Akhuldoba village, P.S. Binpur, Jhargram Subdivi- sion, Dist. Midnapur, W. B. (22° 40' 45" N; 86° 41'36" E). – In 1983 near the Tarafeni tributary of the Kasay river Sudhin De and B. Samanta[41] acquired an axe-ingot of the Ib type for the Directorate of Archaeology of West Bengal, the sole surviving piece of a larger hoard. Find circumstances unknown.

1190. Axe-ingot type Ib. 21.2x17.3x1.5cm, stippled surface (Fig. 17, 1190). – State Archaeological Gallery, Calcutta (no no.). – Unpub.

Bamanghati subdivision[42], Dist. Mayurbanj, Or. – The source of N. K. Sahu's information for this find area is doubtless the inventory book of the Baripada Museum. Unclear, however, is his description, »The specimens from Khiching are two shouldered-celts whereas, the one found from Kshetra (sic., actually Kesna), belongs to the bar-celt variety[43]. In any case, the Baripada collection presently boasts one type I double axe from Bhagada (no. 1194), four axe-ingots and one bar (no. 1204). One axe-ingot is labelled »P.S. Viratgarh«[44], and the other three »Dist. Mayurbanj«. Further Sahu, »Out of the other three shouldered celts...two come from the Bamanghati and one from the Panchpir subdivision«[45]. If we discount the bar from Kesna, in fact from the latter subdivision, the provenance of which is certain, the remaining type Ia axe-ingots (nos. 1191-1193) seem to be those from the Bamanghati subdivision . A more detailed provenance is not possible.

1191. Axe-ingot, type Ia. 20.2x15.8x1.5 cm, butt corners clipped off recently (Fig. 17, 1191). – Presumably formerly Patna Museum (no. ?), now Baripada Museum (no. 5). – Unpub.

1192. Axe-ingot, type la. 20.7x16.8x1.5 cm, 1 kg + (Fig. 17, 1192). – Presumably previously Patna Museum (no.?), now Baripada Mus. (no no.). – Unpub.

1193. Axe-ingot, type Ia. 24.3 x20.5 x1.6 cm, one corner cut off recently, analysis (Fig. 17, 1193). – Presumably previously Patna Museum (no. ?), now Baripada Museum (1D/1). – Unpub.

Bandua village, Dist. Ranchi, Bi. (23° 10' 05" N; 84° 24' 03" E) [47]. – One of the axe-ingots recorded as being in the Patna Museum (which?) is said to come from this site.

Bardangua village, P.S. Chakulia, Dist. Singhbhum, Bi. (22' 32' 29" N; 86' 41' 52" E) normalized rendering of Borodanga[48].

»Bardugua«[49], see Bardangua.

»Bengal«. – No more definite provenance information is available for the type III axe-ingot on exhibit in the Asutosh Museum in Calcutta (non-evaluateable)[50].

41 Orally expressed information 4.10.1985; letter from S.C. Mukherjee 29.10.1986. Coordinates read from a 1:50000 map.
42 Sahu, N. K. 1964, 45-46. This is the northern subdivision of Mayurbanj with a headquarters at Bahalda.
43 Ibid. 46.
44 Infra, for this provenance.
45 Sahu, N. K. 1964, 46.
46 Anon. 1984, 1-36. Curiously, no mention is made here of the acquisition of any prehistoric metallic artefacts, although the Museum certainly had acquired them by this time.
47 Gupta, P. L. 1980, 306. – Lal, M. 1983, 72. – Idem. 1984, 38 (based on Gupta).
48 Census 1971 Singhbhum, »Bardangua« village no. 242, map on p. 59. Coordinates read from here.
49 Yule, P. 1985, 8-9.
50 Source: object label.

Bhagada village, P.S. Suliapada, Dist. Mayurbanj, Or. (22° 00'N"; 87° 00' 20" E). – A type I double axe in the collection of the Baripada Museum (here no. 1194) was mentioned first publicly as belonging to a hoard of nine or ten others from the site »Bhagra Pir«. The finds lay at about 30 cm depth in a collapsed bank of the Gulpha, some 30 km east of Baripada[51]. Two paper labels adhere to the axe catalogued here, one more worn and evidently older which gives the provenance »Bhagra Pir « and a second one which corrects the name to »Bhagada«. In fact, a village named Bhagada lies on the left bank of the Gulpha, corresponding to the original geographic description, whereas »Bhagra Pir« is not locatable. Clearly the correct name for this findspot is Bhagada[52]. Since the axes are all of the same type it is logical that we are dealing with a single, and not two different hoards.

1194. Double axe, type I. 53.4 (pres.)x39.3 (pres.) x 0.92 cm, cast lateral flanges, both cutting edges badly damaged, to judge from the examples of this artefact type, originally the axe must have been almost 60 cm in length. (Fig. 18, 1194). – Previously Patna Museum (no. 236 written on the piece), now Baripada Museum (1D/2). – Brown, J. Coggin 1916, 386-387; Sahu, N. K. 1977, 54; Yule, P. 1985, 8. 107 (provenance updated here).

»**Bhagra Pir**«[53], see Bhagada.

»**Bordogaon**«[54], see Bardangua.

»**Borodanga**«[55], see Bardangua.

»**Chandsai**«[56], see Chansar[57], P. S. Mohagama, Dist. Santal Parganas (24° 59' 33" N; 87° 16' 47" E).

Dimiria (?)[58] (Dunria) village, P. S. Pallahara, Dist. Dhenkanal, Or. (21° 25' 23" N; 85° 11' 05" E).– First published by B. B. Lal in 1951, the axe-ingot from »Dunria« often has been mentioned in the specialist literature[59]. There is some confusion as to the name of the findspot, and the names »Dunuria«[60] and »Diminia«[61] also have been cited for this village in the Pallahara tehsil. Near here, however, the only village with a similar sounding name which is locatable in the Census reports is Dimiria[62]. Although several archaeological find places do not occur in this source, it is still the most authoritative on available for fixing place names, and given the similarity of the name cited in the accession register of the Patna Museum and »Dimiria«, the latter may well be the correct spelling.

Dist. Keonjhar, Or. – Around 1985 three type III axe-ingots and a small stand (nos. 1195-1197), evidently part of the same hoard, to judge from the surface texture and patina, were acquired as a group for the Orissa State Museum from this district. Detailed information exists neither for their provenance, nor the circumstances of discovery[63].

1195. Axe-ingot, type III. 14.7x12.3x1.3 cm, 972 gm, sharp lead edge (Fig. 19, 1195). – Orissa State Museum (0.52.1). – Unpub.

1196. Axe-ingot, type III. 17x13.2x1.4cm, rev. surface very rough (Fig. 19, 1196). – Orissa State Museum (0.52.2). – Unpub.

1197. Miniature stand. 24.6 x 13. 2 x 8. 5 cm, thick light green patina, rough surface similar to other metallic artefacts from eastern Chota Nagpur, heavy corrosion on the legs, legs recently bent inward (Fig. 19, 1197). – Orissa State Museum (0.52.3). – Unpub.

Dist. Ranchi, see Nankom.

51 Brown, J. Coggin 1916, 386-387. – Yule, P. 1985, 8, 107: »Bhagra Pir« is given for the other three extant examples of this hoard. – Sahu, N. K. 1964, 45-46: »Khiching, Kshetra, Bhagada, Bhagrapir, Dunria, Bamanghati«. – *Ibid.* 1977, 54. – Although the first public mention of Bhagada is that of Sahu in 1964, the label adhering to no. 1194 is much older than this. The identity of its author, the source of my information, remains unknown.
52 Census 1971 Mayurbanj, village no. 119 on the map oppos. p. 93.
53 Yule, P. 1985, 8, 107 for three other extant axes from this hoard.
54 Dikshit, K. N. 1968, 50.
55 Yule, P. 1985, nos. 388-390.
56 Gupta, P. L. 1980, 307: »Chandsai, Santhal Parganas, received 1942«.
57 Cf. Yule, P. 1985, nos. 391, 392: »Chandsar«. The name of the police station was supplied to me by U. C. Dwivedi of the Patna Museum. In the 1971 Census handbook for the Santal Parganas a village named Chansar is listed in the Mahagama P. S. (p, 472; maps section: pp. 50-51, village no. 737).
58 Source: letter U.C. Dwivedi 7.04.1983. – Yule, P. 1985, 45.
59 Lal, B. B. 1951, 27, 29 pl. 9B, fig. 3.8 on p. 26 (= Yule, P. 1985, no. 396).
60 Parida, A. N. 1977, 488. – Census 1961 Mayurbanj, 102-105.
61 Inventory book of the Patna Museum (letter U.C. Dwivedi 7.04.1983).
62 Census 1971 Dhenkanal, 510-511. In fact, Dumuria and similar sounding place names are surprisingly common in eastern 1ndia; Dunria is practically unknown.
63 Orally expressed information R. P. Prusty, State Museum Orissa 28.09.1985.

Dist. Ranchi, Bi.

1198. Axe-ingot, type III. 15.5 (pres.)x10.4x1.6 cm, 980 gm (Fig. 19, 1198). – Formerly S.C. Roy Coll., now Patna Mus. (256). – Yule, P. 1985, 84 no. 1000 (incorrectly catalogued as a damaged bar celt-ingot).

Dist. Santal Parganas (»Dist. Manbhum«), Bi. – Between about 1900 and 1930 the Rev. P.O. Bodding assembled a large collection of lithics mostly in the Santhal Parganas district, which he sent in lots to Norway between 1901 and 1934[64]. In 1904 Bodding writes that all of the objects of his collection derive from the Dumka subdivision[65]. Among these artefacts was a single metal axe-ingot of the Ia type (no. 1199) which Bodding bequeathed to the Ethnographic Museum of the University of Oslo on the 31st of August 1907[66]. The original catalogue card records the observation, »...probably belonged to a Jain temple of which there are several ruins in the [now defunct] district of Manbhum.«

1199. Axe-ingot, type Ia. 17.8 (pres.)x16.5x1.4 cm, 2559 gm (Skogseid), (Fig. 19, 1199). – Ethnographic Museum, Univ. of Oslo (15.461).– Allchin, F. R. 1962, 308; Roy Chaudhury, P.C. 1965, 997.

»**Dunria**«[67], see Dimiria (?).

»**Dunuria**«[68], see Dimiria (?).

Garhpada estate, »28 km north of the Balasore station on a rocky spur of the Moharbanj hills«[69] (Tehsil Betnoti?), Dist. Mayurbanj, Or. – In the possession of a certain Bhuyan family of Garhpada is a prehistoric type I axe-ingot which served secondarily as a writing surface upon which Raja Purushottam Deb, king of Orissa, in 1483 AD Poteswar Bhat the estate granted, which 400 years later was still in the possession of the latter's descendants. The original find-spot of the artefact, in fact, is unknown, as is the reason for using this particular kind of object for a land grant text. The »Moharbanj« hills lie not to the north, but rather to the northwest of Balasore, and otherwise the find-spot cannot be verified.

1200. Exact provenance unknown. Axe-ingot, type I. Dimensions and weight unknown. The average length of type I axe-ingots is 19.89 cm and the range is 18-26.2 cm. Thus the original reproduction of this artefact is less than life-size. Secondarily used as a writing surface; writing presumably scribed (not cast). (Fig. 19, 1200).– Bhuyan family, Garhpada estate.– Beames, J. 1872; Gait 1918, 361-363; Gordon 1958, 145.

Hami (Hami khas?, Hami garh?) village, Thana Mahuadanr, Dist. Palamau, Bi. (23° 25' 35" N; 84° 04' 16" E). – 14.5 km NW of the Mahuadanr police station[70]. – Two bar celt-ingots and a type III axe-ingot recorded below are on exhibit in the State Museum Orissa, the exhibition labels of which name this site. These objects are part of a hoard originally consisting of some 23 hoard artefacts, and doubtless belong to the lot ceded to Orissa from the Patna Museum. Several of the previously published artefacts from Hami[71] bear inventory numbers which definitely indicate this provenance[72], and their origin cannot be questioned. But the provenance of all other artefacts assigned to Hami (mostly on the basis of their museum accession numbers), in the final analysis, is somewhat uncertain. Nor can the find-spot itself be easily fixed[73]. In a recent map prepared by the Directorate of Archaeology and Museums Bihar, Hami is indicated in the extreme south of the Palamau district, directly on the border with Madhya Pradesh[74].

64 Allchin, F. R. 1962, 306.
65 Bodding, P. O. 1904, 27.
66 Translation from Norwegian and letter (20.06.1986) from Harald Skogseid, Curator of the Museum.
67 Lal, B.B. 1951, 29.
68 Parida, A. N. 1977, 488.
69 Beames, J. 1872, 355-356+ plates for this inscription.
obv. Śrî jaya durgâyai namah |
bira Śrî gajapati gauṛeshwara nava koti karnâṭakala-vargeśwara Śrî purushottama deva maharâjânkar |
poteśwara bhatañku dâna śâsana paṭâ |
e 5 anka mesha di 10am somabâra grahaṇa-kâle gañgâ-garbhe purushottamapura śâsana bhûmî chaüdasa
ashṭottara bâ1408ṭi dâna deluṇ e bhûmî yâvachchân
drârke putra pautrâdi purushânukrame bhoga karu
thiba jalârâma nikshepa sahit bhûmî deluṅ.
rev. Yâvach chandraścha sûryascha yâvat tishṭhati medinî |
Yâvad dattâmayâhv eshâ sasya |
yuktâ basundharâ ||
Swadattâm paradattâm vâ brahmavṛittim haret yaḥ |
Shashṭir varshasahasrâṇi vishṭâyâm jâyate kṛimiḥ ||
Śrî madanagopâlaḥ |
śaraṇam mama.
70 Letter A. K. Prasad 24.03.1986.
71 Yule, P. 1985, nos. 397-419.
72 Patna Mus. inv. nos. 216-234, 259, 261-Z65 (letter U.C. Dwivedi 7.04.1983).
73 Piggott, S. 1944, 18Z: »Harni«. »Harna« and »Harni« appear in the Sadar subdivision (both Anchal Chhatatarpur). »Hami khas« lies in the Latehar subdivision, and is in the Mahuadanr Anchal. It also is situated on the Bera (A. K. Prasad: »Burhi«) river which generally jibes with the original description of the findspot Hami.
74 Sinha, B.P./B.S. Verma 1977, oppos. p. 2.

1201. Axe-ingot, type III. 16.7x12.9x1.1 cm, *c.* 1098 gm, lead edge damaged (Fig. 20, 1201). – Formerly Patna Museum (no. 2699?), now Orissa State Museum (0.50.3). – Unpub.

1202. Bar celt-ingot. 42.5x5.5x2.4 cm, *c.* 2080 gm, rough surface, very similar in shape to a bar celt (cf. Yule nos. 499, 501, 502) (Fig. 20, 1202). – Previously Patna Museum, now Orissa State Museum (0.49.1). – Unpub.

1203. Bar celt-ingot. 47x5.6 (pres.)x2.1 cm, *c.* 1870 gm, lead edge recently damaged (Fig. 20, 1203). – Previously Patna Museum, now Orissa State Museum (0.49. 2). – Unpub.

Jamboni town, adjoining Parihati, P. S. Jamboni, Dist. Midnapur, W. B. (20° 31' 40" N; 86° 50' 21" E). – Chakrabarty and Chattopadhyay discuss this hamlet as a possible findspot of a hoard[75]. More precisely, »eye witnesses« claim that the hoard said to come from Parihati[76] (a village 9 km to the northwest), in fact, was discovered in Jamboni. Other »eye witnesses« attest to a provenance in Parihati.

Kesna (Kestna) town, P.S. Raruan, Tehsil Karanjia, Dist. Mayurbanj, Or. (21° 53' 49" N; 85° 49' 45" E) – A bar (no. 1204), presently in the Baripada Museum, bears the following label: »Founder – Rana Naik of Sialgolthani. Find Spot – Kestna while digging earth. Date of find – 5th August, 1946, Monday at 12 noon.« The handwriting is clear and in an obviously old style, probably from the time of the find. Kesna and »Sialgolthani« lie in the P.S. Raruan about 5 km from Khiching. The former, locally known for its stone quarries, is located on the left bank of the Baitarani river. The initial, but erroneous public mention of the findspot as »Kshetra«[77] does not correspond with the information on the yellowed old object-label.

1204. Bar. 29.2 (pres.)x4.1x1.7 cm, 884 gm, surface relatively smooth, one end recently hammered flat (Fig. 18, 1204). – Baripada Museum (no no.). – Sahu, N. K. 1977, 54 »Kshetra«.

»**Khiching**«[78], see Bamanghati and Viratgarh.

»**Kshetra**[79]«, see Kesna.

Ludurapada (Ludupra) village[80], P.S. Pandapara, Tehsil Kanjipani, Dist. Keonjarh, Or. (21° 30' 2" N; 85° 40' 49" E). – A group of three type Ib and one la axe-ingots reached the Orissa State Museum from a site here in 1980 (nos. 1202-1208). Find circumstances unknown.

1205. Axe-ingot, type Ia. 20.2x18x1.4 cm, *c.* 2450 gm, recent chunk cut from the centre of the obverse (Fig. 21, 1205). – Orissa State Museum (no no.). – Unpub.

1206. Axe-ingot, type Ib. 21.1x17.6x1.4 cm, *c.* 2900 gm, light green powdery patina (Fig. 21, 1206). – Orissa State Museum (no no.). – Unpub.

1207. Axe-ingot, type Ib. 21.1x16.2x1.3 cm, *c.* 2150 gm light green patina, recently warped (Fig. 21, 1207). – Orissa State Museum (no no.). – Unpub.

1208. Axe-ingot, type Ib. 21.3x16.3x1.3 cm, *c.* 2650 gm, light green patina, lead edge recently damaged (Fig. 21, 1208). – Orissa State Mus. (no no.). – Unpub.

Nankom town, P. S. Ranchi, Dist. Ranchi, Bi. (23° 20' 45" N; 85° 21' 54" E).– A type IIIa axe, presently on display in the State Museum Orissa, is labelled as deriving from the Ranchi district[81]. Its dimensions are identical to those of the axe from Nankom, which S.C. Roy published only preliminarily in 1920[82]. Owing to its unusualness in this area it is reproduced again here.

1209. Axe, type IIIa. 13x6.3x0.5 cm, 288 gm, heavily corroded and rough (Fig. 19, 1209). – Formerly S.C.

75 Chakrabarty, D.K./R.K. Chanopadhyay 1983, 161-163. In fact five different towns of villages in the Midnapur district bear the name Jamboni (Census 1971 Midnapur, village nos. 116, 189, 209, 510, and 593) which allows room to doubt further the actual identification of the findspot.
76 Yule, P. 1985, 22, 47 nos. 435-441. *Infra*
77 Evidently the source of the often repeated name »kshetra« is N. K. Sahu's monograph of 1964 (pp. 45, 46). Cf. Sahu, N. K. *et al.* 1979, 14. According to the label affixed r.o the bar in question, this same object was unearthed in 1946, and not in 1956, as Sahu states (p. 46). – Census 1971 Mayurbanj, 343-344.
78 Sahu, N. K. 1964, 45-46.
79 *Ibid.*
80 »Ludupra, P. S. Pandapara.« Source of this provenance: accession register of the museum, »Ludurpada, Pondapada Thana, Dist. Keonjhar«: Sahu, B. P. 1982, 5. According to Census 1961 Keonjhar, map oppos. p. 294 in the P. S. Pandapara, the village »Ludurapara« is perhaps a more correct transliteration. The coordinates used here are read from the 1971 District Census Handbook.
81 = Yule, P. 1985, no. 614 (without profile and section). – Location: Census 1971 Ranchi, »Nankum« map section pp. 4-5. The coordinates cited here are taken from this source.
82 Roy, S. C. 1920, 400, 417 p. 20.

Roy Coll., then Patna Museum (251), now Orissa State Museum (0.51). – Roy, S.C. 1920, 400, 417 pl. 20; Yule no. 614 on pp. 58-59.

»**Panchpir** (Panchipida)«[83], see Kesna.

Parihati village, P.S. Jamboni, Dist. Midnapur, W.B. (22° 31' 24" N; 86° 50' 51" E). – A »large« hoard is said to have been accidentally discovered in a mound about 1 km NW of this village in the late 1970's[84]. In the past few years the archaeological remains at Parihati have been subject of visits by Shrimati Subhra Bose[85], L. M. Wahal[86], and most recently by D. K. Chakrabarty and R. K. Chattopadhyay[87]. The latter describe the location of the town as on one of the two Jhargram-Sildah routes in the novthwestern part of the Midnapur district. As opposed to Wahal's and Bose's descriptions of the pottery (»...ochrous red colour, black and red ware, a red ware sherd with a fine red slip on one side...«), which suggest its remote antiquity, Chakrabarty and Chattopadhyay characterize it as presumably medieval, but give no reasons for the identification[88]. All agree that Parihati is a smelting site, but the nature and dating of the earliest remains there require clarification.

Perua village, P.S. Sabaang, Dist. Midnapur, W. B. (22° 12' 02"N; 87° 39' 10"E). – A farmer reports having found six axe-ingots while excavating a tank here in March of 1982. Two type Ib examples remain, the other artefacts having been sold for their value as scrap[89].

1210. Axe-ingot, type Ib. 25.5x25x1.5 cm, one corner of the butt recently cut off (Fig. 20, 1210).– Indian Museum, Calcutta (82/3).– Unpub.

1211. Axe-ingot, type Ib, 13.4 (pres.)x23.6x1.3 (pres.) cm, lead portion cut off recently (Fig. 20, 1211). – Indian Museum, Calcutta (82/4). – Unpub.

Near **Sankarjang** village, P. S. Jarapada, Tehsil Angul, Dist. Dhenkanal, Or. (20° 52' 08" N; 84° 59' 19" E). – In 1972 a herdsman from Sankarjang, Somnath Biswal, spotted some curious stone artefacts of a striking technical and artistic quality which protruded out of the side of small hill near his home. Before long, news of his discovery reached the museum officials in Bhubaneshwar, who acquired Shri Biswal's collection. In the same year, P. K. Ray, superintendent of the State Archaeology Orissa, tested three of the mounds of this single-culture site, and revealed a hitherto unknown kind of deposit comprised of further knapped and ground stone axes and adzes, metallic bangles and small tools, as well as human skeletal remains[90]. The ground stone objects proved the finest technically and artistically speaking yet to come to light in South Asia. In 1985 and 1986[91] with no difficulty the mounds excavated by Ray and his colleagues were located (which we call »A«, »B«, and »C«), now simply small graded patches of ground. Balks are still visible in the two eastern ones (»B« and »C«). The mounds appear to rest on the old ground level. An associated settlement could not be located, although our search admittedly was by no means exhaustive or conclusive.
The site lies 300m SSW of the peak of an extinct volcano locally known as the Jiminia hill, the dominant salient in the immediate area, and north of a usually dry stream locally called the Pandiani, which ultimately drains into the Brahmani. Situated on the eastern fringe of the Athmallik hills (altitude *c.* 200 m), the site rests on a lateritic shelf . The climate is semi-humid. Around the find-spot the terrain now is eroded, and is comprised of some 53 hillocks about 6 to 10m in diameter, and 1 to 2 m in height. The hillocks cover an irregularly shaped area of some 500x500 m. A few hundred metres to the west B.K. Rath and the writer recently spotted a smaller group of some 15 mounds. A track which crosses the Pandiani forms an axis through the main burial area. It continues, ending at an abutment about 200m SSW of the Jiminia hill. On the west side of the road 38 mounds have been tallied, and on the east side 15. The hillocks which were investigated were of the same type as the others of the cemetery. Just a few metres to the north is situated the irregularly eroded abutment of an adjacent and slightly elevated plain. Its surface is formed by a poor, denuded, red, hard-pan soil covered with some scrubby vegetation. The finds lay in the lowermost of the three strata in simple pits of the mounds, evidently mostly on the west side beneath mounds. Stone adzes lay together as a group apart from the bangles and skeletal remains.

83 Sahu, N. K. 1964, 45-46.– Parida, A. N. 1977, 488.
84 *Cf.* Jamboni.
85 1985.
86 Personal communication 21.10.1985.
87 1983, 161-163.
88 *Ibid.*
89 Personal communication, S. K, Basu, Indian Museum Calcutta, 8.10.1982.– Lal, M. 1983, 76: »Peuria«. – Ray, B. 1967, 119: »Perua«. – Anon. 1984, 152: »Perna«.
90 Ray, P. K. *c.* 1977, 539-540, »...neolithic burials«. No mention is made of metallic artefacts. – *Ibid.* 1984, 9-14 esp. 12.
91 Sankarjang is reachable from Bhubaneshwar by the National Highway 42 to Angul, and the State Highway 6, travelling to the NW. The last 11 km are motorable. Bijay Kumar Rath, Durga Panda and I briefly inspected the site on two occasions.
92 Mohapatra, G.C. 1962, 4 for a description of the area.

Doubtless the stone and metallic grave goods derived from the same stratigraphic unit, the third above the virgin soil. Moreover, chipped as well as polished adzes often of the same type lay side by side, the one being simply the unfinished version of the other. Pottery was strangely absent. The presence of human mandibles and 41 teeth leaves no doubt even to a non-anthropologist as to the actual identity of the bones, although the possibility of burial offerings of meat might possibly explain some of the numerous less easily identifiable bone fragments. The teeth which were excavated belonged to four adults and five children evidently of Mongolic stock[93].
Unfortunately individual grave inventories were not recorded systematically[94], but include stone bars (belonging to more than one prehistoric musical instruments), stone adzes, type III and V metal bangles, chisels and points (nos. 1212-1236), and stone beads. Besides these objects a few hundred grammes of type V bangle fragments occurred. The innumerable bone fragments indicate that several individuals were interred in the three mounds which were investigated. The excavator understands Sankarjang as a place of secondary burials of the Neolithic period, the dating being based on the presumed chronology of ground stone implements[95]. Except for mere fragments the human remains had all but vanished. Thus little is known of the burial customs. But numerous beads, bangles and other small finds found suggest that perhaps the remains, in fact, were not exhumed and reburied in another place, but rather represent the disturbed traces of the primary resting places of the interred. A radiocarbon determination *(infra),* provides the main reason to attribute the ossuary and its associated stone implements to the first millennium BC. No stratigraphic evidence exists for Neolithic or secondary Chalcolithic burials in Sankarjang. Finds designated as strays were acquired prior to and following the excavation of 1972.

1212. Bangle, type III; O.D. 7.2, I.D. 6, wire D. 0.5x0.35 cm, 24 gm (Fig. 20, 1212).– State Archaeology Orissa (1).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 45, fig. 14.

1213. Bangle, type III; O. D. 6.3, I.D. 5.4, wire D. 0.4x0.45 cm, 15 gm (Fig. 20, 1213).– State Archaeology Orissa (2).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 46. fig. 14.

1214. Bangle, type III; O. D. 6.3, I.D. 5.3, wire D. 0. 4 x Q. 4 cm, 20 gm (Fig. 20, 1214).– State Archaeology Orissa (10).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 47, fig. 14.

1215. Strayfind. – Bangle, type V; O.D. 5.8, I.D. 4.7, wire D. 0.5x0.5 cm, 19 gm (Fig. 20, 1215).– State Mus. Orissa (73.22.69).– Yule, P./B.K Rath/K. Højgaard 1989, no. 48, fig. 15.

1216. Strayfind.– Bangle, type V; O.D. 5.8, I.D. 5, wire D. 0.5 x 0.5 cm, 18 gm (Fig. 20, 1216).– State Mus. Orissa (73.22.70).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 49, fig. 5.

1217. Strayfind. – Bangle, type V; O.D. 5.8, I.D. 4.9, wire D. 0.4x0.45 cm, 19 gm (Fig. 20, 1217). – State Mus. Orissa (73.22.71). – Yule, P./B.K. Rath/K. Højgaard 1989, no. 50, fig. 15.

1218. Strayfind. – Bangle, type V; O. D. 5.7, I.D. 5, wire D. 0.45x0.5 cm, 12 gm (Fig. 20, 1218). – State Mus. Orissa (73.22.72).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 51, fig. 15.

1219. Strayfind.– Bangle, type V; O.D. 5.4, I.D. 4.5, wire D. 0.5x0.55 cm, 20 gm (Fig. 20, 1219). – State Mus. Orissa (73.22.73).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 52, fig. 15.

1220. Strayfind. – Bangle, type V; O.D. 5.6, I.D. 4.7 cm, wire D. 0.4x 0.45 cm, 14 gm (Fig. 21, 1220). – State Mus. Orissa (73.22.74). – Yule, P./B.K. Rath/K. Højgaard 1989, no. 53.

1221. Bangle, type V; O.D. 6.8, I.D. 5.8, wire D. 0.45x0.5 cm, 14 gm, one end broken off (Fig. 21, 1221). – State Archaeology Orissa (3).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 54.

1222. Bangle, type V; O.D. 6.6, I.D. 6.1, wire D. 0.3x0.5 cm, 13 gm, heavily corroded, corrosion spalted away in places (Fig. 21, 1222).– State Archaeology Orissa (4). – Yule, P./B.K. Rath/K. Højgaard 1989, no. 55.

1223. Bangle, type V; O.D. *c.* 6.2, wire D. 0.4 x 0.5 cm, 9 gm, one end broken off (Fig. 21, 1223). – State Archaeology Orissa (5).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 56.

1224. Bangle, type V; O.D. 6.6, I.D. 5.5, wire D. 0.4x0.4cm, 18 m, heavily corroded (Fig. 21, 1224). – State Archaeology Orissa (6). – Yule, P./B.K. Rath/K. Højgaard 1989, no. 57.

93 Dr. Karen Højgaard, dental anthropologist of the Hvidovre Hospital in Copenhagen kindly identified the dental remains (Yule, P./B. K. Rath/K. Højgaard 1988): Ages of the individuals: 6 months, 5 years, 6 years, 8 years, 12 years, 20 years, 20 years, 20-30 years, and 30-40 years. In addition to the human teeth, one tooth, perhaps from a goat or a sheep also was found. The condition of the teeth suggests a possible starch-rich diet.
94 Yule, P./B.K. Rath 1988.
95 Ray, P.K. 1977, 539-540.

1225. Bangle, type V; O.D. 5.9, I.D. 5, wire D. 0.3 x 0.3 cm (measured at an uncorroded place), 12 cm, heavy corrosion, surface intermittently spalted (Fig. 21, 1225). – State Archaeology Orissa (7). – Yule, P./ B.K. Rath/K. Højgaard 1989, no. 58.

1226. Bangle, type V; O.D. 6.1, I.D. 5.2, wire D. 0.5x0.5 cm, 16 gm (Fig. 21, 1226).– State Archaeology Orissa (8). – Yule, P./B.K. Rath/K. Højgaard 1989, no. 59.

1227 Bangle, type V; O.D. 6, I.D. 5, wire D. 0.4x0.4 cm, 16 cm (Fig. 21, 1227).– State Archaeology Orissa (9).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 60.

1228. Bangle, type V; O.D. 6.3, I.D. 5.2, wire D. 0.5x0.5 cm 15 gm, heavily corroded, one end broken off (Fig. 21, 1228).– State Archaeology Orissa (11).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 61.

1229. Bangle, type V; O.D. (pres.) 5.6, wire D. 0.5x0.5 cm, heavily corroded (Fig. 21, l229).– State Archaeology Orissa (12).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 62.

1230. Bangle, type V; O.D. (pres.) c. 5.5, wire D. 0.6x0.6 cm, 13 gm, heavily corroded, one end broken off (Fig. 21, 1230).– State Archaeology Orissa (13).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 63.

1231. Bangle, type V; O.D. 6.1, wire D. 0.4x0.4 cm, 14 gm, one end broken off (Fig. 21, 1231).– State Archaeology Orissa (14).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 64.

1232. Bangle, type V; L. (pres.) 5.6, wire 0.4x0.4 cm, 15 gm, one end broken off (Fig. 21, 1232).– State Archaeology Orissa (15).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 65.

1233. Bangle, type V; L. (pres.) 5.7, wire D. 0.4x0.4 cm, one end broken off (Fig. 21, 1233).– State Archaeology Orissa (16).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 66.

1234. Strayfind. – Chisel. 10x l.6x0.4 cm, 16 gm, one end irregularly hammered flat, squarish in section (Fig. 21, 1234).– State Mus. Orissa (73.22.79).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 67.

1235. Strayfind. – Point. 10.8x0.4x0.4 cm (Fig. 21, 1235).– State Mus. Orissa (73.22.80).– Yule, P./B.K. Rath/K. Højgaard 1989, no. 68.

1236. Strayfind.– Point. 7.9x0.3x0.3 cm, circular in section, slightly bent (Fig. 21, 1236).– State Mus. Orissa (73.22.81). – Yule, P./B.K. Rath/K. Højgaard l 989, no. 69.

Sonpur village, P.S. Belaganj, Dist. Gaya, Bi. (24° 57' 51"N; 84° 56' 25"E)[96].– Located near the Jamuna, this site was excavated in 1956, 1959-62 in four seasons by the members of the Directorate of Archaeology and Museums of Bihar. The earliest period (IA) has been called Chalcolithic owing to the presence of a crude, usually handmade, black-and-red ware in the northern mound. In this level a fragment of copper wire occurred (not reproduced)[97]. Most of the small tools, such as pins, are of bone. The economy of this settlement is based on cattle breeding, fishing, and rice production. In contrast to the foregoing period, the IB period shows black-and-red ware, sometimes decorated with white painted parallel strokes. The fabric is superior to that of the preceeding period. The excavators point to the existence of possible hut-like dwellings. Also important are lumps of iron ore and slag. Ground stone tools also came to light. An uncalibrated ^{14}C determination for the IB level yields a value of 2585 $\pm$ 100 BP (TF-376 calibrated: 635 BC) years[98] which places the IB period in the mid first millennium BC. The excavators have assigned this layer a greater antiquity (»900 BC«) than the ^{14}C determination indicates. In any case, on the basis of the thickness of the occupational deposition (0.61m) of the IA period, they assume an occupation span of at least 100 years, and thus date the earliest habitation at about 1100 BC. This dating seems, however, excessively hypothetical, and the build up of settlement debris is affected by so many variables that it is of no help in establishing age. Thus, if one is to accept the ^{14}C determination at face value, the dating may well be much lower for the IA and IB periods, perhaps in the second quarter of the first millennium BC.

Near **Tamajuri** town, (old) Pargana Jhatibani, P.S. Binpur, Dist. Midnapur, W.B.– Aside from the type I axe-ingot found near this village prior to 1883 (Yule no. 815), a second »shouldered celt« is said to have appeared here in 1977-78 (non-evaluateable)[99]. Dipak Mondal, the finder, disposed of the piece soon after its discovery, and nothing concrete is known of the find or its provenance. Although Tamajuri does not appear in the Census reports, the nearby Jhatibani town may serve as a point of orientation for the approximate location of the find-spot (22° 33' 35"N; 86° 58' 39"E).

96 B.P. Sinha/B.S. Verma l977; Census 1971 Gaya, 128 »Sonpur « village no. 416, p. 23 of the map section.
97 *lbid.* 1977, 6-7 (no serial number).
98 *Ibid.* l2.
99 Non-evaluateable. Bose, S. 1985.

Taradih mound, south-west of the Mahabodhi temple of Bodh Gaya in Gaya, Subdivision Sadar, Dist. Gaya, Bi. (24° 47' N; 84° 59'E).– Taradih is important particularly for its Neolithic and Chalcolithic levels, which are known from several trenches. Characteristic of the Neolithic levels are a handmade thick red rough wave, a grey burnished ware sometimes painted with ochre subsequent to firing, as well as a red burnished ware. After firing, the latter was sometimes scored horizontally or hatched. Associated finds include bone arrow-heads, polished beads in several shapes, and in different materials. The ground stone industry is manifest at this time and onward even into the Iron Age levels[100]. Otherwise, except for microlithic blades, few chipped stone tools occur in this period or in the next one. The Chalcolithic period is characterized by a wheel-made, burnished, red ware and black, and a red ware[101]. Often the vessel interior is dark and the exterior red, or red and black. The surface slip ranges from chocolate to crimson red, light red and orange in both the black and red ware. The pottery is high temperature fired, and the interior fabric blackened by reducing conditions[102]. A rare metal find is a copper ball and a fishhook (non-evaluateable)[103]. Diagnostic shapes include the dish on stand, bowl with pedestal base, globular and ovoid bowl. Tipped out rims and base rings also commonly occur.

1237. Period I (Chalcolithic), settlement. – Copper ball. D. 1.1 cm, 7 gm (Fig. 21, 1237). – State Archaeology Bihar (no no.). – Unpub.

Viratgarh ruin[104], P. S. Raruan, Dist. Mayurbanj, Or. (22° 55' 05" N; 85° 50' 17" E). – In September of 1935 the Baripada Museum acquired a stray axe-ingot of the Ib type (no. 1238) from this rolling ruin, which lies some 500 m north of the Khiching museum. The site is traversed by the Bhandan river. In the temple compound in Khiching N.C. Ghosh, of the Archaeological Survey of India, excavated some red slipped coarse, grit-tempered red ware of a kind which also occurs in 'Neolithic' contexts in Kuchai and Baidyapur also in the Mayurbanj district[105].

1238. Axe-ingot, type Ib. 25.7x24x1.3 cm (Fig. 22, 1238). – Baripada Museum (no. 3). – Unpub.

100 Orally expressed information 16.10.1985, Parvez Akhtar of the State Archaeology Bihar.
101 Prasad, A. K. 1984, 93.
102 This holds for Chirand. Orally expressed information 15.10.1985, A. K. Prasad.
103 Prasad, A. K. 1984.
104 Source: label glued on the reverse of the piece (»P.S. Viratgarh«). In fact, Viratgarh is not a P.S. (police station), but actually is an ancient ruined »palace«. – *Cf.* Mitra, D. 1980, 323-333; Acharya, P. 1969, 328-331.

5. Madhya Pradesh

Balpur on the Mahanadi, Dist. Raigarh, M.P. – »I had occasion to inspect these two celts in the collection of the late Pandit Lochan Prasad Pandeya in his house in Bilaspur in 1958. Both were flat celts, and so far as I can recollect one of them was fitted with a slipped-on oval ring« (non-evaluateable, megalithic Iron Age?)[106].

Ghangharia (Gungeria, Ghangaria) village, Tehsil Balaghat, Dist. Balaghat, M.P. (22° 15' 49" N; 80° 07' 28" E). – Surrounded by dense forests in a valley region at a height of about 360 m above sea level, Ghangharia, now a village of some 69 houses, lies in the valley of the Wainganga River to the west. The area is reachable from Balaghat by train, although the nearest train stop is at Gudru one km to the north[107]. The road to Ghangharia is motorable in the dry season. The exact location of the well-known hoavd *(cf.* 443-531, 1239- 1270) on the old Mair estate remains unknown. Of the originally reported 424 pieces 129 were locatable and were recorded. The whereabouts of the others is unknown. The inventory of types is limited, and presumably is representative.

1239. Axe, type Va. 16.7x12.9x0.5 cm, 870 gm (Fig. 22, 1239).– Central Museum Nagpur (80).– Dikshit, M.G. 1964, 99-102, pl. 18.

1240. Axe, type Va. 16.3x13.8x0.6 cm, 698 gm (Fig. 22, 1240). – Mahant Ghasidas Museum, Raipur (no no.). – Unpub.

1241. Axe, type VII. 17x12.9x1.9 cm, 1474.2 gm (Dikshit), butt slightly dented recently (Fig. 22, 1241). – Central Museum Nagpur (24/47). – Dikshit, M.G. 1964, 99-102, pl. 17.

1242. Axe, type VII. 17.9x13.3x1.8 cm, 1559.2 gm (Dikshit) (Fig. 22, 1242). – Central Museum Nagpur (24/48). – Dikshit, M.G. 1964, 99-102, pl. 17.

1243. Axe, type VII. 16.9x9.8x1.6 cm, 1063.1 gm (Dikshit) (Fig. 22, 1243). – Central Museum Nagpur (24/49). – Dikshit, M.G. 1964, 99-102, pl. 17.

105 Mentioned in Ghosh. N. C. 1970, 333-334.
106 Dikshit, M. G. 1964, 105 note 1. – Gordon, D. H. 1958, 142. – The description brings to mind axes with bands from megalithic burials. *Cf.* Allchin, B./F.R. 198Z, 337- 338, fig. 12,20a.
107 Cf. »Ghangharia« Sheet NF 44 6, series U502, edition 1- AMS (U.S. Army 1955). – Bloomfield's initial published description of this find-spot (1870, 130-134) must now be modified. The town »Burha« with which he helps to localize the find is in fact Baihar. Ghangharia lies not

1244. Axe, type VII. 18x14x1.1 cm, 862 gm, cleaned (Fig. 22, 1244).– Central Museum Nagpur (24/50). – Dikshit, M.G. 1964, 99-102, pl. 17.

1245. Axe, type VII, 17.5x12.7x1.9 cm, 1644.3 gm (Dikshit) (Fig. 22, 1245).– Central Museum Nagpur (24/51). – Dikshit, M.G. 1964, 99-102, pl. 17.

1246. Axe, type VII. 18x13.2x1.7 cm, 1247.4 gm (Dikshit) (Fig. 22, 1246).– Central Museum Nagpur (24/52). – Dikshit, M.G. 1964, 99-102, pl. 17.

1247. Axe, type VII. 17.9x11.3x1.2 cm, 970 gm, recently bent, very clean (Fig. 23, 1247).– Central Museum Nagpur (24/53). – Dikshit, M.G. 1964, 99-102, pl. 18, fig. 5, 1.

1248. Axe, type VII. 16.5x10.8x1.5 cm, 956 gm (Fig. 23, 1248).– Central Museum Nagpur (24/54). – Dikshit, M.G. 1964, 99-102, pl. 18.

1249. Axe, type VII. 16.5x12.3x1.6 cm, 1190.7 gm (Dikshit) (Fig. 23, 1249).– Central Museum Nagpur (24/55). – Dikshit, M.G. 1964, 99-102, pl. 18.

1250. Axe, type VII. 17x12.3x1.6 cm, 1211 gm, modern break, sampled (Fig. 23, 1250).– Centval Museum Nagpur (24/56). – Dikshit, M.G. 1964, 99-102, pl. 17, fig. 5.5.

1251. Axe, type VII. 17.3x12x1.3 cm, 870 gm (Fig. 23, 1251).– Mahant Ghasidas Museum (no no.). – Unpub.

1252. Axe, type VII. 13.8x9.4x1.4 cm, 660 gm (Fig. 23, 1252).– Mahant Ghasidas Museum (no no.). – Unpub.

1253. Axe, type VII. 15.2x9.5x 1 cm, 536 gm (Fig. 23, 1253).– Mahant Ghasidas Museum (no no.). – Unpub.

1254. Axe, type VII. 19.2x12.4x1.4 cm (Fig. 23, 1254).– Mahant Ghasidas Museum (no no.). – Unpub.

1255. Axe, type VII. 19.9x12.2x1.3 cm (Fig. 23, 1255).– Mahant Ghasidas Museum (no no.). – Unpub.

1256. Axe, type VII. 19.9x12.6x1.5 cm (Fig. 23, 1256).– Mahant Ghasidas Museum (no no.). – Unpub.

1257. Axe, type VII. 16x10.7x1.2 cm, 962 gm (Fig. 23, 1257).– Mahant Ghasidas Museum (no no.). – Unpub.

1258. Axe, type VII. 14.3x9.4x1.2 cm, 736 gm (Fig. *24,* 1258).– Mahant Ghasidas Museum (no no.). – Unpub.

1259. Axe, type VII. 18.5x12.6x1.2 cm, 952 gm (Fig. 24, 1259).– Mahant Ghasidas Museum (no no.). – Unpub.

1260. Axe, type VII. 18x11.3x1.1 cm, 808 gm (Fig. 24, 1260).– Mahant Ghasidas Museum (no no.). – Unpub.

1261. Axe-ingot, type IV. 13.2x9.7x1.2 cm, 644 gm (Fig. 24, 1261).– Mahant Ghasidas Museum (no no.). – Unpub.

1262. Bar celt. 52.5x9.7x1.2 cm, 1000+ gm (Fig. 24, 1262).– Mahant Ghasidas Museum (no no.). – Unpub.

1263. Bar celt. 53.6x7.5x0.9 cm, 1403. 3 gm (Dikshit), surface patterning with a hammer, surface pitting (corrosion?) (Fig. 24, 1263). – Central Museum Nagpur (25/57).– Dikshit, M.G. 1964, 99-102.

1264. Bar celt. 49 (pres.)x7.2x1.3 cm, 1417 gm (Dikshit), surface smoothed lengthwise, butt broken off recently, recent hacking below right on the edge (Fig. 24, 1264).– Central Museum Nagpur (25/58). – Dikshit, M.G. 1964, 99-102.

1265. Bar celt. 37.2 (pres.)x9.1x1.34 cm, all 4 of the edges lengthwise decoratively rippled through hammering (Fig. 24, 1265). – Mahant Ghasidas Museum (no no.).– Unpub.

1266. Bucranion, type I. 13x7.2x0.03 cm, 8 gm, 1 »horn« broken off (Fig. 24, 1266).– Central Museum Nagpur (25/63). – Dikshit, M.G. 1964, 102.

1267. Disc. 12. 2 x 12. 4 x 0.02 cm, 11 gm (Fig. 25, 1267). – Central Museum Nagpur (25/59). – Dikshit, M.G. 1964, 102.

1268. Disc. 11.7x11.8x0.01 cm, 9 gm, edge hatched, bluish patina, slight damage to the edge Cu 0. 2%, Fe 326ppm, Pb 52ppm, Zn 45ppm, Ag 99.3%, Co <30 ppm, Ni <30 ppm, Sn <20ppm, As <20ppm, Sb <10ppm, Bi 222ppm, (Fig. 25, 1268).– Central Museum Nagpur (25/60).– Dikshit, M.G. 1964, 102.

1269. Disc. 12.3x11.2x0.02 cm, 9 gm (Fig. 25, 1269).– Central Museum Nagpur (25/61).– Dikshit, M.G. 1964, 102.

58km to the north of this town, but rather about this distance to the northwest. This location jibes with later accounts which additionally name the nearby Mau police station, *c.* 5 km to the SSF. Coordinates taken from a 1:50000 map.

1270. Disc. 14.2x11.2 (pres.)x0.03 cm, 13 gm (Fig. 25, 1270). – Central Museum Nagpur (25/62). – Dikshit, M.G. 1964, 102.

1271. Axe, typ IIIe. 16. 2 (pres.) x 9. 2 x 1.5 cm, 1148 gm (Dikshit), butt and blade (recently?) damaged (Fig. 25, 1271). – Central Museum Nagpur (65). – Dikshit, M.G.1964, 103-105, pl. 19.

»**Kelsi**«[108], see Kesli.

Kesli village, Tehsil Rehli, Dist. Sagar, M.P. (23° 25' N; 78° 48' E)[109]. – Kesli lies 44 km south of Sagar (58 km by road via Gaur Jhamar) at some 490m altitude. The area is forested, the soil light and particularly susceptible to a failure of the later rains[110]. The findspot is nearly 4km away from the village at an unknown spot. In April of 1910 Anant Singh Charar sold three palstaves (nos. 1271-1273) from here for the sum of three rupies to the district commissioner at Sagar[111]. Nothing more than this is known of the provenance.

1272. Axe, type IIIe. 11.9 (pres.) x 8.9x1.4 cm, 895 gm (Dikshit), rough crystalline surface, recently broken, (Fig. 25, 1272). – Central Museum Nagpur (66). – Dikshit, M.G. 1964, 103-105.

1273. Axe, type IVc. 21.5x7.8x1.8 cm, 1644 gm (Dikshit), butt recently hammered (Fig. 25, 1273). – Central Museum Nagpur (64). – Dikshit, MG. 1964, 103-105, p. 19.

1274. Axe, type I. 10.75 x *c.* 8.9x 0.73 cm, 552.1 gm (Bloomfield) smooth surface (Fig. 25, 1274).– Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.9.

1275. Axe, type II. 13.28x *c.* 9.5x0.83 cm, 637.6 gm (Bloomfield) slightly rough (Fig. 25, 1275). – Formerly A. Bloomfield Coll., present whereabouts unknown.– Bloomfield, A. *c.* 1890, 5-6, pl. 2.7.

1276. Axe, type II. 14.86x *c.* 12.1x1.26 cm, 473.1 gm (Bloomfield) green patina (Fig. 25, 1276). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c,* 1890, 5-6, pl. 2.8.

1277. Axe, type 11 var. 9.79 x *c.* 8.8x0.63 cm, 279.9 gm (Bloomfield) no oxidation (Fig. 25, 1277). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.11.

1278. Axe, type IIIa. 14. 86 x *c.* 12.5x0.94 cm, 839.8 gm (Bloomfield) reddish copper colour (Fig. 25, 1278). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.4.

1279. Axe, type IIIa. 14.54x *c.* 10x1.05 cm, 762 gm, (Bloomfield) earth incrustation, greenish hue (Fig. 26, 1279). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.6.

1280. Axe, type IIIa. 11.38x *c.* 7.2x1.26 cm, 544.3 gm, (Bloomfield) very rough (Fig. 25, 1280). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.10.

1281. Axe, type IIIa. 12.65x *c.* 10.1x1.05 cm, 800.9 gm (Bloomfield) recent hammering, butt broken off (Fig. 26, 1281). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2. 13.

1282. Axe, type IIIa. 17.1x *c.* 9.6 (pres.)x1.5 cm, 1189.7 gm (Bloomfield) cutting edge recently broken off and splayed on the corner (Fig. 26, 1282).– Formerly A. Bloomfield Coll., present whereabouts unknown.– Bloomfield, A. *c.* 1890, 5-6, pl. 2.20.

Narsimhapur (Narsinghpur) town", Dist. Narsimhapur, M.P. (22° 57' N; 79° 12' E) *c.* 500m altitude. – Between 1888 and 1890 A. Bloomfield acquired some 26 flat axes and fragments of such in this town (nos. 1274-1297) and in the surrounding wooded area.

1283. Axe, type IIIa. 8.85 (pres.) x *c.* 6.5x1.58 cm, 233.3 gm (Bloomfield) front half preserved (Fig. 26, 1283). – Formerly A. Bloomfield Coll., present whereabouts unknown.– Bloomfield, A. *c.* 1890, 5-6, pl. 2. 21.

1284. Axe, type IIIa. 5.7 (pres.)x7.5x1.4 (pres.) cm, 357.7 gm (Bloomfield), front half preserved (Fig. 26, 1284). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2. 22.

1285. Axe, type IIIa. 11.4(pres.)x *c.* 6.1(pres.)x1.26 cm, 622 gm (Bloomfield), butt end preserved (Fig. 26, 1285). – Formerly A. Bloomfield Coll., present whereabouts unknown.– Bloomfield, A. *c.* 1890, 5-6, pl. 2. 23.

108 Gupta, P. L. 1980, 313.
109 Since no specific find-spot is known, here and in certain other cases only the degrees and minutes, and not the seconds are given.
110 Census 1961 Sagar, 182.
111 Letter of 6.10.1910 from the D.C, (cited in the inventory book of the Central Museum, Nagpur). »Kelsi« *(sic):* Gupta, P. L. 1980, 313.
112 Bloomfield, A. *c.* 1890, 5-6, pl. 2. – Yule, P. 1985, 110.

1286. Axe, type IIIa. 14.2x *c.* 9.3x0.83 cm, 598.7 gm (Bloomfield) one butt corner broken off (Fig. 26, 1286). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2. 24.

1287. Axe, type IIIa. 17.7x14x1.1 cm, 1389.3 gm (Bloomfield) edge »blunted«, well finished, green patina (Fig. 26, 1287). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.1.

1288. Axe, type IIIa. 13.9x *c.* 11x1.26cm, 793.1 gm (Bloomfield) green patina (Fig. 26, 1288). – Formerly A. Bloomfield Coll., present whereabouts unknown.– Bloomfield, A. *c.* 1890, 5-6, pl. 2.2.

1289. Axe, type IIIa. 15.2x *c.* 11.8x0.83 cm, 622 gm (Bloomfield) smooth, green in places (Fig. 26, 1289). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.3.

1290. Axe, type IVa. 20.2x *c.* 6.9x1.64 cm, 1298.6 gm (Bloomfield) smooth green patina, fresh crack in the middle (Fig. 26, 1290). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.14.

1291. Axe, type IVa. 16.1x *c.* 7x1.26 cm, 777.6 gm. (Bloomfield) smooth green patina (Fig. 26, 1291). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.18.

1292. Axe, type IVa. 12.7 (pres.)x *c.* 4.6x0.5 cm, 209. 9 gm (Bloomfield) butt broken off (Fig. 26, 1292). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.19.

1293. Axe, type IVa var. 17.4x *c.* 4.1x1.64 cm, 155.5 gm (Bloomfield) very thin, green patina (Fig. 26, 1293). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.17.

1294. Axe, type IVf. 12.7x *c.* 5.8x1.26cm, 552.1 gm (Bloomfield) smooth green patina (Fig. 26, 1294). – Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.12.

1295. Axe, type Va var. 19x *c.* 13.5x1.26cm, 1314.1 gm (Bloomfield) »unusual shape«, rough surface, green spotty patina, corner recently broken off (Fig. 26, 1295).– Formerly A. Bloomfield Coll., present whereabouts unknown. – Bloomfield, A. *c.* 1890, 5-6, pl. 2.5.

1296. Axe, type VII. 21.5x *c.* 12.6x1.73 cm, 1780.7 gm (Bloomfield) green patina, sand mixed with corrosion products on the surface (Fig. 26, 1296).– Formerly A. Bloomfield Coll., present whereabouts unknown.– Bloomfield, A. *c.* 1890, 5-6, pl. 2.16.

1297. Misc. axe. 14.5x *c.* 6.6x0.94 cm, 451 gm (Bloomfield) sharpened at both ends, excellent finish, green patina (Fig. 26, 1297).– Formerly A. Bloomfield Coll., present whereabouts unknown.– Bloomfield, A. *c.* 1890, 5-6, pl. 2.15.

Pondi (Panti, Pati) village, Tehsil Theonthar, Dist. Rewa, M.P. (24° 59' 48" N; 81° 22' 39" E). – Most of the hoard accidentally unearthed at Pondi in 1949 (nos. 532-535. 1298-1344) has been on exhibition since 1955[113] in the museum located in Dhubela in the Chhatarpur district, the remaining few pieces being in the Allahabad Museum. Pondi lies in a forested valley at an altitude of some 120 m above sea level, and 8 km north of the Tamasa river. It is located north of the ghats in the plain on the east side of the metalled road 61 km north of Rewa. The hoard itself was salvaged in the course of digging foundations for a school. The associated type IIIa axes are large, of excellent manufacture, and similar to each other in their dimensions and shapes[114]. No. 1298 has a thick light green patina, and the other axes have a dark green patina. The bangles are all light copper-red colour, and no doubt have been cleaned.

1298. Axe, type IIIa. 19.7x15.7xl.l cm, *c.* 3000 gm, thick light green patina, (Fig. 27, 1298). – Dhubela Museum (911.A). – Unpub.

1299. Axe, type IIIa. 18.5x13.6x1 cm, *c.* 2000 gm, thin dark green patina (Fig. 27, 1299) – Dhubela Museum (911.B). – Unpub.

1300. Axe, type IIIa. 18.5x14.3xl cm, *c.* 2500 gm, thin dark green patina (Fig. 27, 1300). – Dhubela Museum (911.C). – Unpub.

1301. Bangle, type I. O.D. 9.5x9.8 cm, I.D. 6.1 x 6.4 cm, Th. 1.7cm, 436 gm (Fig. 27, 1301). – Dhubela Museum (1). – Unpub.

1302. Bangle, type I. O.D. 9.1x9.2 cm, I.D. 6.2 x 6.3 cm, Th. 1.4cm, 304 gm (Fig. 27, 1302). – Dhubela Museum (2). – Unpub.

1303. Bangle, type I. O.D. 8.8x 9 cm, I.D. 6.1 cm, Th. 1.4cm, 288 gm (Fig. 27, 1303). – Dhubela Museum (3). – Unpub.

113 My thanks go to B. P. Badoria, keeper of the Dhubela Museum, for this information.– Yule, P. 1985, 23, 110.– Census 1971 Rewa, p. 48, village no. 69.

114 One of the axes cannot be located.

1304. Bangle, type I. O.D. 9.3 x9.7 cm, I.D. 6x6.4 cm, Th. 1.6 cm, 408 gm (Fig. 27, 1304). – Dhubela Museum (4). – Unpub.

1305. Bangle, type I. O.D. 9.1x9.5 cm, I.D. 6.6 x 6.3 cm, Th. 1.4 cm, 256 gm (Fig. 27, 1305). – Dhubela Museum (5). – Unpub.

1306. Bangle, type I. O.D. 10x10.5 cm, I.D, 7.1 x 7.3 cm, Th. 1.6 cm, 408 gm (Fig. 27, 1306). – Dhubela Museum (6). – Unpub.

1307. Bangle, type I. O.D. 10.1x10.2 cm, I.D. 6.9 x 7.2 cm, Th. 1.5 cm, 392 gm (Fig. 27, 1307). – Dhubela Museum (7). – Unpub.

1308. Bangle, type I. O.D. 9.5x9.8 cm, 1.D. 6.2 x 6.6 cm, Th. 1.6 cm, 390 gm (Fig. 27, 1308). – Dhubela Museum (8). – Unpub.

1309. Bangle, type I. O.D. 8.8x9.2 cm, I.D. 6.2 x 6.5 cm, Th. 1.4 cm, 254 gm (Fig. 27, 1309). – Dhubela Museum (9). – Unpub.

1310. Bangle, type I. O.D. 9.9x10.4 cm, I.D. 7 x 7.7 cm, Th. 1.4 cm, 320 gm (Fig. 27, 1310). – Dhubela Museum (10). – Unpub.

1311. Bangle, type I. O.D. 9.4x10.8 cm, I.D. 6.3 x 7.7 cm, Th. 1.5 cm, 388 gm (Fig. 27, 1311). – Dhubela Museum (11). – Unpub.

1312. Bangle, type l. O.D. 9.6x9.7 cm, I.D. 6.8 x 7 cm, Th. 1.4 cm, 326 gm (Fig. 27, 1312). – Dhubela Museum (12). – Unpub.

1313. Bangle, type I. O.D. 9.1 x 9.6 cm, I.D. 6 x 6. 5 cm, Th. 1.6 cm, 390 gm, ends meet very snugly (Fig. 28, 1313). – Dhubela Museum (13). – Unpub.

1314. Bangle, type I. O.D. 9.4x10.3 cm, I.D. 6.2 x 7.1 cm, Th. 1.7 cm, 390 gm (Fig. 28, 1314). – Dhubela Museum (14). – Unpub.

1315. Bangle, type I. O.D. 9.3x9.7 cm, I.D. 5.9 x 6.3 cm, Th. 1.7 cm, 444 gm (Fig. 28, 1315). – Dhubela Museum (15). – Unpub.

1316. Bangle, type I. O.D. 9.7x10.1 cm, I.D. 6.7 x 7 cm, Th. 1.5 cm, 374 gm (Fig. 28, 1316). – Dhubela Museum (16). – Unpub.

1317. Bangle, type I. O.D. 9.5x10.1 cm, I.D. 6.5 x 6.8 cm, Th. 1.6 cm, 444 gm (Fig. 28, 1317). – Dhubela Museum (17). – Unpub.

1318. Bangle, type I. O.D. 9.2x9.4 cm, I.D. 7 x 7.2 cm, Th. 1.2 cm, 220 gm (Fig. 28, 1318). – Dhubela Museum (18). – Unpub.

1319. Bangle, type I. O.D 9.5x9.7 cm, I.D. 7x7.1 cm, Th. 1. 3 cm, 262 gm (Fig. 28, 1319). – Dhubela Museum (19). – Unpub.

1320. Bangle, type I. O.D. 9.2x9.6 cm, I.D. 6x6.3 cm, Th. 1.6 cm, 418 gm (Fig. 28, 1320). – Dhubela Museum (20). – Unpub.

1321. Bangle, type I. O.D. 9.9 cm, I.D. 7.2 cm, Th. 1.3 cm, 326 gm (Fig. 28, 1321). – Dhubela Museum (21). – Unpub.

1322. Bangle, type I. O.D. 9.8x9.9 cm, I.D. 6.7 x 6.9 cm, Th. 1.5 cm, 394 gm (Fig. 28, 1322). – Dhubela Museum (22). – Unpub.

1323. Bangle, type I. O.D. 9.7x10.2 cm, I.D. 7 x 7.4 cm, Th. 1.4m, 306 gm (Fig. 28, 1323). – Dhubela Museum (23). – Unpub.

1324. Bangle, type I. O.D. 9.3x9.6 cm, I.D. 5.9 x 6. 2 cm, Th. 1. 7 cm, 432 gm (Fig. 28, 1324). – Dhubela Museum (24). – Unpub.

1325. Bangle, type I. O.D. 9.7x10 cm I.D. 6.4 x 6.6 cm, Th. 1.8 cm, 416 gm (Fig. 28, 1325). – Dhubela Museum (25). – Unpub.

1326. Bangle, type I. O.D. 9.7x10.2 cm, I.D. 6.7 x 6.8 cm, Th. 1.5 cm 396 gm (Fig. 28, 1326). – Dhubela Museum (26). – Unpub.

1327. Bangle, type I. O.D. 9.8x10.1 cm, I.D. 6.7 x 6.9 cm, Th. 1.6 cm, 402 gm (Fig. 28, 1327). – Dhubela Museum (27). – Unpub.

1328. Bangle, type I. O.D. 9.7x9.8 cm, I.D. 6.8x7cm, Th. 1.4 cm, 268 gm (Fig. 28, 1328). – Dhubela Museum (28). – Unpub.

1329. Bangle, type I. O.D. 9.9x10.2 cm, I.D. 6.8 x 7.2 cm, Th. 1.5 cm, 400 gm (Fig. 28, 1329). – Dhubela Museum (29). – Unpub.

1330. Bangle, type I. O.D. 9.5x10.1 cm, I.D. 6.3 x 6.8 cm, Th. 1.8 cm, 442 gm (Fig. 28, 1330). – Dhubela Museum (30). – Unpub.

1331. Bangle, type I. O.D. 9.3 cm, I.D. 6.8x6.9 cm, Th. 1. 2 cm, 258 gm (Fig. 28, 1331). – Dhubela Museum (31). – Unpub.

1332. Bangle, type I. O.D. 9.3x9.5 cm, I.D. 6.9 cm, Th. 1. 3 cm, 276 gm (Fig. 28, 1332). – Dhubela Museum (32). – Unpub.

1333. Bangle, type I. O.D. 8.9x9.3 cm, I.D. 5.7 x 6.1 cm, Th. 1.7 cm, 402 gm (Fig. 28, 1333), – Dhubela Museum (33). – Unpub.

1334. Bangle, type I. O.D. 9.5x10 cm, I.D. 6.4 x 6.8 cm, Th. 1.5 cm, 424 gm (Fig. 28, 1334).– Dhubela Museum (34). – Unpub.

1335. Bangle, type I. O.D. 9.2x9.5 cm, I.D. 6.2 cm, Th. 1.5 cm, 404 gm (Fig. 28, 1335).– Dhubela Museum (35). – Unpub.

1336. Bangle, type I. O.D. 9.6x9.9 cm, I.D. 6.4 x 6.6 cm, Th. 1.5 cm, 400 gm (Fig. 28, 1336).– Dhubela Museum (36). – Unpub.

1337. Bangle, type I. O.D. 9.1x9.4 cm, I.D. 6.4 x 6.6 cm, Th. 1.3 cm, 272 gm (Fig. 29, 1337).– Dhubela Museum (37). – Unpub.

1338. Bangle, type I. O.D. 9.4x9.7 cm, I.D. 6.2 x 6.5 cm, Th. 1.6 cm, 414 gm (Fig. 29, 1338).– DhubeIa Museum (38). – Unpub.

1339. Bangle, type I. O.D. 10.5x10.9 cm, I.D. 7.5 x 8 cm, Th. 1.6 cm, 464 gm (Fig. 29, 1339).– Dhubela Museum (39). – Unpub.

1340. Bangle, type I. O.D. 9.3x9.6 cm, I.D. 5.9 x 6.2 cm, Th. 1.7 cm, 408 gm (Fig. 29, 1340).– Dhubela Museum (40). – Unpub.

1341. Bangle, type I. O.D. 9.5x9.9 cm, I.D. 6.1 x 6.5 cm, Th. 1.7 cm, 436 gm (Fig. 29, 1341).– Dhubela Museum (41). – Unpub.

1342. Bangle, type I. O.D. 9.1x9.3 cm, I.D. 6.5 x 6.6 cm, Th. 1.3 cm, 282 gm (Fig. 29, 1342).– Dhubela Museum (42).– Unpub.

1343. Bangle, type I. O.D. 9.6x10 cm, I.D. 6.5 x 6.9 cm, Th. 1.5 cm, 416 gm (Fig. 29, 1343).– Dhubela Museum (43).– Unpub.

1344. Bangle, type I. O.D. 9.6x9.8 cm, I.D. 6.5 cm, Th. 1.7 cm, 426 gm (Fig. 29, 1344). – Dhubela Museum (44). – Unpub.

6. Midwestern India

Daimabad hill, Taluk Shrirampur, Dist. Ahmednagar, Mah. (19° 31' N; 74° 41' E). – During the course of excavations from 1976 to 1979 S.A. Sali recovered several important metallic implements of a domestic nature (nos. 1345-1358) from the settlement"[115]. With the exception of a fragmentary axe (1356, from burial 72a in a house of the Jorwe Culture, little is known of the find circumstances of the other metallic implements from Daimabad.

1345. Phase I (Savalda Culture). – Bangle, type V (excav. no. 84/1977-78). O.D. *c.* 4.5, Th. 0.3 cm (Fig. 29, 1345). – ASI Ahmednagar. – Sali, S.A. 1985, 512- 516, fig. 110, 1, pl. 143, 1.

1346. Phase II (Late Harappan). – Lower half of a type IIIa axe (excav. no. 128/1976-77). 4.5 (pres.) x 2.9 x 0.6 cm (Fig. 29, 1346). – ASI Ahmednagar. – Sali, S.A. 1985, 513-518, fig. 110, 8, pl. 144, 10.

1347. Phase IV (Malwa Culture). – Fragmentary axe of undeterminable type (excav. no. 43/1978-79). 4 (pres) x 9.5 (pres.) x 0.7 (pres.) cm (Fig. 29, 1347).– ASI Ahmednagar.– Sali, S.A. 1985, 513-518, fig. 110, 14, pl. 144, 12.

1348. Phase IV (Malwa Culture).– Bangle, type II (excav. no. 1/1977-78). O.D. 7, Th. 0.7 cm (Fig. 29, 1348). – ASI Ahmednagar. – Sali, S.A. 1985, 513-518, fig. 110, 2, pl. 143, 2.

1349. Phase IV (Malwa Culture). – Chisel (excav. no. 40/1978-79). 13.4 (pres.) x 2 x *c.* 1.3 cm (Fig. 29, 1349). – ASI Ahmednagar. – Sali, S.A. 1985, 513-518, fig. 110, 9, pl. 144, 11.

1350. Phase IV (Malwa Culture). – Spearhead? (excav. no. 37/1977-78). 9.5 (pres.) x1 (pres.) x0.2 cm (Fig. 29, 1350). – ASI Ahmednagar. – Sali, S.A. 1985, 513-518, fig. 110, 10, pl. 144, 10.

1351. Phase IV (Malwa Culture), from the hearth in the coppersmith's workshop.– Razor (excav. no. 51/ 1977-78), 8.1x5.8x0.1 cm (Fig. 29, 1351). – ASI Ahmednagar. – Sali, S.A. 1985, 513-518, fig. 110, 11, pl. 144, 13.

1352. Between phases IV and V (Malwa and Jorwe Cultures). – Bangle, type IV (excav. no. 110/1977-78). O.D. 8.3, Th. 1x1.1 cm (Fig. 29, 1352).– ASI Ahmednagar.– Sali, S.A. 1985, 513-518, fig. 110, 3, pl. 143, 3.

1353. Between phases IV and V (Malwa and Jorwe Cultures). – Bangle, type IV (excav. no. 44/1978-79). O.D. 8, Th. 0.8 cm (Fig.29,1353).– ASI Ahmednagar. – Sali, S.A. 1985, 513-518, fig. 110, 4, pl. 143, 4.

1354. Between phase IV and V (Malwa and Jorwe Cultures). – Bangle, type IV var. (excav. no. 46/1978- 79). O.D. 4.2, Th. 0.4 cm (Fig. 29, 1354).– ASI Ahmednagar. – Sali, S.A. 1985, 513-518, fig. 110, 5, pl. 143, 5.

115 Sali, S. A. 1986, 512-518.

1355. Phase V Jorwe Culture). – Upper half of a misc. axe, (excav. no. 107/1978-79). 4.5 (pres.)x2.7x0.3 cm (Fig. 29, 1355).– ASI Ahmednagar.– Sali, S.A. 1985, 513-518, fig. 110, 13, pl. 144, 8.

1356. Burial 72 in a house of phase V Jorwe Culture). – Upper half of a misc. axe (excav. no. 115/1978-79). 3.7 (pres.)x1.9 (pres.)x0.2 cm (Fig. 29, 1356).– ASI Ahmednagar.– Sali, S.A. 1985, 513-518, fig. 110, 12, pl. 144, 9.

1357. Phase V Jorwe Culture). – Bangle, type IV var. (excav. no. 120/1976-77). O.D. 5.1 Th. 0.4 cm (Fig. 29, 1357). – ASI Ahmednagar. – Sali, S.A. 1985, 513-518, fig. 110, 6, pl. 143, 6.

1358. Phase V (Jorwe Culture). – Bangle, type V. (excav. no. 578/1975-76). O.D. 4.8, Th. 0.3 cm (Fig. 29, 1358). – ASI Ahmednagar. – Sali, S.A. 1985, 513- 518, fig. 110, 7, pl. 143, 7.

7. Chronologically uncertain finds and recent copies

a. Chronology uncertain

1359. »**Ganges plain**«, U.P. – Human figure. 10.4x4.4x0.3 cm head slightly bent (Fig. 29, 1359). – Dumoulin Coll., Brussels, formerly Wannieck Coll. – Unpub.

1360. **Shahabad area**, Dist. Hardoi, U.P. – Chisel. 5.7x2 x 0.9 cm, 54 gm, thick green patina, possibly bro- ken off (Fig. 29, 1360). – National Mus. Delhi (86.59/ 28). – Unpub.

1361. **Shahabad area**, Dist. Hardoi, U.P. – Globular vessel with conical neck. 8.6x10.3 cm, wall Th. 0.1 cm (at neck), 176 gm, raised, dirt and corrosion inside, dented in one place (Fig. 29, 1361). – National Mus. Delhi (85.108). – Unpub.

b. Recent copies of hoard harpoons

A) **Bithur**, Dist. Kanpur, U.P. – Found together with 2 other harpoons (here B and C) and 3 axes (nos. 1114-1116).– 28.2x4.3x1.1 cm. – Temple belonging to Arjun Panda, Ganges ghat, Bithur (no no.). – Lal, M. 1984, 315, pl. 11a, left.

B) **Bithur**, Dist. Kanpur, U.P. – Provenance: *supra.* – 10.1x4.6x1 cm, 360 gm. – Temple belonging to Arjun Panda, Ganges ghat, Bithur (no no.). – Lal, M. 1984, 315, pl. 11a, centre.

C) **Bithur**, Dist. Kanpur, U.P. – Provenance: *supru.* 25.3x5.3x1.3 cm, 500 gm. – Temple belonging to Arjun Panda, Ganges ghat, Bithur (no no.). – Lal, M. 1984, 315, pl. 11a, right.

c. Non-evaluateable, Unpublished finds

Balpur, Dist. Raigar, M.P. – Axe of unknown type in the collection of Lochan Prasad Pandeya (Gordon, D.H., The Prehistoric Background of Indian Culture 1958, 142).

Bandua, Dist. Ranchi, Bi. – Axe-ingot of unknown type in the Patna Museum (Gupta, P.L., Copper Hoards in India 1980, 306).

Barrajpur, Dist. Kanpur, U.P. – A type I and II harpoon are said to be in the possession of a villager from here (letter L.M. Wahal, 6.05.1986).

»**Bengal**«. – Asutosh Museum, vitrine P.H. 97. – Unpub. *Cf.* Yule no. 865 for an axe-ingot similar in its size and shape (type III).

Chandausi, Dist. Moradabad, U.P. – Harpoon of unknown type. – Mathura Mus. (letter from L.M. Wahal 6.05.86; Dikshit, K.N., Bull. of Ancient Ind. Hist. and Arch. 2, 1968).

Chandausi, bank of the Srota river, Dist. Moradabad, U.P. – Miscellaneous harpoon listed in Yule, P. 1985, p. 108, is incorrectly cited as on display in the Jhansi Museum, and is actually in the collection of the Chandausi Museum. L. 23.2 cm. Finder: Surender Mohan Misra (personal communication with Virjanand Devakarni 12.09.86).

Hallur, Taluk Hirekerur, Dist. Dharwar, Kar. Razor? *c.* 3.7x3.9 cm. – State Museum Hyderabad (oral information Nagaraja Rao). – Nagaraja Rao, M. S. 1984, 92 no. 15?, pl. 11A, 5.

Kindhaulia village, Dist. Hardoi, U.P. – Miscellane- ous axe same type as Yule nos. 798 and 1174 (misc.). – Present whereabouts unknown. – Letter Krishna Kumar, Allahabad 4.08.1986.

Sanchan Kot mound, Dist. Unnao, U.P. – Harpoon. – Letter L. M. Wahal, 6.05.1986.

Near **Tamajuri**, Dist. Midnapur, W.B.– »Shouldered celt« (probably an axe-ingot). – Bose, S., Copper Hoard Sites in West Bengal (1985).

Taradih, Period I of the settlement, Dist. Gaya, Bi. – Fishhook. – Prasad. A.K., Man and Environ 8, 1984, 92.

III. Discussion

1. Representativeness of the Material

In the proceeding lines, and in the catalogue of Indian hoard artefacts of 1985, well over 1300 objects are recorded and classified typologically to facilitate their study. But this seemingly large number of specimens should not delude us into believing that the material available for study is truly representative, for just the opposite seems true. Up to one half (the exact figure depending on how one tallies) of the finds derive from the collecting activity of two lone individuals, Swami Omanand Saraswati and S.C. Roy, who to satisfy their intellectual curiosity, acquired hoard objects near their respective homes in Haryana and in southern Bihar. Furthermore, recording campaigns in 1985 and 1986 yielded a considerable amount of new material from Orissa and Madhya Pradesh which again alter a find situation in any case still apt to change.

On the most basic level hoards of portable artefacts, anthropogenic (e.g. stone axes), or natural (e.g. food, or human hair) objects, which based on the total impression they render, may be taken as having an origin in ancient times. Moreover, they also intentionally are deposited through human agency, and belong neither to the immediate accessories of burials, nor to the usual trappings of ruined settlements (debris, garbage, goods stored in ditches, basements, granaries *etc.*)[116]. Thus this heterogeneous category of finds is defined to a large extent negatively. A complete lack of settlement and grave finds alerts us that archaeologists are dealing essentially with chance finds which alone cannot sustain expectations for dramatic breakthroughs in an understanding of the prehistory of the region. One must also consider that hoards no doubt accidentally were uncovered during medieval, and subrecent times, although none thereof (except no. 1200) are recorded, which casts further doubt on the representativeness of the source material. Certainly the hoards were not identifiable to the early finders as prehistoric[117], nor could their historical value come close to their value as raw material for which reason so few are preserved. Prehistoric hoards were not a sudden and brief aspect of material culture for they are far too many, too developed, and too differentiated in their forms and methods of manufacture. In his recent comprehensive summary on the subject of deposits Geißlinger surveys several clear instances of deposits (= hoards) dating as early as the middle Palaeolithic of central Europe (the skulls and long bones of cave bears and other animals as well as humans carefully laid down in a specific pattern). The different kinds of European hoards range in date to the end of the Viking Period (10th century AD), and raise analogously doubts in light of the present state of research that the Indian hoards be chronologically and functionally limited. If one takes the number of artefacts and divides it over an arbitrary but reasonable estimated interval for their production (say 1000 years), the resulting somewhat more than one implement per year hardly awakens the impression of a true picture of the actual production for all of North India. Metaphorically speaking we are dealing with just the exposed tip, and not the bulk of the iceberg.

All in all only 23% of the prehistoric metallic objects catalogued to date derive from controlled excavations, particularly in western India. For the hoards, the only archaeological contexts which have been investigated under controlled conditions, and provide information about the hoards are those in Lothal and Saipai. The extant finds from these two sites account for about one percent of the known objects. Till recently the geographic distribution and concentrations of the extant regional groupings of the material remained little known. As of 1985 the largest body (382 implements)[118] derived from the South Haryana/North Rajasthan area, with the eastern Chota Nagpur (304), Doab (207), and Madhya Pradesh (119) areas trailing behind. Since 1985 cataloguing of the material from the least known areas, Chota Nagpur

116 Geißlinger, H. 1984, 320.

117 Menke (1982,36) analogously relates how in 1925 a hoard of copper ring ingots in Freinhausen, Germany was first taken to be a snake nest.

118 An implement here may consist of several pieces, as in the case of bangles. Depending on how one counts them, up to 2000 artefacts are possible in South Haryana.

(especially Orissa) and Madhya Pradesh, has resulted in an increase in the finds from these two areas respec- tively to 352 and 224 pieces. In terms of sheer numbers the Doab finds, which have dominated the controversy surrounding the background of the hoards, in fact are less significant than those from other parts of India which till 1985 had played only a minor role in the discussion of the hoards. The vastness of the hoard homeland is made clear in Maps 1 and 2. It is interesting to note that there is little spatial overlap of the mature Harappan culture (c. 2300-c. 1800 BC) – the most prominent historic manifestation – and the hoard cultures. Where this does occur is in the northern part of the Doab and of Haryana. In any case, the occurrence of the fragmentary type I anthropomorph in Harappan Lothal (no. 22) suggests a Harappan contemporaneity with the Doab group at least at one point in time. But aside from this no clear evidence exists with which to articulate the correlation. Although the South Haryana/ North Rajasthan and the Doab groups appear separate from each other in terms of their area and repertoire of types, certain finds (esp. from Sandhay and Mallah) may be taken as an indication of some overlapping of their geographical areas. Of the three main groups the Doab Group covers the largest area, and the Chota Nagpur Group the smallest. Hoard sites are most heavily concentrated in the Doab, and except for Madhya Pradesh, are most sparse in South Haryana/North Rajasthan. Future finds no doubt will clarify the details of the distribution of the hoard groups, especially in little-known central Madhya Pradesh. The following table summarizes the discovery of the Indian metallic finds over the decades. The fewness of the finds in the nineteenth and early twentieth centuries explains the relatively slow progress at first made in the study of this material.

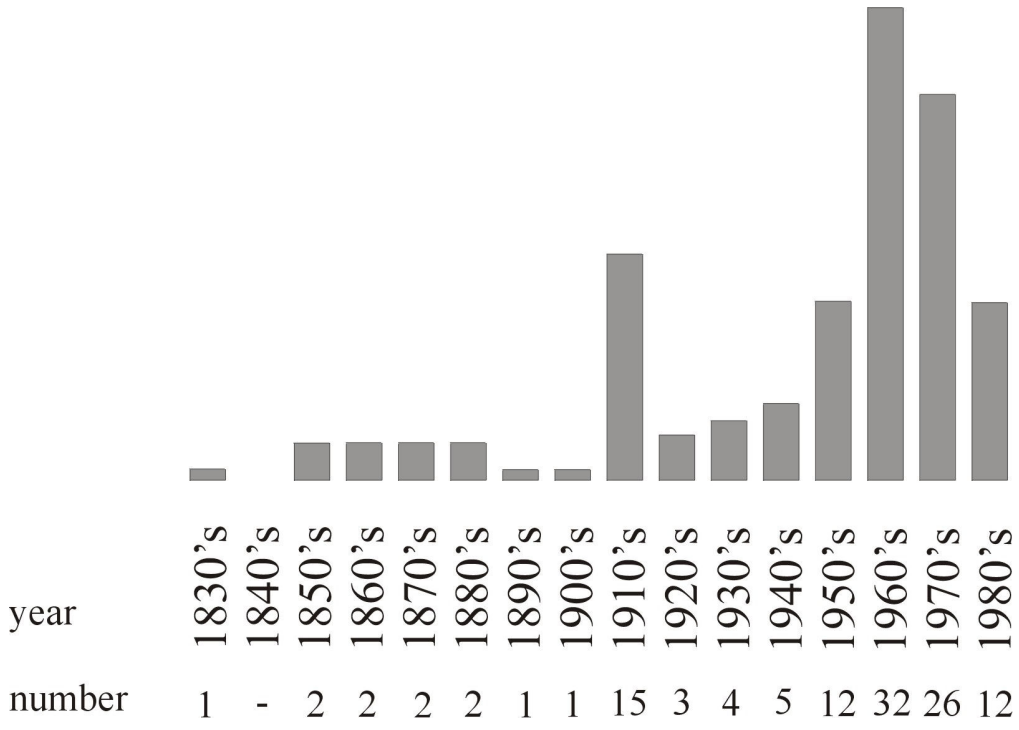


Table 1 Discoveries of prehistoric metallic artefacts in India arranged by hoard.

Perhaps a mere quirk of fate is the cluster of finds in the first decade of this century. Less surprising is the large number either reported or excavated particularly beginning in the 1960's corresponding to more effective reporting and an increasing awareness of the past at that time. In the midst of the 1980's, with 12 finds already having been made, there is reason to hope that in the remainder of the decade an already

large number of discoveries will help focus our understanding of the material. But all in all the relative fewness of the finds underscores the chance nature of the available material. Again it should be noted that the finding of objects is one thing, and their often tardy publication quite another. In passing, a positive development also might be mentioned that over the years the finds increasingly have reached the proper authorities, and have not remained inaccessible in out of the way collections.

2. Groups of hoards by area (Map, Fig. 2)

a. South India

In terms of new finds, beginning in South India, the discovery of a long type IIa double edged slashing sword (no. 1086) from Shavinipatti, despite its sketchy provenance, proves an unexpected addition to those of the same type from Kallur (nos. 1052-1054), and provides further indication of possible hoard practices in this area.

b. South Haryana/North Rajasthan

As for the South Haryana/North Rajasthan Group, a few further finds mostly of type III flat axes have accumulated in recent years. More significantly a new hoard from Mallah complements the repertoire of metallic artefacts here. A unique chisel and a harpoon (nos. 1089-1090) resemble neither those from this area, nor from the Ganges-Yamuna Doab, and Mallah (the finds incompletely published as they are) cannot be bound decisively to either. From Rewari another new find, owing to its shape and technique of manufacture, to judge from its size and shape, appears to be a prehistoric arm spiral (nos. 1104) similar to those in Europe *(supra).* Unique in India it is difficult to fix in terms of its historical connections.

Of considerable importance for the reconstruction of the relative chronology of implements is recently gleaned information with regard to a hoard which came to light in Narnaond (Dist. Hissar) in the late 1960's (nos. 715-722, 958-960, 1032-1039)[119]. Previously the finds from here were not identifiable as deriving from a hoard, and simply were subsumed among the strayfinds acquired in Hansi. Reportedly weighing some 300kg, the Narnaond »treasure« (if indeed only a single one recently was found here) has attained considerable fame among the local population of Haryana, and tales of the find belong to the lore of the country. To judge from them, and the description of the finds by the vender, the size of this hoard rivals even that from Ghangharia. New is the confirmation of the contemporaneity of axes of type IV, bars, and type III harpoons, as well as the confirmation in this area of the existence of serial finds which show no traces of use-wear. At the time of writing, the only excavated finds of the present group are those from Ganeshwar, a site about which little is known[120]. Nor are these finds hoards in the strict sense, but rather perhaps the stores of an industrial site.

The dating of this regional complex as a whole still presents difficulties. As a support for the internal chronology, the type II double axe from Mitathal, Period II (no. 211), and those from Kurada are similar in shape and presumably are also roughly contemporary. The channel-spouted bowls as well as the bowls with a carinated shoulder also from there can be compared with those from the mid second millennium Malwa Culture in Navdatoli[121]. A further chorological hint for the relative dating lies in the survey map produced by the French-Indo team[122]. Particularly sites designated Late Harappan are concentrated in the eastern part of Haryana where, it appears the greatest number of hoard sites in Haryana also are located. This suggests an association of the two categories of finds. That so few hoards occur in the actual copper

119 *Supra,* note 21.
120 Agrawal, R.C./V. Kumar 1982. – Dikshit, K. N. 1983. – Yule, P. 1985, 13.
121 Agrawal, R.C. 1980, 91. – *Cf.* also Aachen 1987, 106 fig. 80; 257 B16 from Sibri (Baluchistan) grave LV *c.* 1900 BC: similar, dated, spouted vessels.
122 Francfort, H.-P, *et al.* 1985, 62 fig. 26. This work became available to me after I had already finished the maps for the present study.

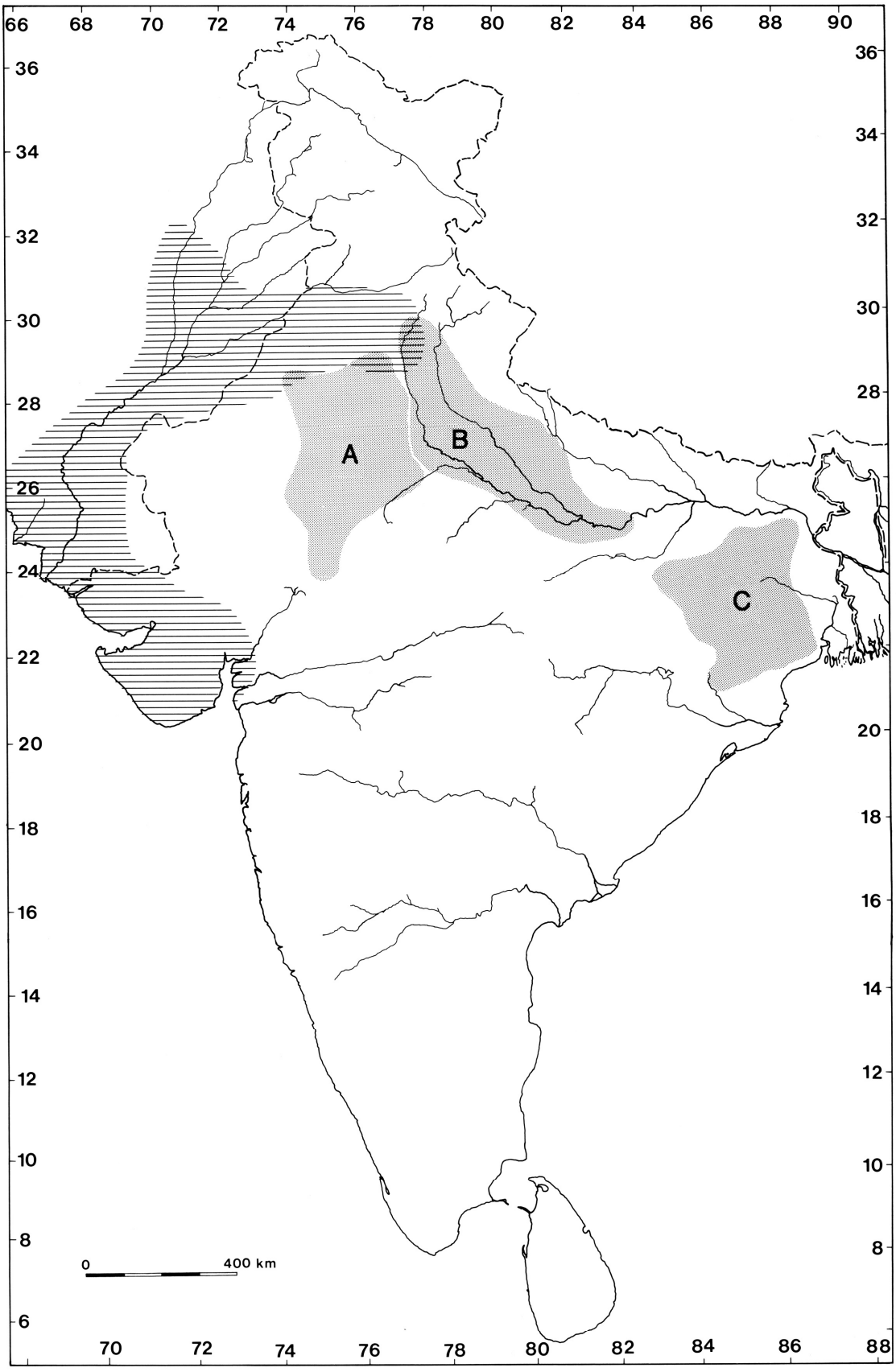


Fig. 2 Distribution of the main groups of hoard artefacts, and of the mature Harappa Culture: A = South Haryana-North Rajasthan Group. – B = Doab Group. – C = Chota Nagpur Group. – Horizontal hatching = mature Harappa Culture.

producing areas must be a result of archaeological chance. While the French-Indo team also mapped pre- and mature Harappan sites here, an association of pottery and metalwork for these periods does not come into question because the hoards differ in the artefact types, methods of manufacture, and the technology from the Harappan material. Also significant for the dating, the French-Indo team record an absence of Ochre Coloured Pottery (OCP) – the other cultural manifestation generally thought to complement the hoards. Our definition of the assemblage of the South Haryana/North Rajasthan Group of metallic implements coincides roughly with the Northern Nuclear Region which the Allchins have described using pottery as a criterion for the period in the aftermath following the urban Harappan culture[123]. In selecting Mitathal as an example, they refer to »redware of Harappan tradition« with its overlapping of forms at Cemetery H in Harappa, Bara, Sanghol and others. This area of the dry Saraswati and Drishadvati rivers certainly is geographically in a better position to lay claim as the home of the Aryans than any other hoard area[124]. Still their archaeological trace cannot be proven in the Late Harappan sites which overlap significantly the distribution of the hoards.

c. Doab

Numerous new metallic artefacts have come to light in the last few years from the Yamuna-Ganges Doab, although regrettably without clear provenances. The majority are strays of diverse shapes from the area near Shahabad. The finds of this group cluster at mid Doab, although some lie even outside the Doab itself. A look at the sites where the admittedly still poorly defined OCP has been reported shows them to lie in the upper reaches of the Doab *(cf.* Map, Fig. 3). The distribution as it is mapped here is conditioned to some extent by the easy accessibility to surveyors of the area of heaviest concentration, and the inaccessibility of other areas. This aspect and the lack of firm descriptive data for the pottery weaken the correlation between the hoard finds and OCP[125]. Nonetheless, in light of current thought and the correlation of the distribution of the two find categories, the contemporaneity of the hoard and OCP complexes remains a likely hypothesis.

Of the new finds from the Doab the most spectacular belong to a hoard plundered by locals at Saipai in 1969[126]. A disarray of several heterogeneous types occurs, none of which show any trace of use-wear. Significantly, the context contained not simply an isolated hoard, but possibly may reflect a settlement or dwelling, even if the numerous metallic implements are anything but household objects. The pounders, rubbers, querns, and pallets of stone might as easily occur, however, in an offering site. A heavy sword, harpoons, anthropomorphs, and some lance heads were in an almost new condition, and awaken the impression of a votive deposit because they occur severally in series. Yet, the non-metallic finds, and the observations of the context yield few hints as to the nature of the findspot. The forthcoming report may clear up some matters. Also striking in the Doab are the large number of damaged metallic artefacts

123 Allchin, F. R./B. Allchin 1982, 250-261.
124 *Cf.* Yule, P./M. Thiel-Horstmann 1985, 121-138.
125 Yule, P. 1985, 4-5.
126 Nos. 338 and 340 are excavated; nos. 337, 339 and 1128- 1133 were recovered after the plundering of the site.

Fig. 3 Findspots of Ochre Coloured Pottery: 1 Ahichchatra. – 2 Akrabas. – 3 Ambkheri. – 4 Aneki. – 5 Atranjikhera. – 6 Badla Kaiwada. – 7 Bahadarabad. – 8 Baharia. – 9 Bargaon. – 10 Bhabri. – 11 Bhaupur. – 12 Bhedki. – 13 Bisauli. – 14 Budhakhera. – 15 Chandpur. – 16 Chuneti Shekh. – 17 Deevlakhara. – 18 Deoti. – 19 Dhamola. – 20 Gadharona. – 21 Garh. – 22 Ghathera. – 23 Hardakheri. – 24 Haribas. – 25 Hastinapur. – 26 Hetampur. – 27 Jainer. – 28 Jhinjhana. – 29 Kajipur. – 30 Kamalpur. – 31 Kamauli. – 32 Kannauj. – 33 Karawarkhera. – 34 Kaseri. – 35 Katpalon. – 36 Kauria Ganj. – 37 Kazimpur. – 38 Khatauli. – 39 Kheri Gaurian. – 40 Kolkikalan. – 41 Kota. – 42 La Qila. – 43 Mahdud. – 44 Malehra. – 45 Manpura. – 46 Marhanwalla. – 47 Mathana. – 48 Mayapur. – 49 Morthal. – 50 Mujahidpur. – 51 Nahli. 52 Nalher-Bakal. – 53 Nasirpur. – 54 Nirpalpur. – 55 Nimsar. – 56 Noh. – 57 Pajrana. – 58 Papreki. – 59 Pariar. – 60 Puranpur. – 61 Rajdhana. – 62 Rajpur Parsu. – 63 Saipai Lichchwai. – 64 Salempur. – 65 Sandhay. – 66 Sarangur. – 67 Sarangpur. – 68 Sikrera. – 69 Sikri. – 70 Sothi. – 71 Sringaverpur. – 72 Tauli. – 73 Teliwala. – 74 Thataula. – Stippled: Nos. 3, 7, 9-12, 14, 16, 19-24, 26, 27, 29, 38, 40, 41, 43, 47, 48, 52-54, 57, 58, 60, 61, 64, 69, 72, 74.

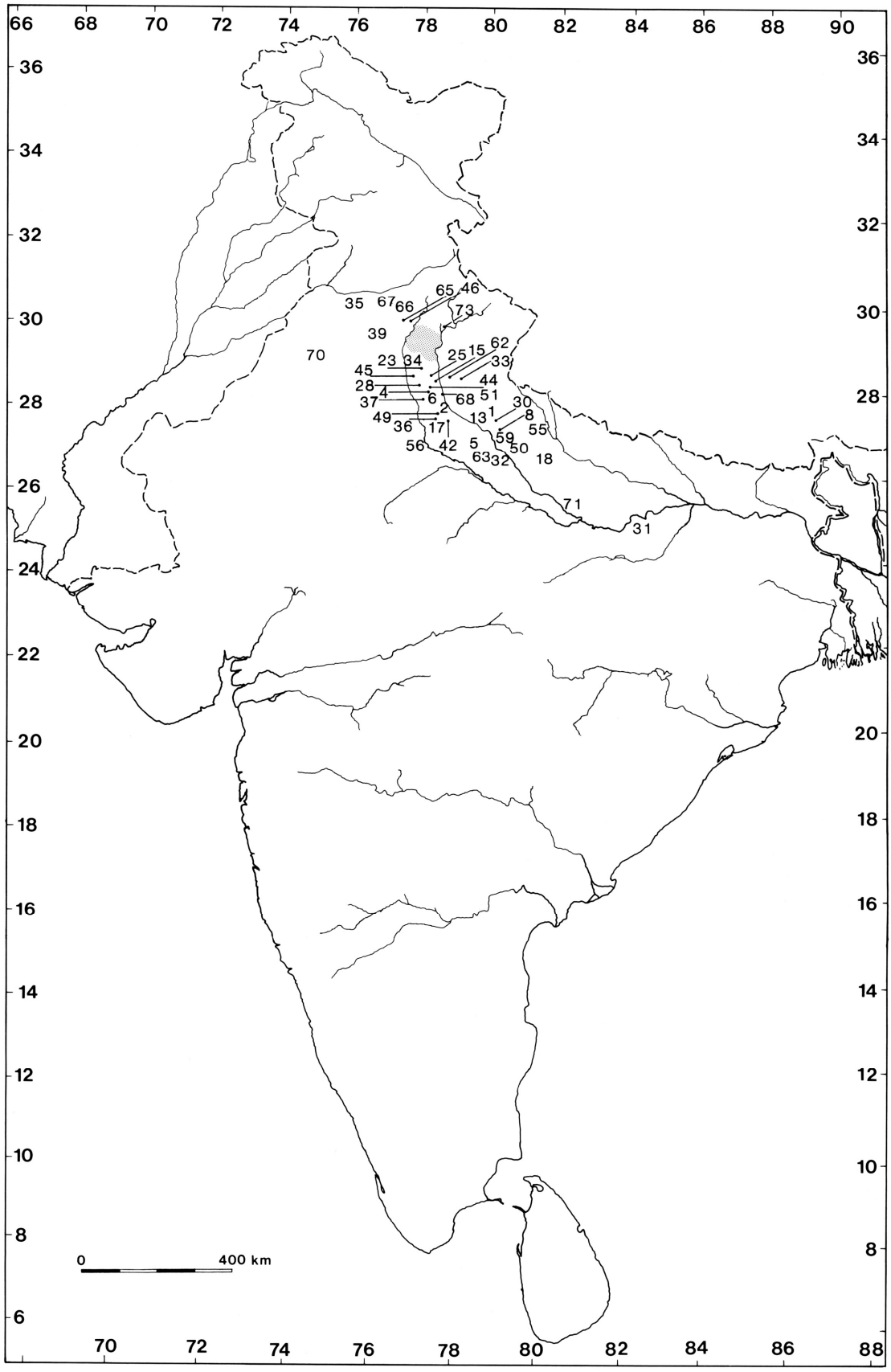


Fig. 3 For the figure caption see preceeding page.

from the Shahabad area, and from sites all over India. Unfortunately, in practice it is often difficult to determine whether this damage is recent, subrecent, or prehistoric. And numerous cases exist for which recent mutilation is well documented. Clear evidence is neither available in the Doab nor elsewhere for the ancient ritual mutilation of artefacts.

Further to the northwest near Ambala in Haryana an unusual hoard from a village called Sandhay (nos. 538, 1105-1108) is the first containing objects of Doab character west of the Yamuna for which the find-spot is certain. Now, in addition to a presumably prehistoric bull-snake in copper from Naurangabad (no. 1008), the shank of a lance head (no. 1108) from Sandhay, which is fashioned into a surprisingly expressive human face, provides an unexpected and better dated indication of an interest in pictorial representation in this remote period.

Several newly recorded type I anthropomorphs *(cf.* nos. 1105, 1121-1123) reveal them to be the most common kind, in contradiction to earlier views that those of type II predominate[127]. Also unique is a fragmentary small, honeycombed, bun-shaped ingot (no. 1180) from the area of Shahabad, and a miniature sword (no. 1120) from the Bithur area, neither type having occurred earlier in this region. The tiny sword brings to mind similar examples in Europe which have been explained as representatives in burials of full scale examples[128].

Two kinds of artefacts from the Doab require particular attention owing to the problematic nature of their classification. Numerous and variously shaped razors and lances proved the most difficult kinds of artefacts to identify because of features shared with several other kinds of implements and weapons. Recent work has added new information and several problematic pieces to the corpus. Thus, with the publication of section views the small copper implements from Hallur in South India these objects are more plausibly razors than as usually thought miniature axes *(cf.* Fig. 4). In this same way, the extreme

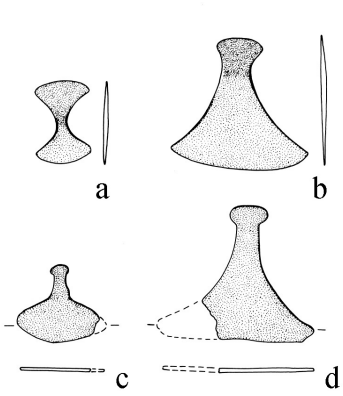


Fig. 4 Selected prehistoric Indian razors: a.b. Neolithic Hallur (nos. 5.6). – c.d. Ramapuram, period IC (Iron Age) (no nos.). a.b after Nagaraja Rao 1984; c.d, after Anon. 1983. – Scale 1:3.

thinness of at least some of the type II double axes from Kurada (nos. 198-201)[129] in the South Haryana/ North Rajasthan Group suggests the same identification, whereby the edges at both ends may have been the cutting edges. Copper objects from the Bahadarabad hoard (nos. 225-228) previously were identified as miscellaneous (cult?) axes, but can be more plausibly explained as razors. The cutting edge is the broader lead edge. Taken in the context of the recent publication of other razors from Daimabad (no. 1351), the Harappa culture, and Iron Age Ramapuram the new finds increase the number of examples, and we may surmise that shaving was widespread in prehistoric South Asia.

127 Rao, S. R. 1958, 13, p. 21A.
128 Hundt, H.-J. 1955, 112-113.
129 I have viewed them in the Hava Mahal in Jaipur.

Indian so-called lance heads characteristically have a ribbed blade, a tang, as well as a hook which is split off from the grip. They range between 28.3 and 69.7cm in length, somewhat large for this type of weapon. None has the tubular shank common outside of India. A major difficulty in certain cases lies in distinguishing them from spears, which are thrown, and from daggers which are plunged. The metal curl which is split off of the tang can be explained as a means to fasten the head to a shaft. Alternatively, it could have been sheathed with a wooden handle (no traces of wood ever exist) if one wants to interpret these blades as swords and/or daggers. Other difficulties arise with very large examples, such as nos. 1131 and 1132 from Saipai which measure respectively 57 and 67cm, and which seem unwieldy as lances used for actual combat. The heavy midrib of no. 1181 (Shahabad) is a more probable indicator of a lance head than a short sword. Another difficult piece is no. 1182 (also Shahabad) which has a thick blade, flat edges, and is biconvex in section. The classification of these implements is less certain than originally believed during the working up of the 1985 catalogue.

d. Madhya Pradesh

Owing to a general paucity of the artefacts, little real sense can be made of the metals industry in this vast area. Thus in the map appearing in Fig. 2 the distribution of the findspots of metallic objects from here is not represented. The current explanation for the lack of finds that central India in the prehistoric period was thinly populated, is based less on systematic research than on the negative evidence and rare random finds.

But the metalwork from a site such as Ghangharia (nos. 443-531, 1239-1270) cannot have existed in a vacuum without predecessors, descendants and relatives. This view is confirmed by a chance find from Narsimhapur – a type VII palstave (no. 1296) – a form otherwise known only from Ghangharia. The former site lies 130km away from Ghangharia, and is not from the same immediate area. With more intensive archaeological prospecting, axes and other finds like those from Kesli (nos. 1271-1273) and a half dozen scattered others could be brought together to form a group of metal using sites with a common repertoire of types. The now lost and hitherto ignored metal objects from Narsimhapur (nos. 1274-1297) are the only other witnesses to the Metals Period repertoire in this region. Unfortunately they are known solely from a photo taken obliquely (Fig. 5) and are difficult to see clearly. We have attempted to restore photogrammetrically their original appearance in the plates[130] and show that the kinds of objects share general technical and typological similarities with those from the Doab and the South Haryana/North Rajasthan areas, but not those from Chota Nagpur.

Particularly the type VII axes from Ghangharia, the simplest axe form possible *(cf.* Chalcolithic European axes), and the bar celts correspond to the earliest kind of metallic hoard objects known, to judge from better known typologies outside of India and, for this reason the Ghangharia implements may belong among the earliest known Indian hoards. On the other hand, long attenuated forms such as the bar celts take full advantage of the tensile properties of metal, and are by no means simply skeuomorphs translated from stone into metal.

e. Chota Nagpur and Neighbouring Areas (see distribution map, Fig. 2)

From this area including the adjacent eastern part of present day Madhya Pradesh, the majority of the newly recorded finds derive from find-spots concentrated in northern Orissa. Since 1985 of all the other areas of India investigated, our knowledge here has increased most significantly. Important additions to the known corpus of finds include the large type I double axe from Bhagada (no. 1194)[131] which belongs to a hoard composed of other such recently republished double axes (nos. 382-384). Although all the axes from here are of the same type, they nonetheless differ enough from each other in size, shape and details

130 Since a photo is the source, no cross section views are possible.

131 Yule, P. 1985, 107.

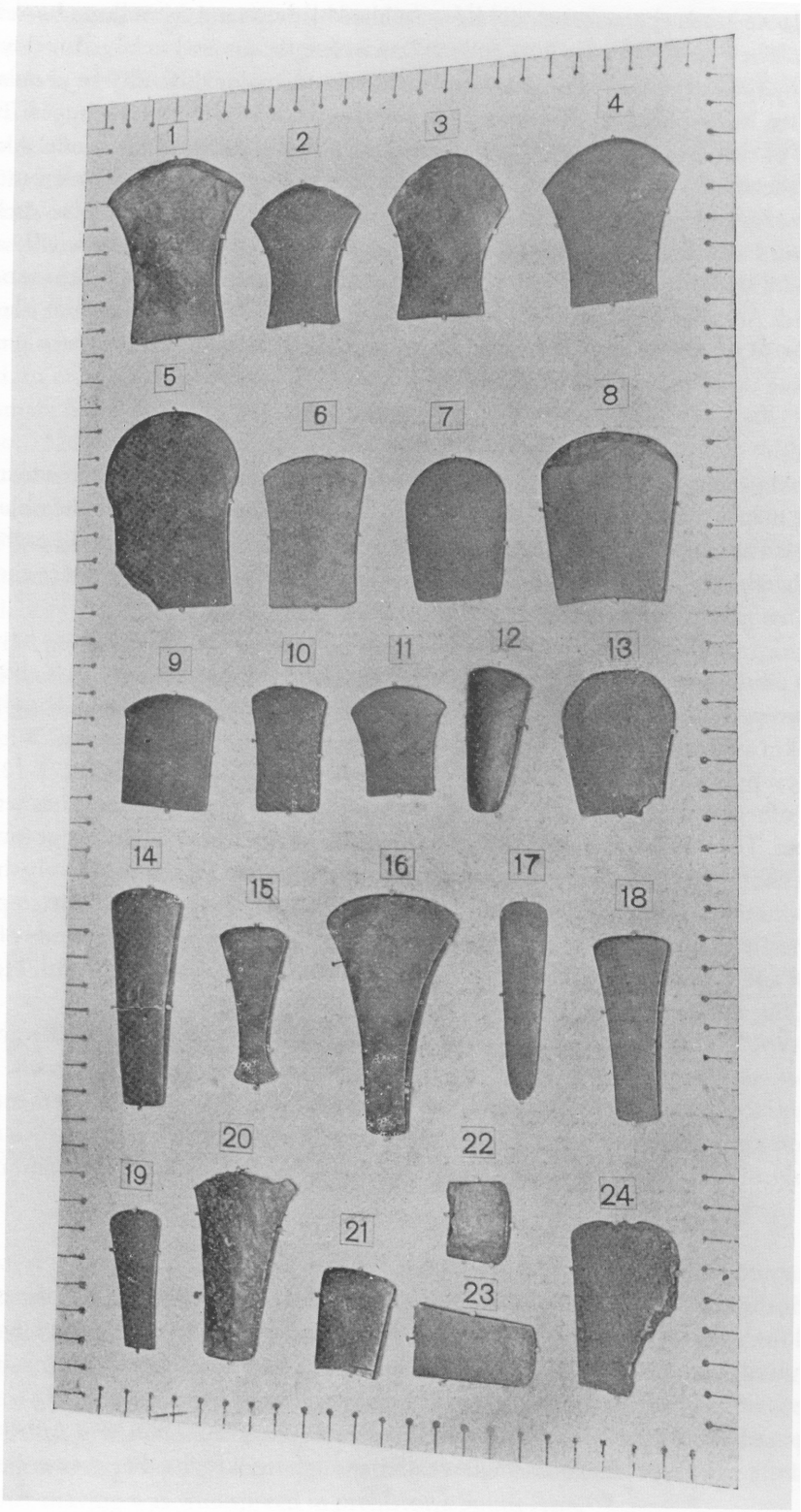


Fig. 5 Palstaves collected by A Bloomfield around Narsimhapur 1888-1897 (after Bloomfield).

of their manufacture that one cannot speak strictly of a »serial find« in the interpretation of this hoard. Perhaps the differences of the objects from here are explicable through their production over an extended period, or by an origin in different places. In contrast, the type I double axes from Parihati (nos. 435-439), the other hoard of these objects, are quite similar to each other, and probably derive from a common source. The »votive bangle« and bar also from the Parihati hoard (nos. 440, 441), in any case are contemporary with the axes. As stated elsewhere, type I double axes awaken the impression of anything but functional weapons, and to judge from the objects themselves we are dealing with cult-related paraphenalia[132].
Given the striking difference in the appearance of the »finished« finds from Bhagada, Parihati and Kesna (no. 1204), on the one hand, and the rough ingots on the other, one is inclined to query to what degree both belong to the same chronological period, even if the question is not readily answerable. These divergent types never have been encountered in the same find. Notwithstanding the possible chronological disparity, contrasting appearances simply may reflect numerous contemporary finds the value of which lay in their metal, and rare ones valued as particular finished implements. A hint for the relative dating of the rough ingots is the similarity in the form of the bar celts and bar celt-ingots which links the hoards of the Chota Nagpur Group to those of Ghangharia. No. 407 from Hami is, for example, hardly distinguishable from nos. 498 and 499 from Ghangharia. *Beilage* 2 shows a suggested relative chronology.

3. Hoard Function

There is reason to doubt the completeness of most of the hoards which is a handicap in using the combination of the types of a given hoard as a tool of interpretation, particularly of the hoard functions. Despite this and a lack of find observation, several hoards exist which owing to the kinds of objects which they contain, their find circumstances, and traces of use-wear provide at least some basis for interpreting their original function. Still it should be bourn in mind that even basic kinds of distinctions for the study of hoards in practice cannot be made with the Indian material. For example, few cases exist of hoards which are distinctly intentional and not simply accidental deposits[133]. Nor can hoards irrevocably or revocably deposited be distinguished from each other on the basis of their find circumstances[134]. If a hoard is deposited in a place where it cannot be recovered as in the case of a deep river or swamp, the reason for its deposition can hardly be a practical one. There is little or no way to identify the existence of places prehistorically held to be sacred or auspicious which coincide with hoards occurrences. Here the sole exception is the high concentration of hoards reportedly found in river banks which previously may have been river beds. Moreover, there are no clear examples of hoards which are distinctly offerings. None of the hoard objects occur in pairs, as might be expected of burial goods (two pins, two earrings etc.). A tally of all of the find-spots specifically of the copper hoards (Table 2) reveals, that the vast majority to be of unknown provenance.
On a more positive note, if the hoard owners in fact can be linked to a particular sex, then to judge from the large proportion of weapons males were responsible for most of the deposits. The only objects which might possibly be considered to reveal a female occupation are axes, indicative of a possible domestic activity, namely the gathering of wood and brush. If the Haryana and Doab hoards were attributable to the struggles recounted in the *Mabharata,* then a case could be made for hoards reflecting an attempt to protect possessions against the depredations of war.
With regard to hoards as possible offerings it is clear that random objects were not offered, and many specific factors influenced the selection made. A present or offering should not invoke simply the favour of

132 *Ibid.* 103.

133 Clearly intentional: Daimabad, Ghangharia, Kayatha.
134 Stein, F. 1976, 117-118. – Geißlinger, H. 1984, 322-323.

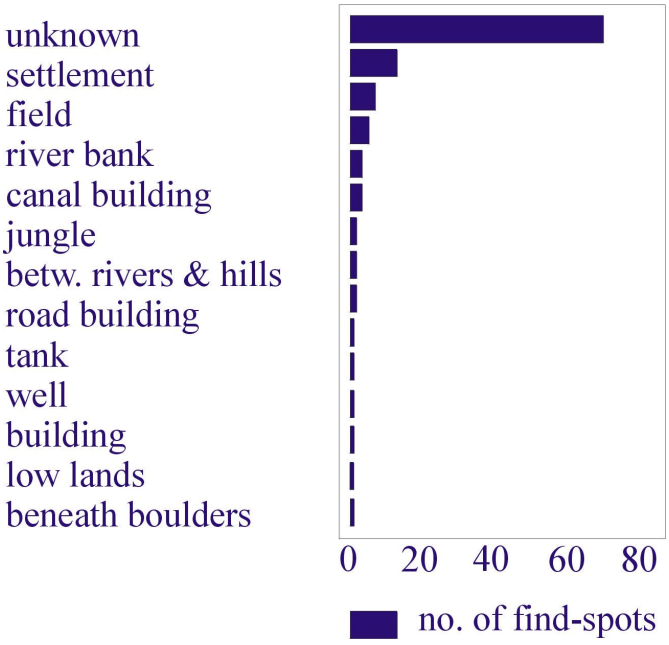


Table 2. Find situation of Indian hoard objects, 1989

a personified deity, but rather should magically invoke other perhaps animistic numinosities that accomplish specific tasks beyond the capabilities of the individual or group. Often in the invocation of magical powers analogy thinking plays an important role, for example, the Roman *augurium canarum,* in which dogs with red hair are killed in order to hinder wheat rust[135]. Of the finds catalogued above, from Orissa's Keonjhar district, perhaps part of a larger hoard, several type III axe-ingots and a unique miniature stand with a tang (nos. 1195-1197) reaffirm thoughts that not all the hoards from Chota Nagpur are primarily caster's stores (an otherwise likely conclusion)[136], but might also possess an underlying cultic significance. For example, a miniature stand from here is a most unlikely form for an ingot. Too small and ill-suited to be a household object, it and no. 1076 from Bartola evoke thoughts of a non-functional use. Also from this area a large serial find from Hami *(supra* n. 71 and 72) contains a large number of bar celt-ingots, and type III axe-ingots (here nos. 1201-1203). By considering it a »serial find« it can be taken to be a cult-related deposit. The high proportion of weapons in the hoards of the Doab could be taken as an indication of warlike deities.

Alternatively, the only hoard which appears to be a caster's hoard is that from Aguibani (nos. 351-360) which contains bangles, axe-ingots, and bun ingots, one of which is broken, as if to facilitate its melting, perhaps anciently. This use also holds for the little ingot from Shahabad (no. 1180). Few scraps of evi-

135 Kirchner, H. 1968, 384.

136 Yule, P. 1985, 103.

dence exist in India for assortments, i.e. »merchants« sample cases, tentatively identified in other prehistoric cultures. The only example of a hoard which conceivably could be taken as a store is that from Ghangharia (Madhya Pradesh), in which the implements were stacked in alternating layers as if in an oblong crate[137]. Equally as plausible, however, is a cultic interpretation for this hoard, however, because the ordered regularity of the finds and their non-functional character seem more in keeping with a formulaic ritualistic intent[138].

4. Patina and surface texture

During the course of the cataloguing an attempt was made to systematize the descriptions of the patina (corrosion) of the different copper or bronze objects. Were this successful, one conceivably could describe more critically the conditions under which the pieces originally were deposited. Moreover, an additional criterium would exist as a help for attributing or disattributing certain artefacts to a given hoard. The first step in this direction was simply a description of the patina of each individual piece. While from Rajpur Parsu, Saipai, Bhagada, and Dimiria great differences exist in the patination of the individual pieces of each hoard, those from the Resgavaon, Etawah, Gandhauli, Nasirpur, Ghangharia, and Bardangua hoards each show respectively the same patinas confirming in principle the validity of this attempt.
But here a problem arises in that rarely if ever do records exist as to whether or not artefacts have been restored, cleaned, or for the general conservation measures employed in the cleaning. *E.g.* in the case of the hoard from Pondi, whereas certain pieces have a thick, waxy, light green patina, others are bright red and unpatinated. No doubt the latter have been cleaned at some time following their discovery. In the case of the Narnaond hoard, again, only after several discussions did it become clear that the objects had undergone treatment with caustic soda. Also, the patina of museum pieces has changed over the decades from handling (esp. Fathgarh). It is also clear that metallic artefacts from the same hoard, or even the surface of a single given piece can manifest great differences in their patinas. The cause lies in the heterogeneity of the metal even within a single piece as well as local differences in the preservation conditions. The fine bronze patina *(aerugo nobilis),* wild or flour patina, lead patina, earth patina, moor or water patina, and »cadaver« (Covellin) patina all were occasionally observed in the entire corpus of the material[139] although with nowhere near the regularity that one knows from certain European finds. The main characteristics of the surfaces from the different regions appear below, with the caveat that they by no means apply to all, or even a majority of the objects in a given area.

South Haryana: middle glossy, green-dark green, often heavy accretions mixed with sand
Doab: middle glossy, light green to dark green
Chota Nagpur: dull, light green to dark gren, tendentially lighter than in other areas, high incidence of flour patina
Madhya Pradesh: dull, dark green, usually dull grainy surface (Ghangharia).

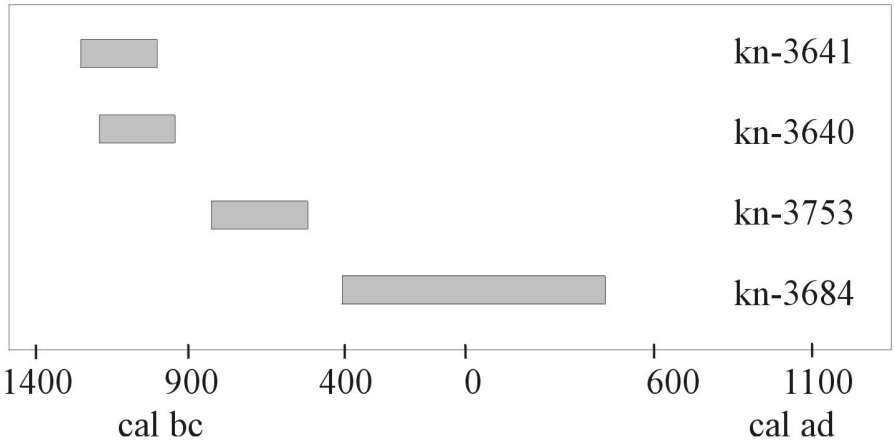
The lack of clear cases of the smooth moor and river patinas is not surprising, and whereas much of the Doab previously was a watershed, the yearly rising and sinking of the water table would not produce these kinds of patinas. Rather, and not unexpectedly in these often salty lands, a heavy corrosion and scarring is prevalent. The »cadaver patina«, with its bluish opalescent surface, was of particular interest as a potential indicator of contact with a cadaver such as one might expect with grave goods. Given its extreme rarity (exception: no. 1164) and hoard composition there is little reason to see the hoards as

137 *Ibid.* 13.
138 *Cf.* the ritual conditions imposed on metal objects in Vedic texts (Rau, W. 1974, 55-56).
139 For these terms see Roeder, G. 1928; Ullrich, D. 1985; Willroth, K.-H. 1985, 24.

funerary objects. Other potentially revealing peculiarities of the deposition on the patina such as influences caused by a deposition in closed containers (for example, pottery vessels) remain unknown[140]. The main value of the observations of the patina turns out to be as an additional instrument for the confirmation of the attribution of hoard objects to given hoards where such questions arise. The scepticism which the heterogeneity of the patinas of objects from Rajpur Parsu, Saipai, Bhagada, and Dimiria could engender in part can be dismissed as a result of some of the pieces having been cleaned.

5. Chronology

Of all the excavated finds potentially associated with the hoards, because of their proximity to the known Chalcolithic settlements those from Bihar and West Bengal (and not the Doab) are most likely to be historically linked with the hoards. The investigated Chalcolithic sites of Sonpur, Taradih, and Chirand in present-day Bihar contain some rare copper artefacts and lie in close proximity to India's eastern copper range. Characteristic of the above-mentioned sites are a hand-made, burnished, red and black ware, and a developed bone and ivory-working industry, which continue from the Neolithic into the succeeding periods with the addition of copper working. Yet recent radiocarbon results from »Chalcolithic« Sonpur and Pandu Rajar Dhibi, just outside of the eastern hoard zone, as it is presently known, are important for they strengthen the few radiocarbon high datings of the Chalcolithic in the first millennium BC, and indirectly the dating of the hoards as well. For the time being the connection with the eastern hoards remains inferential.



lab. No.	site	14C date BP	cal. date at 1 sigma
Kn-3641	Pandu Rajar Dhibi Per. II	2940±55	1292-1051
Kn-3640	Pandu Rajar Dhibi Per. I	2870±50	1209-943
Kn-3753	Sankarjang	2590±60	814-663
Kn-3684	Sankarjang	2000±400	430-410AD

Table 3 Recent radiocarbon determinations and calibrations of selected Metals Period sites in eastern India (adapted from M. Stuiver and P. J. Reimer 1986).

140 Exceptionally as with nos. 109-119 from Kayatha.

An important new site just 100km south of the southernmost known hoard (Dimiria) of the Chota Nagpur Group is the cemetery near the village of Sankarjang, which despite certain limitations in its documentation, helps us focus the picture of prehistoric culture and chronology of this period in the interior of India's archaeologically otherwise unknown eastern seaboard in present-day Orissa. In 1985 we hoped that this hitherto all but unknown site would shed light on the culture of the eastern hoards. At that time little evidence existed for their southern distribution. Sankarjang serves in the present state of research as a first bench mark for the local Chalcolithic, thanks to radiocarbon (Table 3), in the first millennium BC. Striking cultural remains here include large, polished bars and adzes in basalt, as well as non-ferrous bangles and small tools. In the new metals analyses listed in Table 4 one of the few un- equivocally intentional arsenical alloys (5.7% As) occurs in a bangle from Sankarjang, which serves as a reference for a metallurgical technology more advanced than that of the surrounding area. Of the various explanations, the simplest is that Sankarjang is later than the neighbouring known metal-using sites. In the initial mentions of this site the ground stone industry served as the main criterium for the dating if not a characteristic of the economic/societal form (e.g. »Neolithic«)[141]. In any case, in India the ground stone industry telescopes chronologically between early agricultural settlements which use exclusively such tools, and an astonishing number of iron bearing archaeological contexts[142]. Nor are these periods fixed in point of time, and often develop highly regionally.

For the modern »archaeological Hamlet « one of the few means available out of the »chronology/culture« quandry is radiocarbon assaying[143]. From Sankarjang the determination KN-3684 to cal AD 10 + 420 is not significant owing to the smallness of the carbon sample, whereas KN-3753 from here (cal BC 740 + 160) does not suffer this inadequacy. Much the same results from new calibrated determinations apply to Chalcolithic levels at Pandu Rajar Dhibi to the north. For Periods I (KN-3640) and II (KN-3641) respectively cal BC 1080 + 130 and cal BC 1170 + 120 confirm the dating of this cultural phase at least in part of the late second millennium[144]. The dating and definition of the Chalcolithic of North India in general have increased in complexity with the unfolding of the different cultures particularly in neighbouring Western India by the archaeologists of Deccan College in Pune[145]. Several sites have produced determinations in the late second and early first millennia for non-iron-using cultures. For this reason it is increasingly evident that the typological/chronological designations »Neolithic«, »Chalcolithic«, or »Iron Age« have little absolute chronological relevance to those of the Near East, or Europe which still more or less serve as main historical models. The hoards as a group cannot be dated absolutely except by inference, and then not more exactly than simply by an educated guess »partly contemporary with the mature Harappan civilisation, most hoards later rather than earlier in the second millennium«.

6. Mining and Metallurgy

Metallurgy can shed light on the 1evel of prehistoric technology complementary to the study of the types of implements. Among the questions to be raised are whether or not a knowledge of alloying was manifest or even developed; second, whether oxidic or the more difficult sulphidic ores were smelted. These two aspects in turn illuminate the question as to whether the hoards represent a first developmental stage in the local metallurgy, or whether future researchers must seek up till now unknown still earlier incipient stage of metallurgy. It should be bourn in mind that in other parts of the world such archaeometallurgical questions are hotly debated, often with data far superior to those available here. Agrawal *et al.* have made the main contributions in this line of enquiry in India[146], and determined that

141 Yule, P./B.K. Rath 1988. – Misra, V.N./V.S. Mate 1965.
142 *Ibid.*
143 Since this tcxt was written numerous umpublished radiocarbon determinations for the second millennium in Bihar have been compiled by Gregory Possehl in a data bank, Possehl, G. 1989.
144 Allchin, B./F.R. Allchin 198Z, 258-259.
145 Dhavalikar, M. K. 1979. – Agrawal, D.P./S. Kusumgar 1973, 105-116.
146 Agrawal, D.V. 1971, 168-171; 186-188. – *Ibid. et al.* 1978, 42, summarised in Yule, P. 1985, 100-101.

the hoard objects were alloyed with arsenic, but not with tin. A difficulty with this study was the limited number of artefacts available for chemical and metallographic analysis, the fewness of the elements analysed and a lack of a control as to whether hard alloys belong to edged tools. 79 recently made quantitative analyses serve as a control on earlier results (Tables 4 and 5). The major chemical element is of course copper. In order of concentration iron is next in importance, in one case amounting to 32.9% (no. 668). Such a high iron content is not typical, and is hardly desirable *(infra)*. Half of the assays show the presence of arsenic in low quantities, and of these only in three cases is the arsenic of high enough (over 3%) content that it would improve the hardness of the metal in an appreciable way[147]. If arsenical alloying in fact was possible by the hoard metallurgists, it is unlikely that they would limit themselves usually low percentages. Only in one case (no. 767) does a hoard artefact show a significant presence of tin, and in this case in a low not necessarily manufactured concentration (2.7%). Thus, the copper hoards in fact appear to be generally of copper; most of the low grade arsenical copper reflects a natural occurrence of this metal in the copper ore. Next in terms of its frequency is lead which occurred in minute (<10ppm- 2.1%) quantities in all of the samples. Appreciable amounts (over 1%) were found in 7% of the samples. Nickel generally was determinable, but never amounted to even 1%. Of the 11 metals quantitatively analysed zinc, silver, cobalt, antimony, and bismuth occur only in minute quantities, *i.e.* in the lower ppm range.

Harder alloys of arsenic and tin were not determined to be used for edged tools as opposed to bangles and ingots. Paradoxically, the very high occurrences of iron in the copper – a brittle alloy unsuitable for use – appears in axes from Haryana which on the basis of their size and shape I previously took to be common tools *(e.g.* nos. 540, 668), as well as in very large axes for which a practical use is less likely (nos. 714 and 796). That early metallurgists went to the trouble smith axes of this useless alloy instead of re-smelting the metal to drive out the impurities, or leaving an unpractical alloy in rough ingot form does not speak for the production of use implements. Significant in this regard is the observation that two bangles from Haryana, and a third from Sankarjang (no no.) have the highest arsenical content of any of the objects assayed here (5.7%), perhaps owing to a desire for a more silvery colour.

Moreover, with the exception of the Sankarjang bangle and a type 1a axe-ingot from the Manbhum District (no. 825, 4.6%) there is no clear evidence for arsenic alloying. In contrast, tin alloying is documented in prehistoric India in the Daimabad hoard (nos. 38 and 39), the metallurgy of the Malwa and Jorwe periods from Navdatoli (nos. 52, 54, 56, 70, 78, 86), some hoard objects of unknown provenance (nos. 1002, 1024 and 1043), and some random objects the historical connections of which with the hoards is unclear (Kallur no. 1053 and Dist. Mehsana no. 1056). The upshot of these analyses suggests the insignificance of tin alloying in the hoards, and a loss of metallurgical technology in this period. The few isolated occurrences of tin perhaps can be explained best as the result of the re-smelting of Harappan tin-bronze artefacts. A lack of interaction with the more technologically advanced urban Harappan civilisation explains the simple technology of the hoards. Nor did the Late Harappan or Aryan immigration in the zones of contact have any detectable transfer of technology on the hoards.

The origins of the ores used for the hoard objects resist study for several reasons. First, recent detailed studies of ore zones are largely inaccessible outside of India. Second, no datable and well provenanced slag is available for study. Its acquisition would entail considerable effort and expense. Whereas the use and occurrence of tin has received careful study[148], for arsenic, which plays a possible role in alloying, there is next to no literature available because this metal nowadays in India is unimportant and is imported[149]. A great variety of ores exist in India over a vast area (see Map Fig. 6). But the ores presently worked for

147 Northover, lecture in Heidelberg 04.10.1987. Below 2% concentrations are insignificant and often unintentional; above 4% arsenic has a clear effect on the hardness. See also Böhne, C. 1965.

148 Chakrabarty, D.K. 1979. – Agrawal, D. P. 1971, 149-150, 159. – *Ibid.* 1970. Tellingly, stannite *(i.e.* a copper-tin ore) is never mentioned.

149 However, see Agrawal, D. P. 1971, 150. – Bhardwaj, H. C. 1980. In the standard work on exploration of nonfer- rous ores in 1ndia (Raghu Nandan, K. R. 1981) arsenic is not mentioned even once.

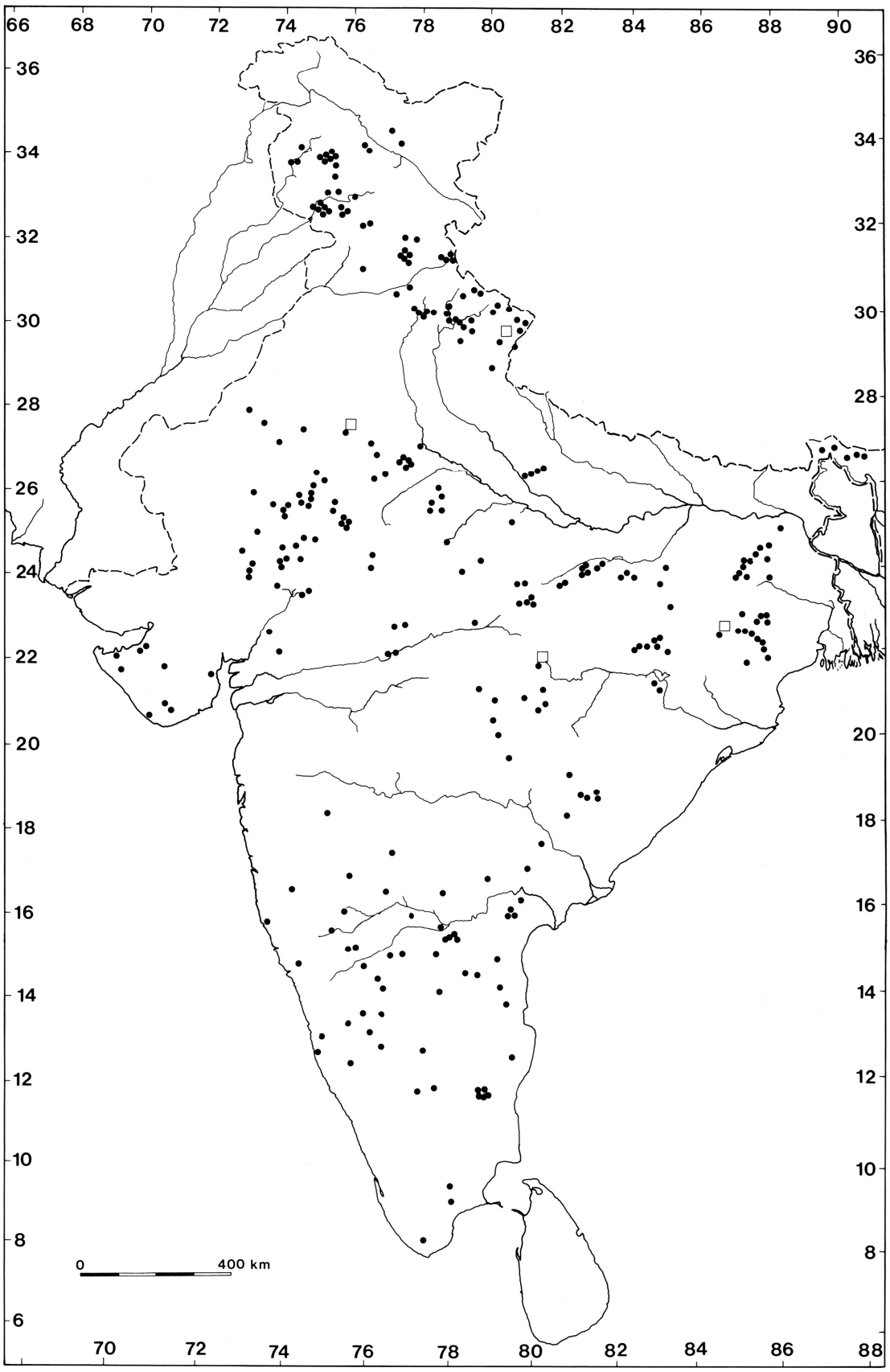


Fig. 6 Copper deposits in India (after J. A. Dunn 1965; S. Krishnaswami 1979): □ Important Cu-districts. ● Small deposits and old workings.

obvious reasons by no means need represent those used in antiquity. If native copper nowadays is exceedingly rare in India[150] this means only that the most accessible and richest ores were the ones first exploited.
In principle oxidic ores (malachite, azurite, cuprite) which lie near or on the surface were the first ones to be smelted. Innumerable abandoned pits bear witness to the exploitation of the most accessible richest deposits. Hand picked nuggets from Timna in Sinai, for example, may contain as much as 30% copper[151]. After crushing and the sorting the copper content is considerably higher and reduction in a simple charcoal kiln is possible at a dull red heat slightly below 1200°C. Extraction is not necessary as opposed to sulphidic ores. A world exists between the smelting of simple ores[152] and more difficult sulphidic ones. Copper and polymetallic mineralisation visible in strikes offered a far greater source of ores in varying concentrations and in a variety of forms. Oxidic ores comprise, however, a fraction of the sulphidic ones, which owing to their relative inaccessibility were for an incipient metallurgy of secondary importance. Owing to the present day concentration on sulphidic ores (particularly chalcopyrite, pyrite, sphalerite, pyrrhotite and cubanite) the descriptions of the forms of oxidic ores are vague. In general these ores occur in fractures/ shears and in association with metamorphic as well as igneous rocks. What most authors on the subject of archaeometallurgy have not recognized is the importance of the beneficiation of this ore, which must have been far more time consuming than the actual smelting[153].
This prerequisite for the copper production played at least as great a role in the smelting of sulphidic ores. Such mineralisations occur in metabasic faults, in specks and stringers, gossan bands, veins, lenticles, lenses, patches and bunches. In Kolihan in the Khetri Copper Belt, for example, copper mineralisation is present in all rock types, although payable ore zones appear to be mainly confined to chlorite biotite and amphibole-bearing schists close to the footwall quartzite contact[154]. These ores first must have been crushed, washed and otherwise selected (beneficiation) so that a cut-off of at least 2% copper was available to the smelter[155].
Instead of the simple reduction as was the case with malachite, the sorted sulphidic ore first was roasted under oxidizing conditions in order to drive out the sulphur. The procedure was repeated often enough that the iron contents in the ore and most of the copper were oxidized. The roasted ore and host rock then under reducing conditions could be refired with charcoal and possibly with the addition of quartz sand as a fluxing agent. Thereby the iron content formed a slag together with the host rock and quartz. The reduced copper together with remnants of copper sulphide and the slag were tapped from the furnace, the slag floating on top of the »cake«. Further perhaps repeated firings under slightly reducing conditions were required to oxidize impurities in the copper and to melt the metal into larger cakes.
The relation between the prehistoric occurrence of implements and the sources of the ore is generally close, and massive sources lie usually near or in each of the hoard regions, the exception being the Doab. Well documented deposits lie in much of northern Rajasthan[156]. In any case the close location of copper from North Rajasthan and South Haryana to the Doab is logistically simpler than the next closest source in the Himalaya mountains[157]. It is possible *(infra)* that our division into South Haryana/North Rajasthan and Doab cultural zones is overly schematic and may neither account for the actual geographic realties of the second millennium B.C., nor for the trade and regional groupings of the age. In these respects there may have been more interaction between these two regions than is suggested in the map of the

150 It is reported in Sikkim, Meghalaya and Malanjkhand *(infra)*.
151 The copper concentrations listed for Indian ores by Agrawal are far too high (Agrawal, D. P, 1971, 145-146).
152 In the main office of Hindustan Copper Limited in Calcutta a clump of native copper weighing some 15 kg is on exhibit from Malajkhand in Madhya Pradesh.
153 *Cf.* Hauptmann, A./G. Weisgerber 1985, 27-28 figs. 10 and 11.
154 Raghu Nandan, K. R. *et al.* 1981, 73.
155 Hauptmann, A./G. Weisgerber 1985, 28.
156 Dunn, J. A. *et al.* 1965, 127, 129-157. – Raghu Nandan, K. R. *et al.* 1981, 63, 143, 188-189. – Dey, R. C./R.B.S. Rao 1981, 11-20. – Several sources of tin in the area which have remained unnoticed by students of archaeometallurgy are here worthy of mention even if their exploitation in the prehistoric period is not demonstrable. – In addition to Chakrabarty, D. K. 1979: Dist. Bhiwani: Anon. 1984, 1; Anon. 1985, 13.
157 Raghu Nandan, K. R. *et al.* 1981, 184-195.

hoard groups. For the manner in which this trade was conducted there are no direct sources. The copper sites in the Doab which appear on the Map, Fig. 6, in the Banda and Allahabad districts represent reported slag heaps near the Majhgaon railway station and almost non-evaluateable geophysical indications[158]. These isolated and insignificant sources, lying as they do in the Doab, are difficult to conceive of a being of any real significance for the local hoard production.

With over 150 reported occurrences of copper, lead, tin and zinc alone in Bihar, and to judge from the modern and ancient copper production particularly in the Singhbhum copper belt, this area was perhaps an even more important source in antiquity than that of North India. Centred in south-eastern Bihar, this district fringes out into western West Bengal, northern Orissa and Sikkim[159]. The Chota Nagpur Group lies in the heart of this copper district which ranges over 128 km in length.

Whereas the last hoard region, that of Madhya Pradesh, in terms of prehistoric metallurgy is known in principle from a single hoard (Ghangharia), recently within 35 km of this hoard at Malanjkhand the largest single ore deposit in the country was discovered. Given the immensity of the deposit and it easy accessibility on the surface, it is strange that only a single hoard from the area has survived as evidence of the early production.

Here and in other copper districts the zone of oxidation reaches from 40 to 60/100 m depth[160] and in all of the districts secondary ores such as malachite and azurite are abundant on the surface. Adits, slag heaps, dumps and pounding stones[161] all are documented in the literature although selected relics previously reported by Dunn and others during a brief visit in 1986 could not be located easily[162]. In the hilly erosion-prone Singhbhum area what has not been carried off over the centuries has washed into the valleys and lies beneath a cover of sediment.

As a first hand example of the readily accessible finds are the following: In the hills of Surda numerous abandoned pits are caved in or filled in which follow the line of the strike over several hundred meters. Originally they reached a depth of some 30 to 40 m, i.e. to the water table[163]. Typical shaft entrances were irregularly formed and measured up to 6x 6m. Tool marks from metal picks quadratic in cross section are still visible in some of the pits suggesting exploitation of oxidic ores in the sub-recent period. On the one hand the mines inspected in Surda literally have been picked clean of ore. On the other, slag remains especially in Rakha lie in the valleys where stream water was available for the washing of the ore. Up to 2 m of slag sediment in the bank over 200m in length is all that attests generations of ore washers in Rakha[164]. The absence of mining debris near the mines is explained presumably by its re-smelting in the valley by later metal workers. Despite the undisputed intensive and extensive mining and smelting operations here over the centuries, pre-industrial slag remains are not as frequent as the literature suggest.

158 *Ibid.* 194-195.

159 Dunn, J. A. et al. 1965, 71-93. – Raghu Nandan, K. R. et al. 1981, 144-178.

160 *Ibid.* 40; Agrawal, D. P. 1971, 147.

161 Dunn, J. A. 1937. – Dunn, J. A. et al. 1965.

162 Dunn, J. A. 1937, pl. 10: Examples from Dhalbhum. These are in stone, but one reason for an absence at least of such early historic instruments is that most were of metal. This seems the case at the Mauryan period zinc mines at Zawar, Rajasthan. Personal communication Paul Craddock, 4.10.1987.

163 In particular here I should like to thank G. D. Mathur, B. K. Puranik, A. K. Lal of Hindustan Copper Ltd. and Prof. R. K. Lal of Benares Hindu University for discussing these matters with me.

164 We witnessed gold being panned here in 1986.

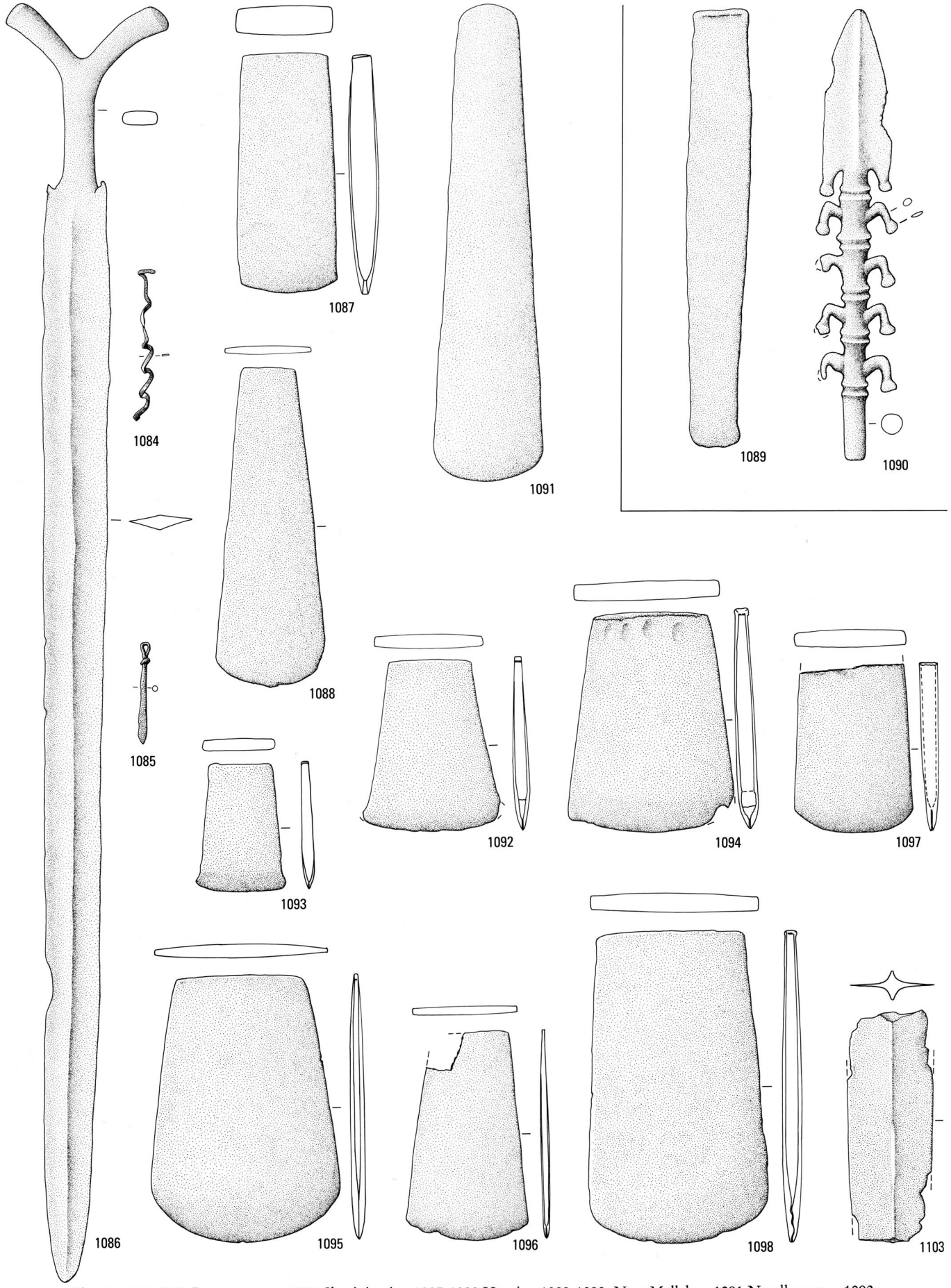


Fig. 7 1084-1085 Ramapuram. – 1086 Shavinipati. – 1087-1088 Hansi. – 1089-1090. Near Mallah. – 1091 Nandlapura. – 1092-1098. 1103 Rewari. – Scale 1:3.

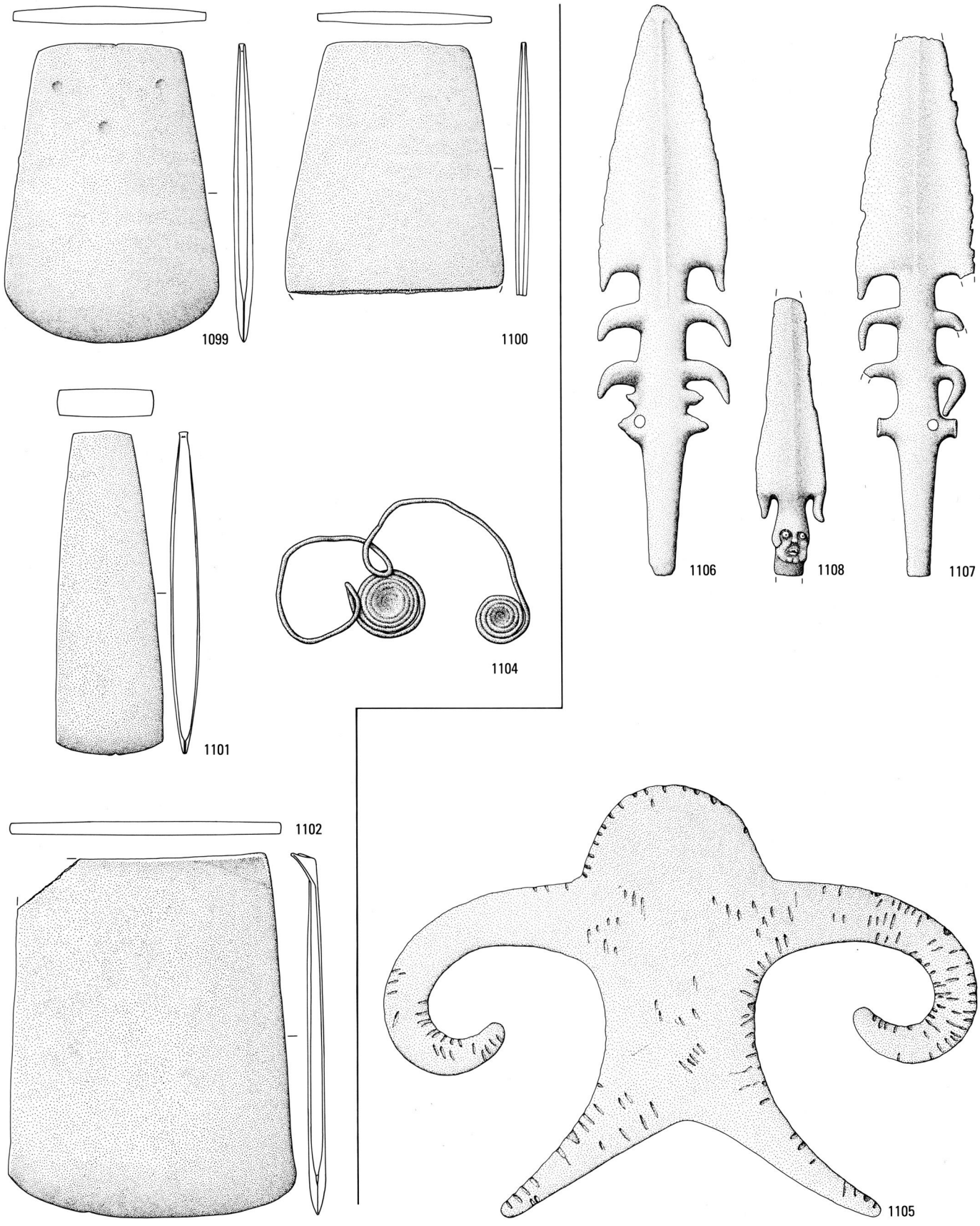


Fig. 8 1099-1102. 1104 Rewari. – 1105-1108 Sandhay. – Scale 1:3.

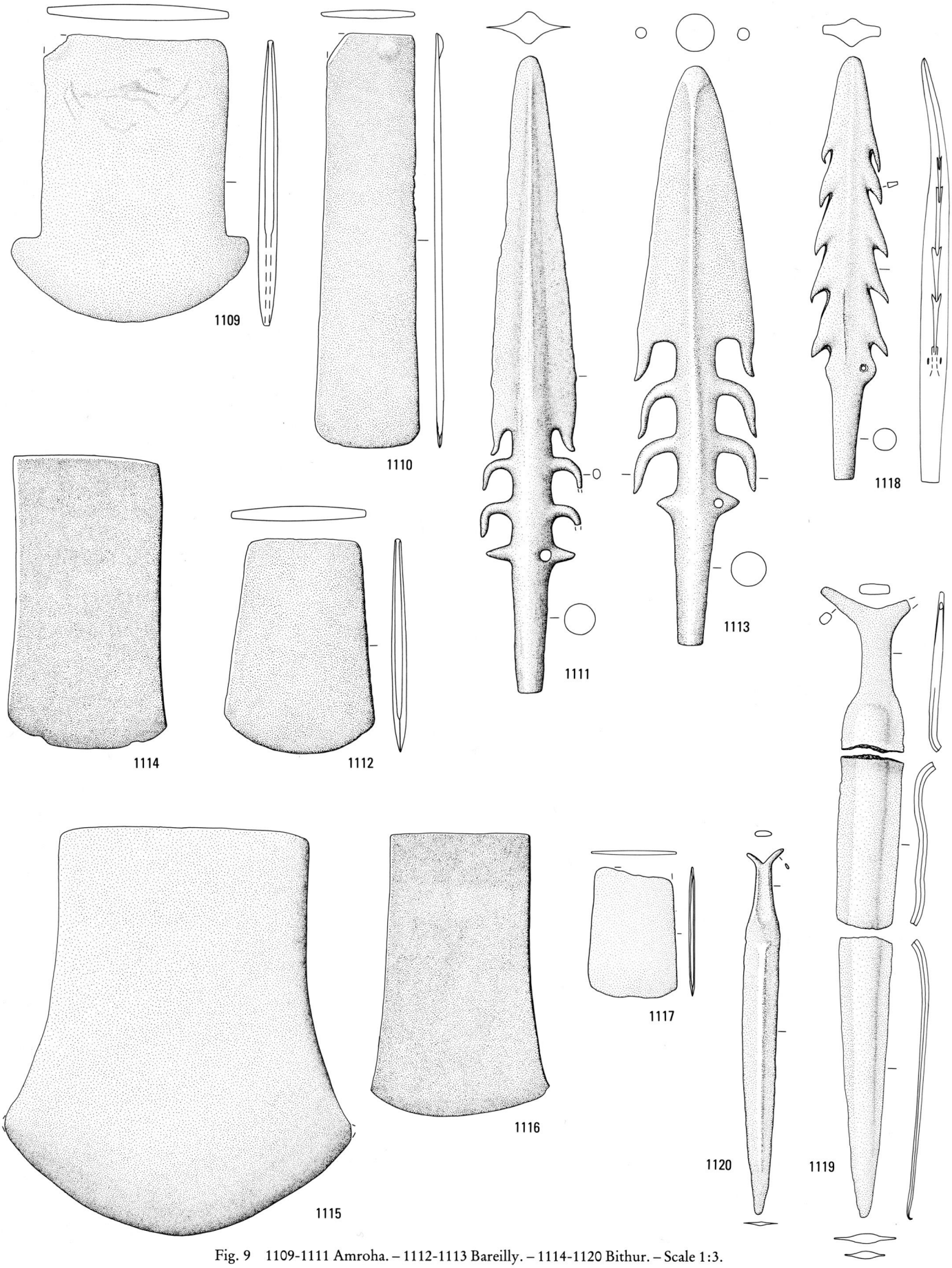


Fig. 9 1109-1111 Amroha. – 1112-1113 Bareilly. – 1114-1120 Bithur. – Scale 1:3.

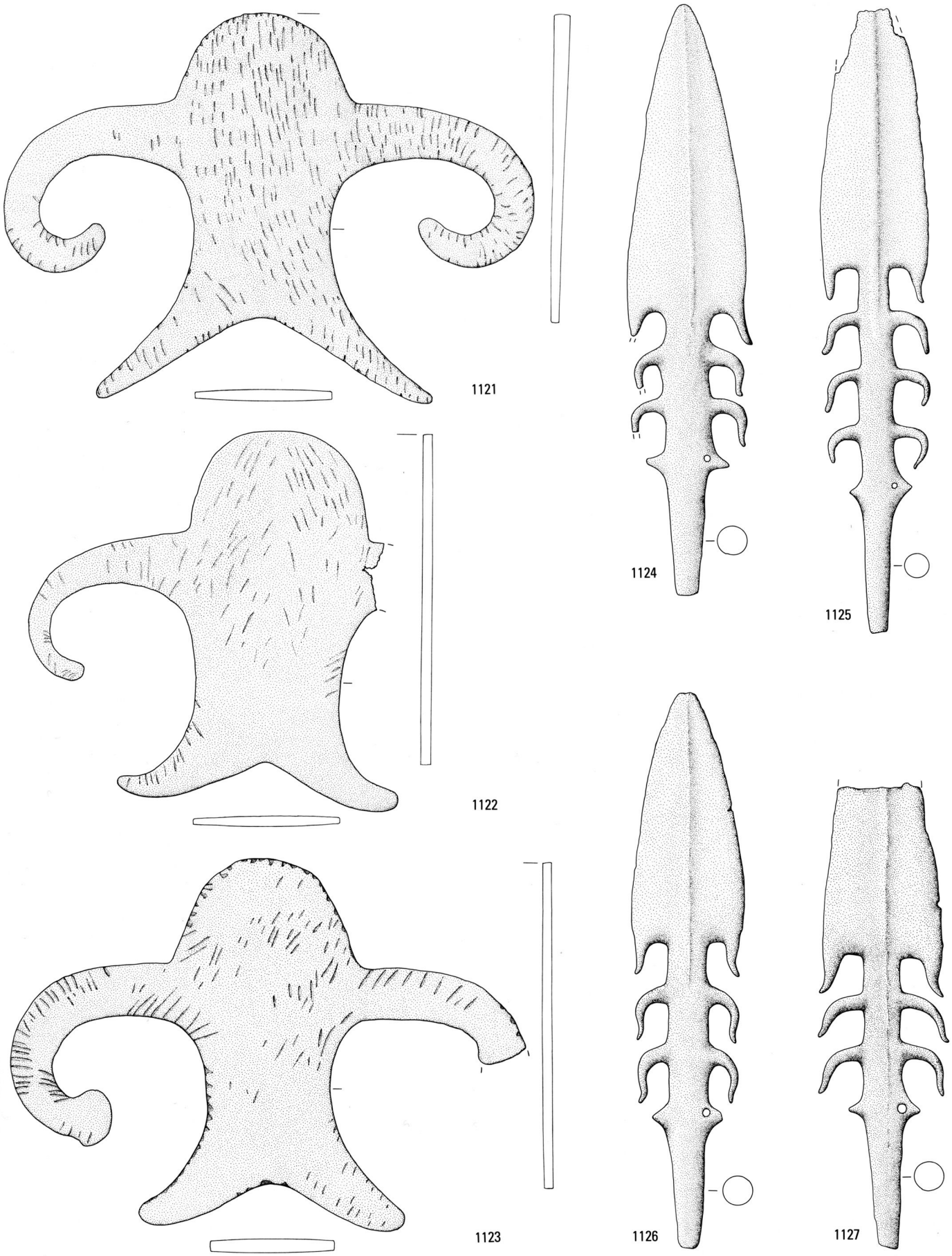


Fig. 10 1121-1127 Provenance unknown. – Scale 1:3.

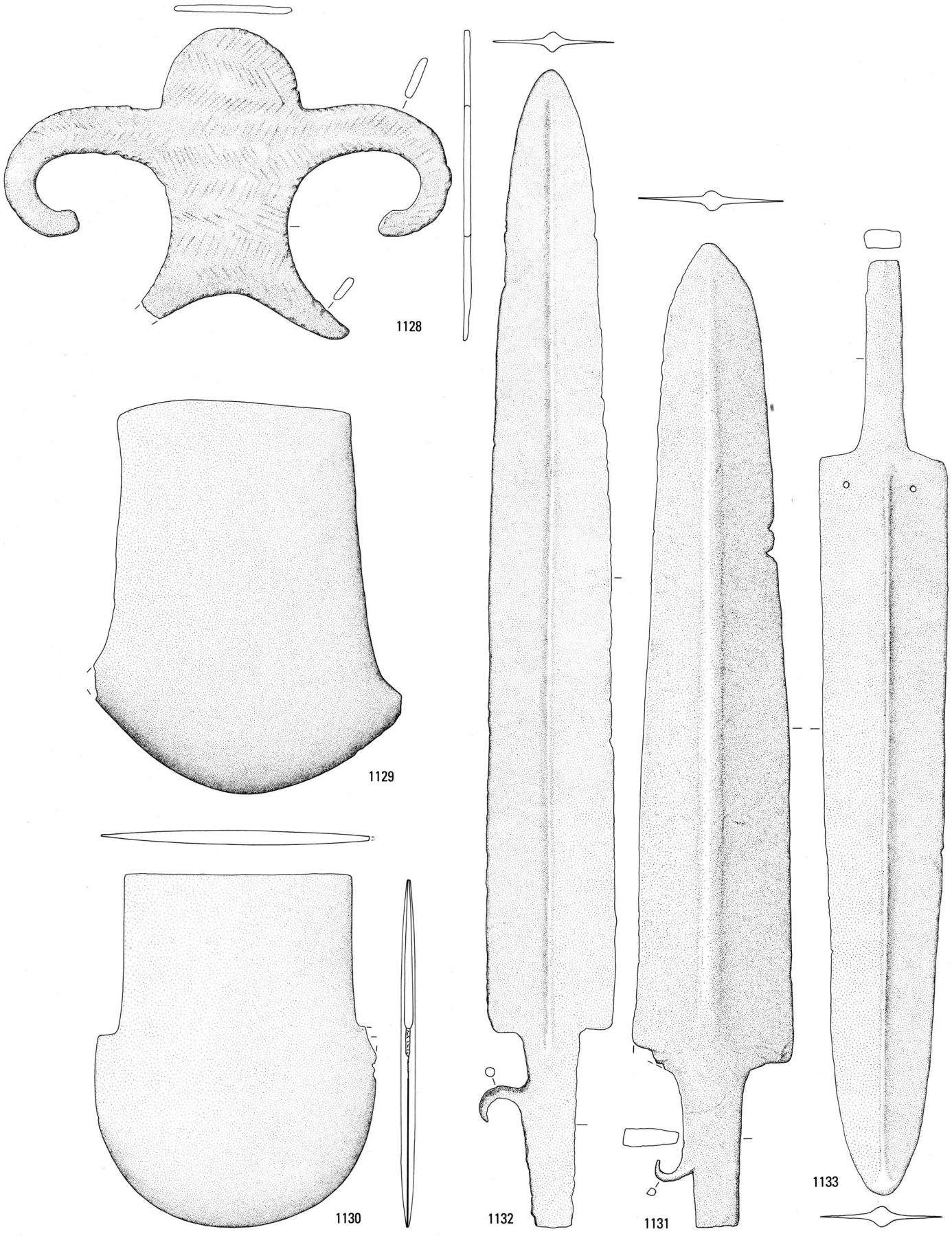


Fig. 11 1128-1133 Saipai Lichchwai, hoard. – Scale 1:3.

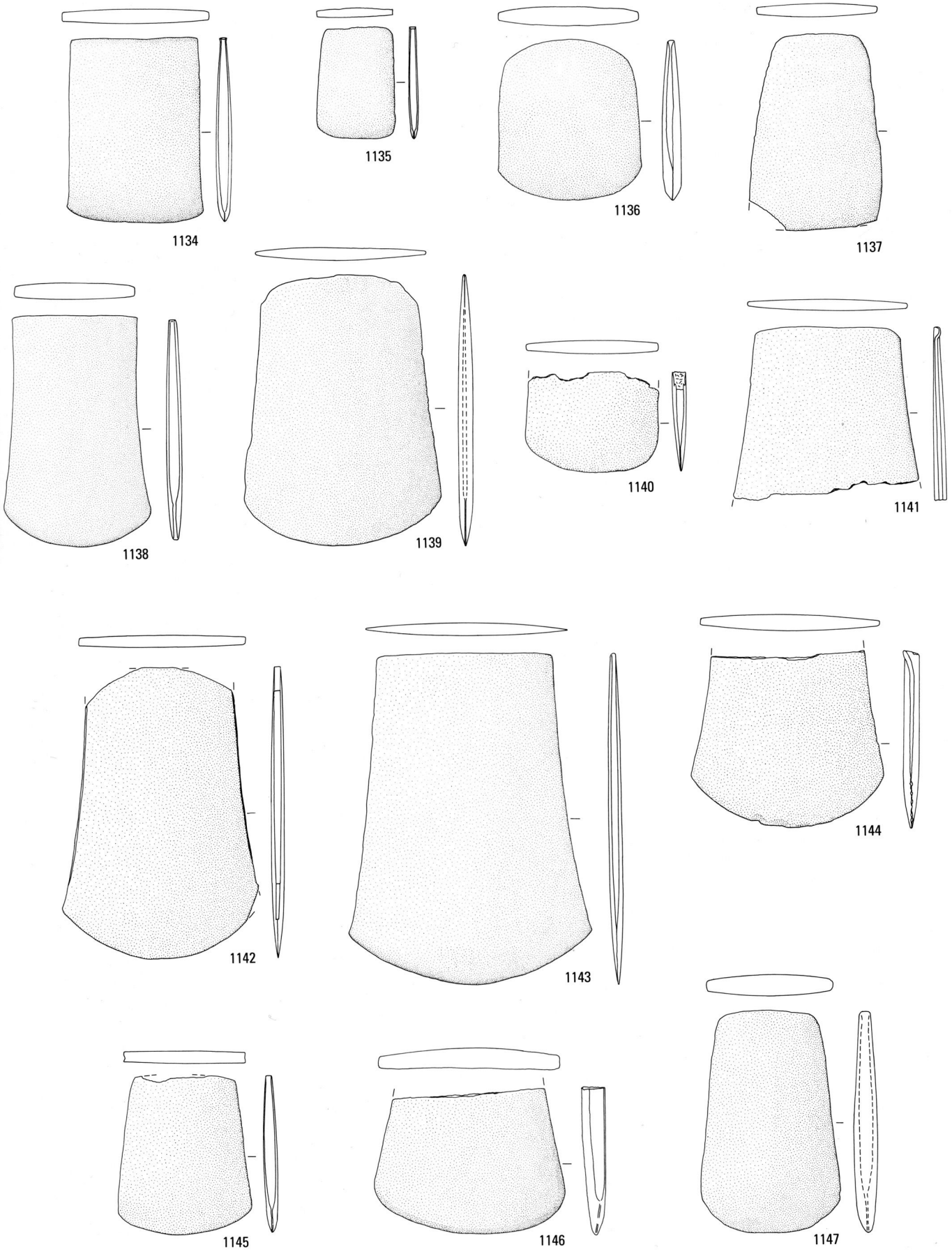


Fig. 12 1134-1147 Shahabad. – Scale 1:3.

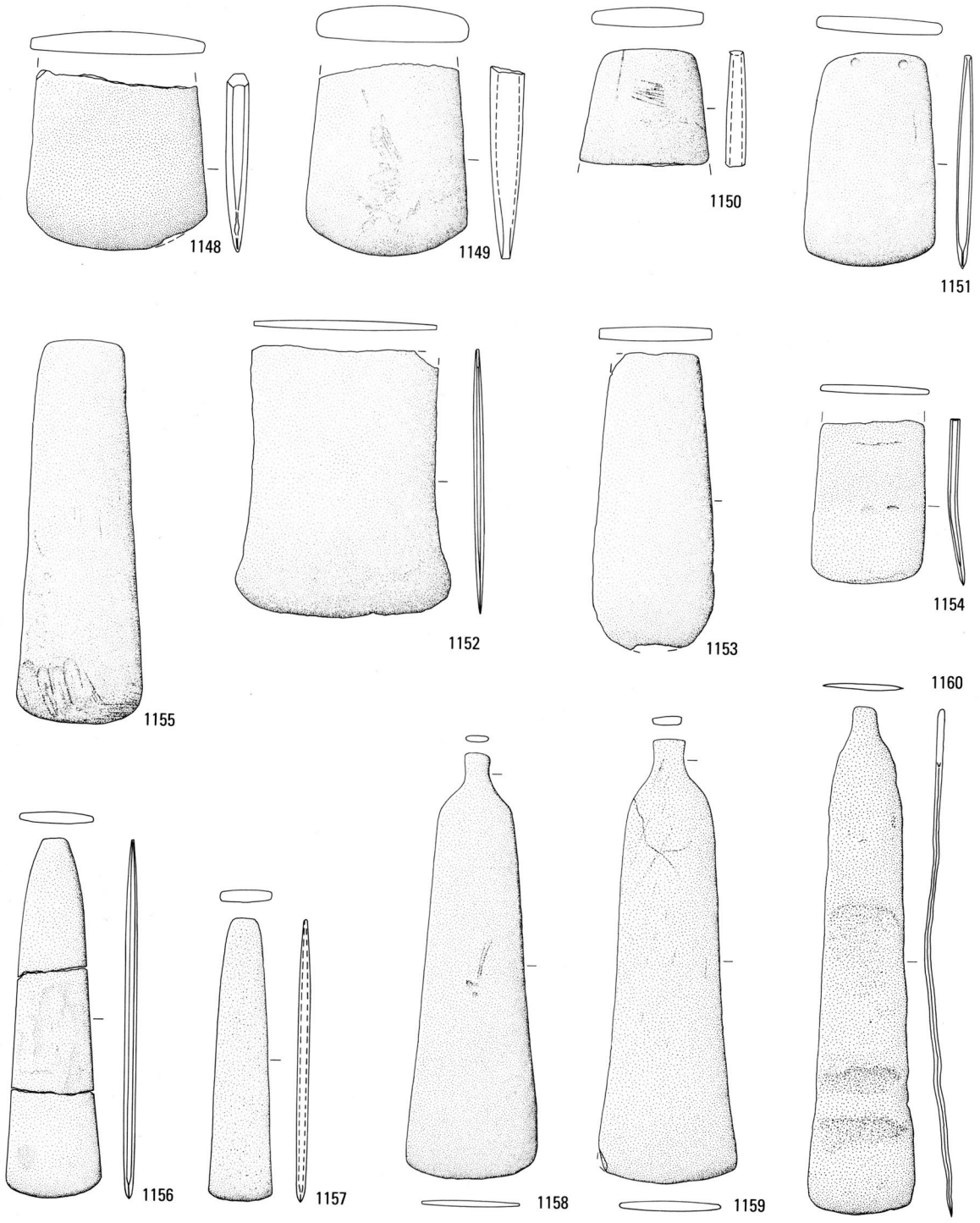


Fig. 13 1148-1160 Shahabad. – Scale 1:3.

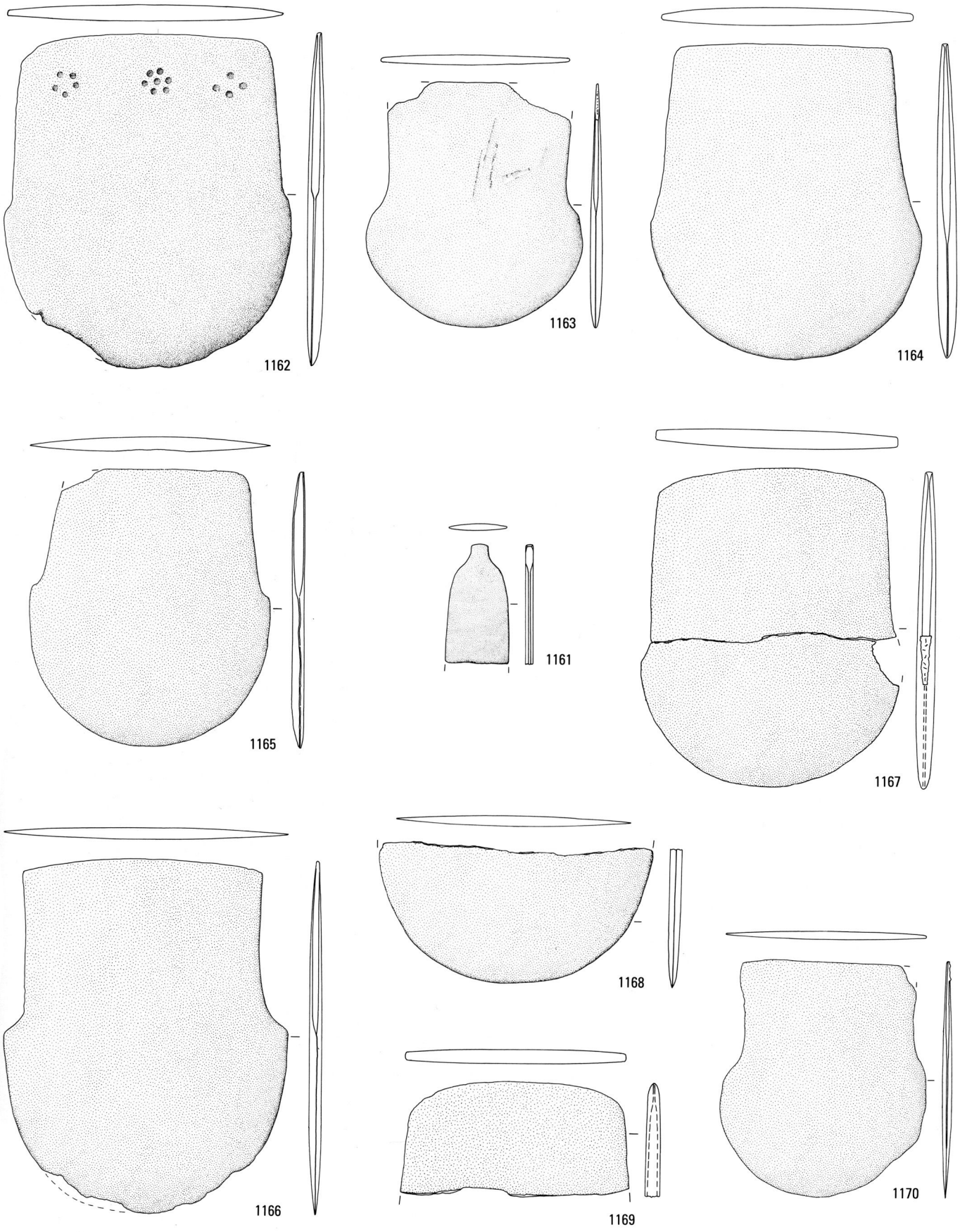


Fig. 14 1161-1170 Shahabad. – Scale 1:3.

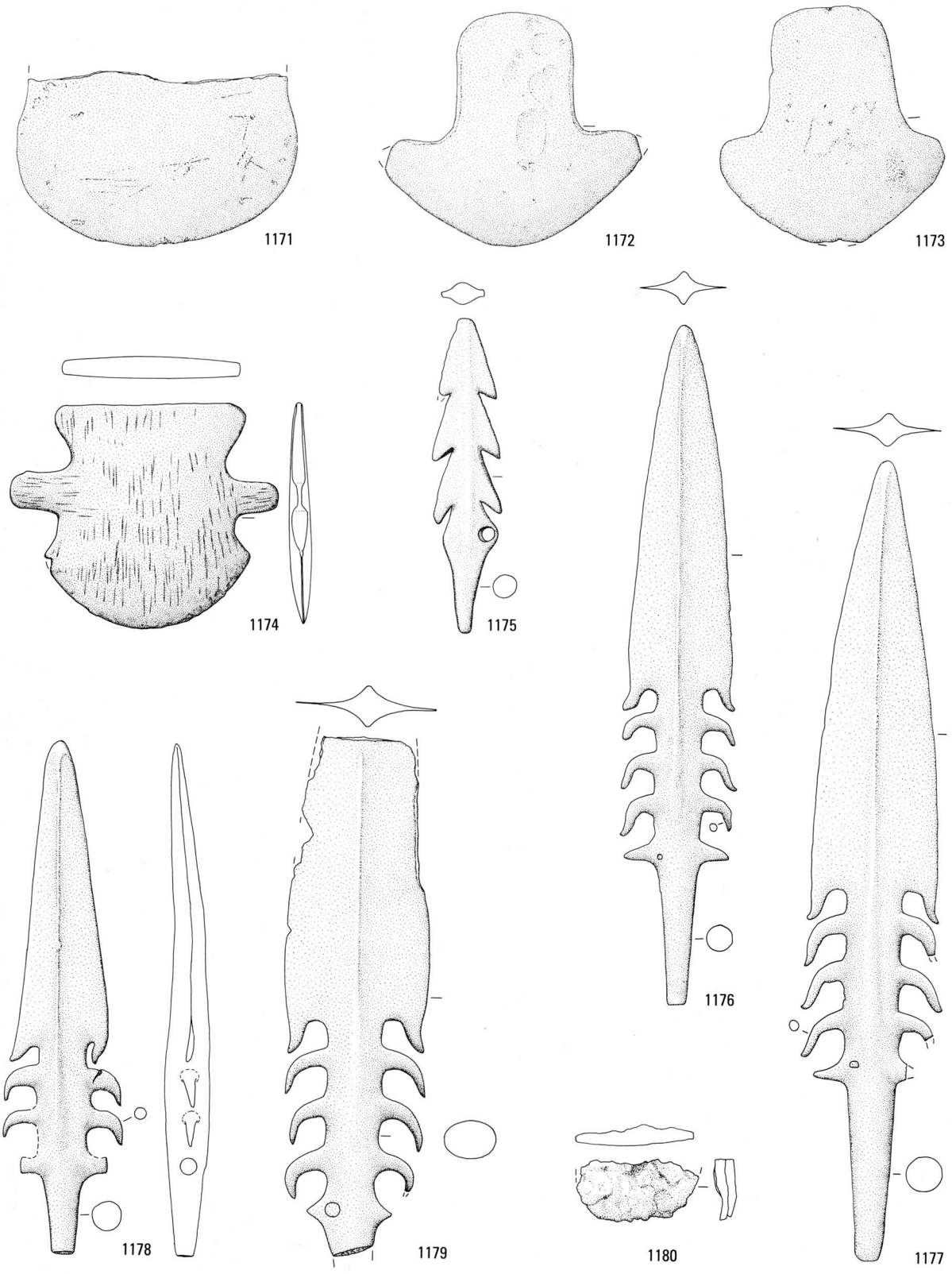


Fig. 15 1171-1180 Shahabad. – Scale 1:3.

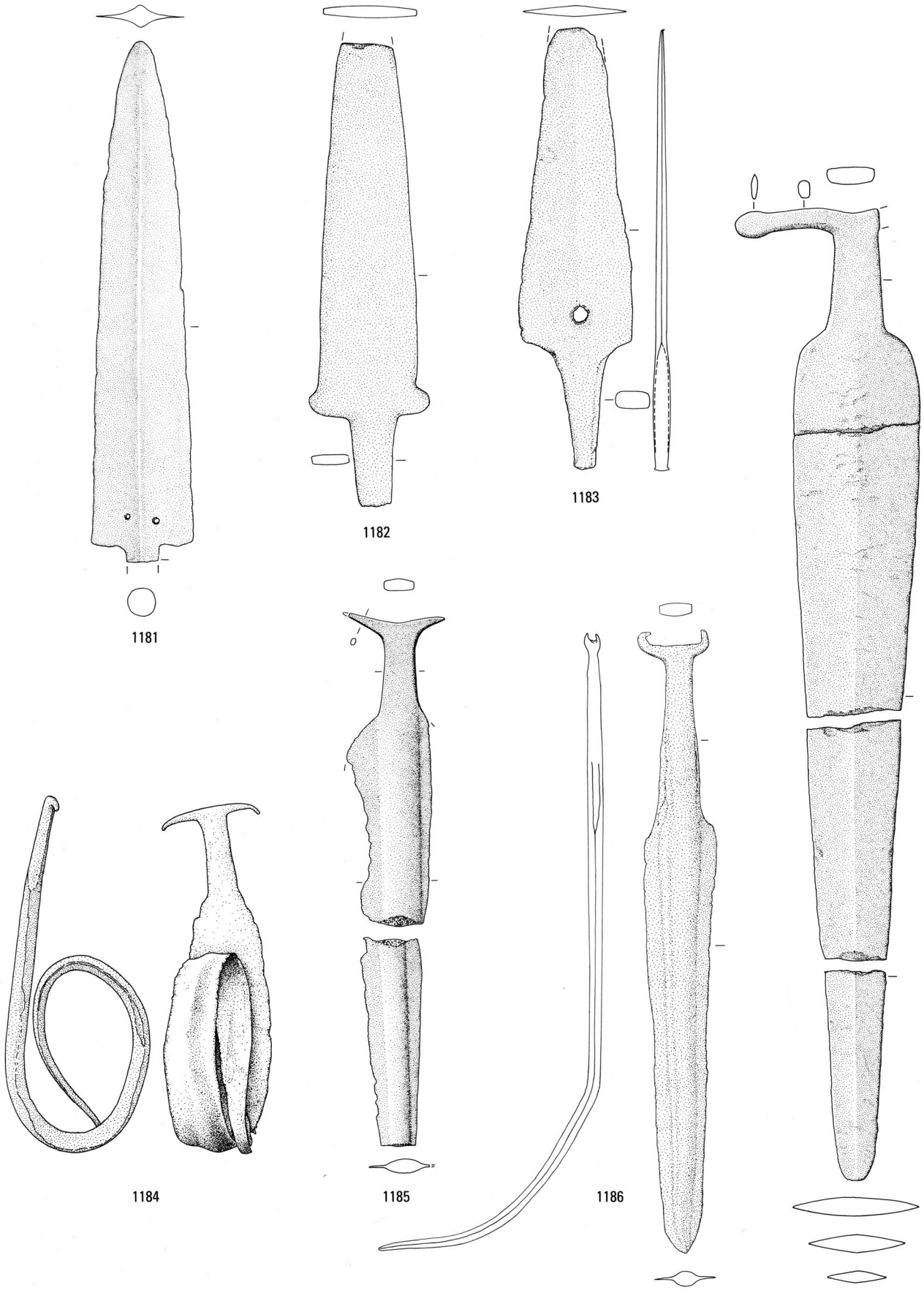


Fig. 16 1181-1187 Shahabad. – Scale 1:3.

Fig. 17 1188-1189 Shahabad. – 1190 Akhuldoba. – 1191-1193 Bemanghati subdivision. – Scale 1:3.

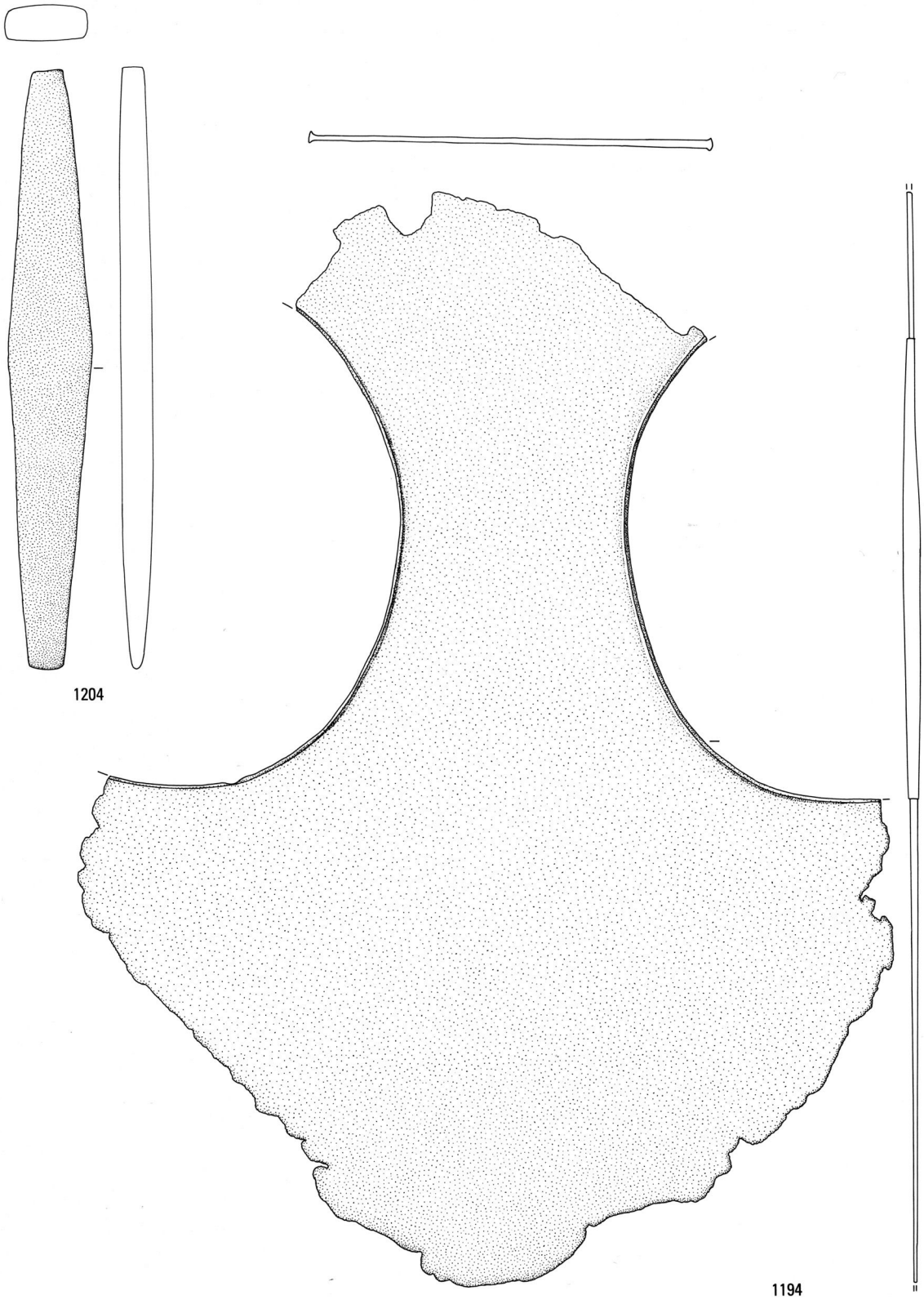


Fig. 18 1194 Bhagada. – 1204 Kesna. – Scale 1:3.

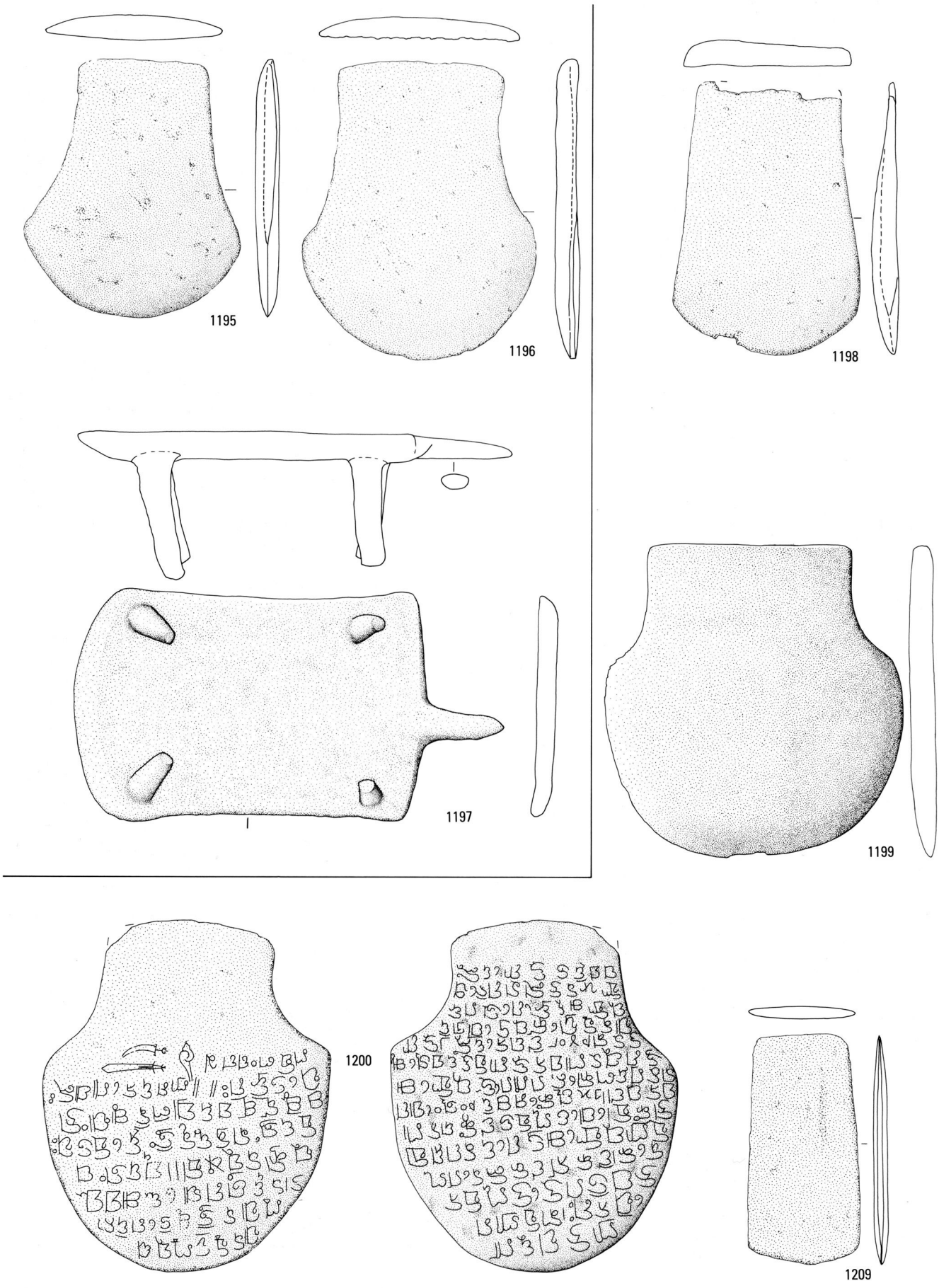


Fig. 19 1195-1197 Dist. Keonjhar, hoard. – 1198 Dist. Ranchi. – 1199 Dist. Santal Parganas. – 1200 Garhpada estate. – 1209 Nankom. – Scale 1:3.

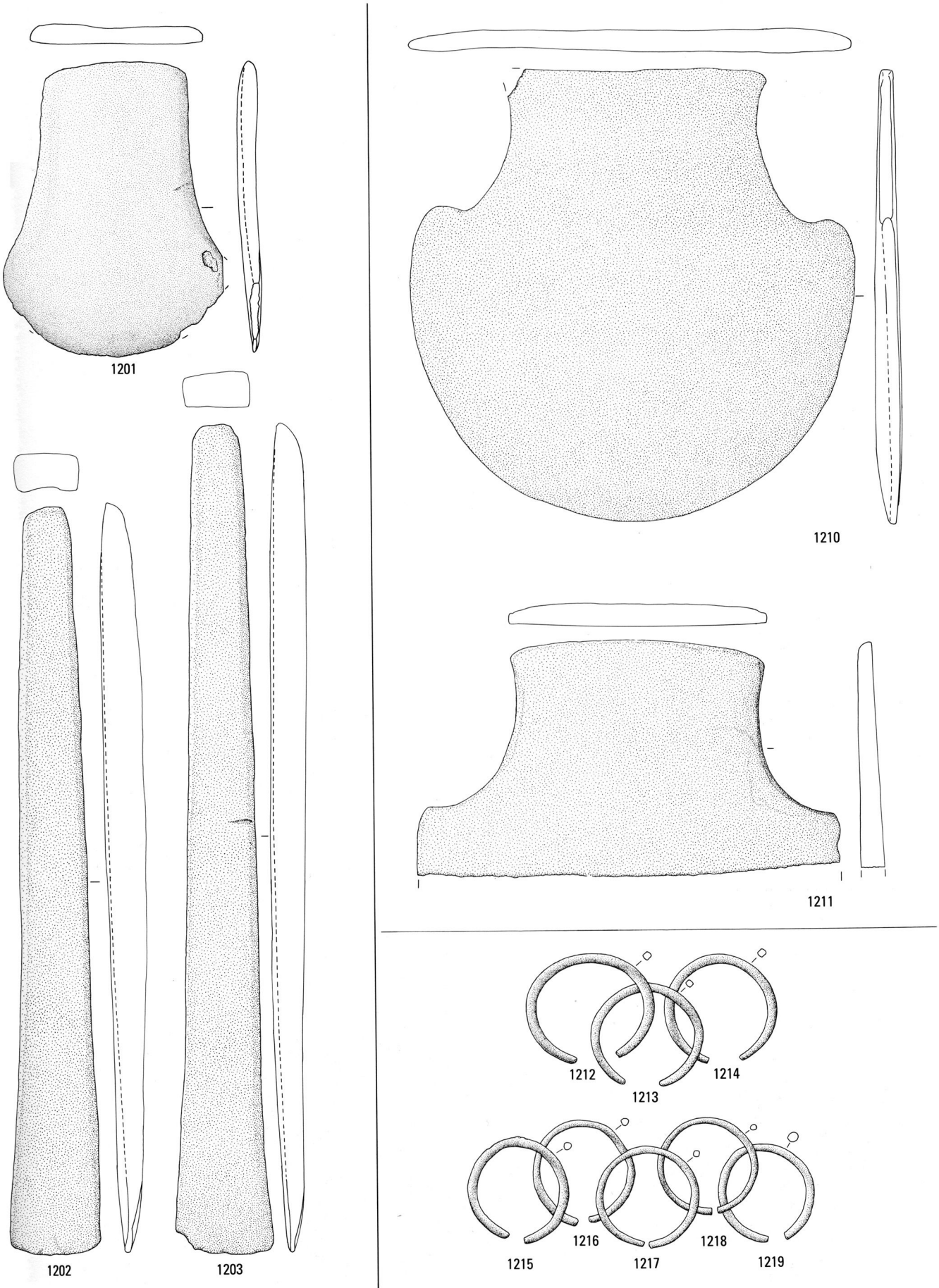


Fig. 20 1201-1203 Hami, hoard. – 1210-1211 Perua. – 1212-1219 Near Sankarjang. – Scale 1:3.

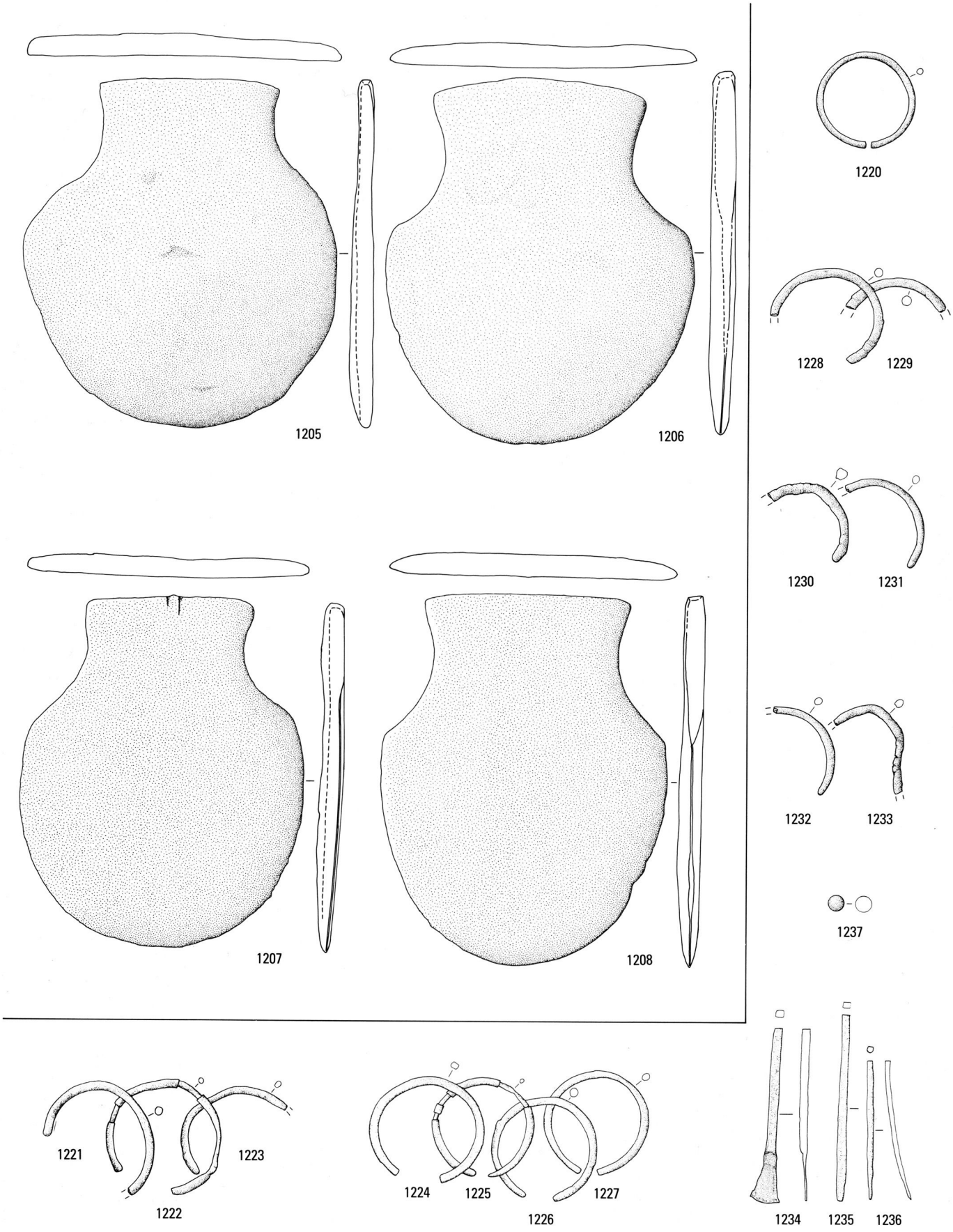


Fig. 21 1205-1208 Ludurapada. – 1220-1236 Near Sankarjang. – 1237 Taradih. – Scale 1:3.

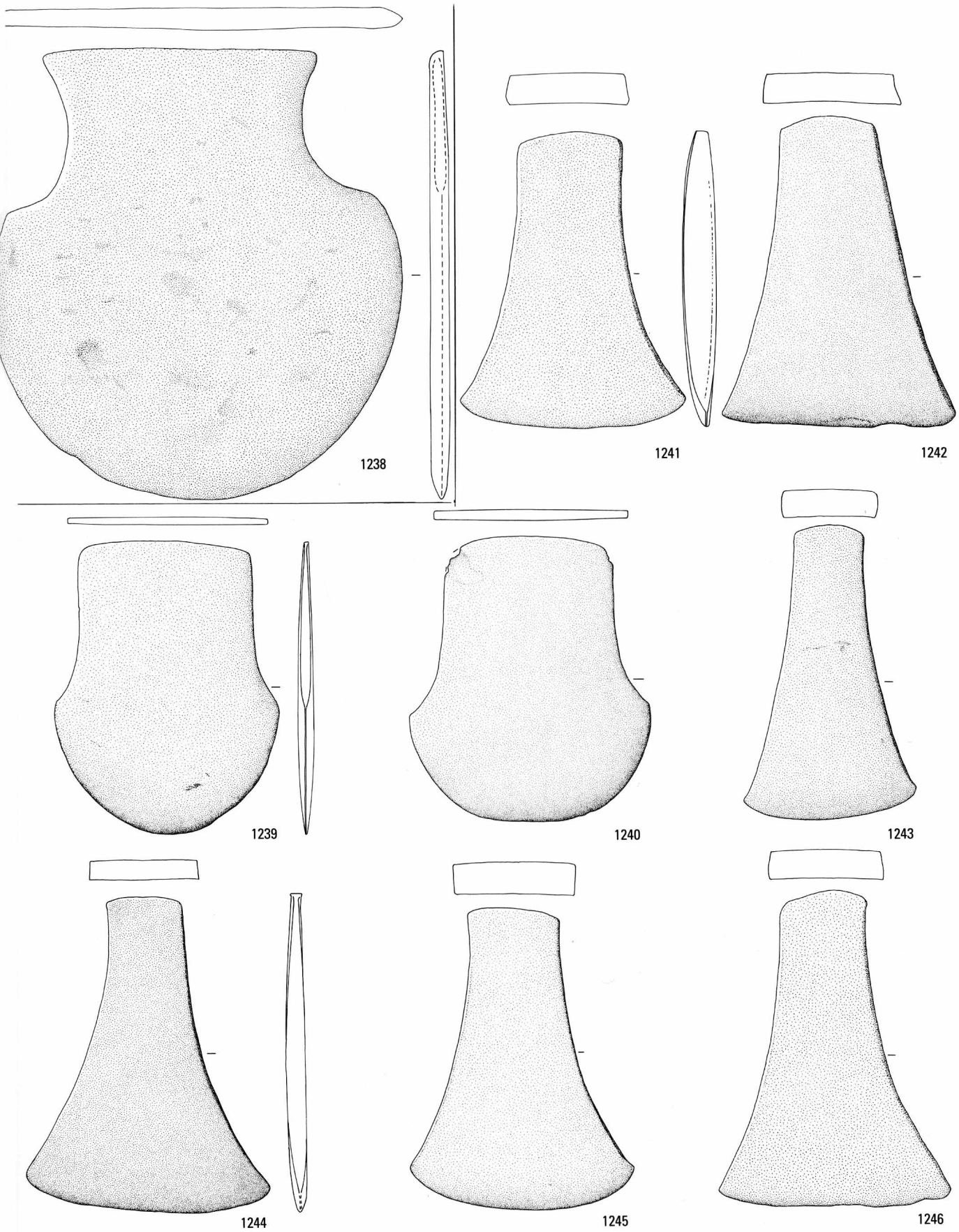


Fig. 22 1238 Viratgarh. – 1239-1246 Ghangharia. – Scale 1:3.

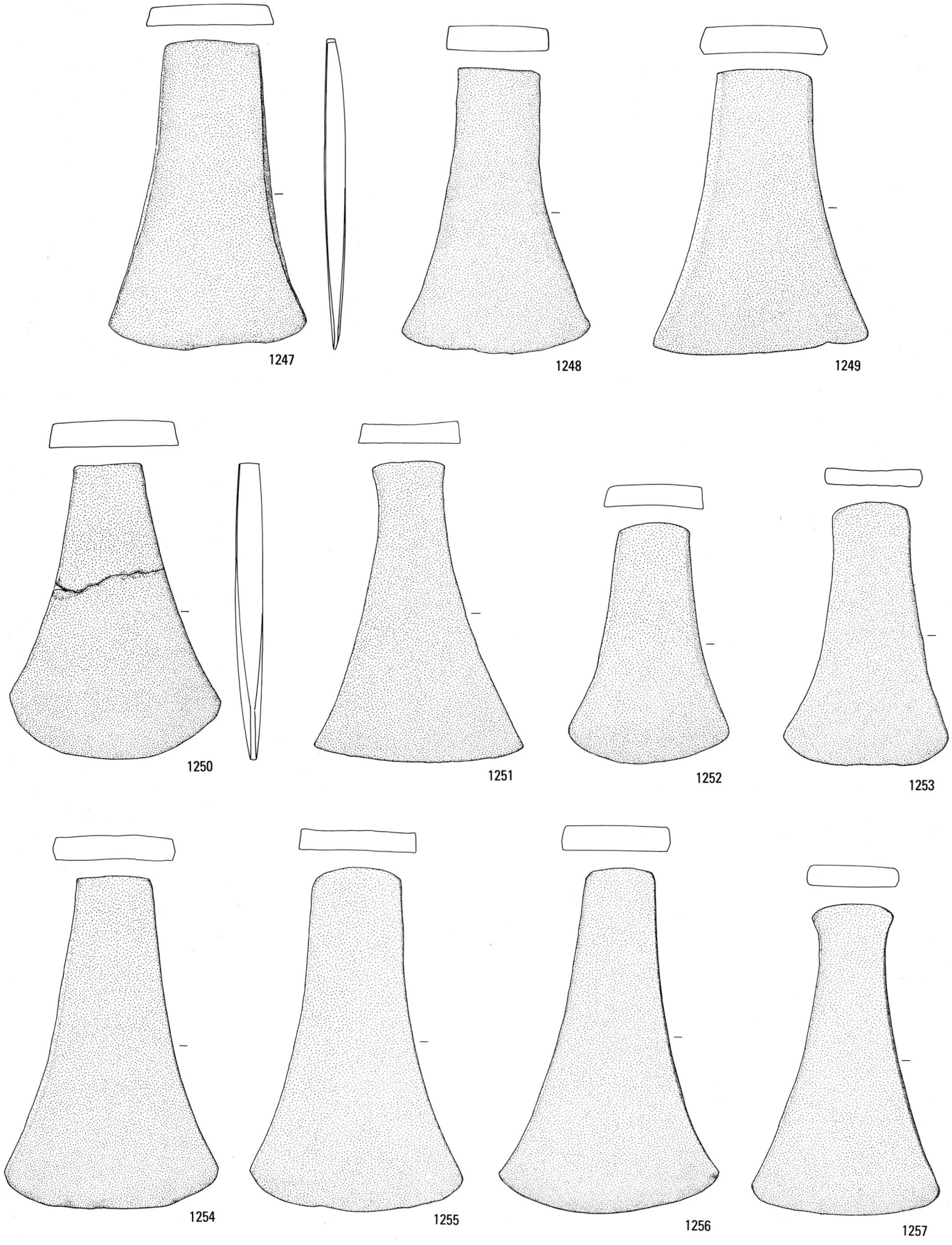


Fig. 23 1247-1257 Ghangharia. – Scale 1:3.

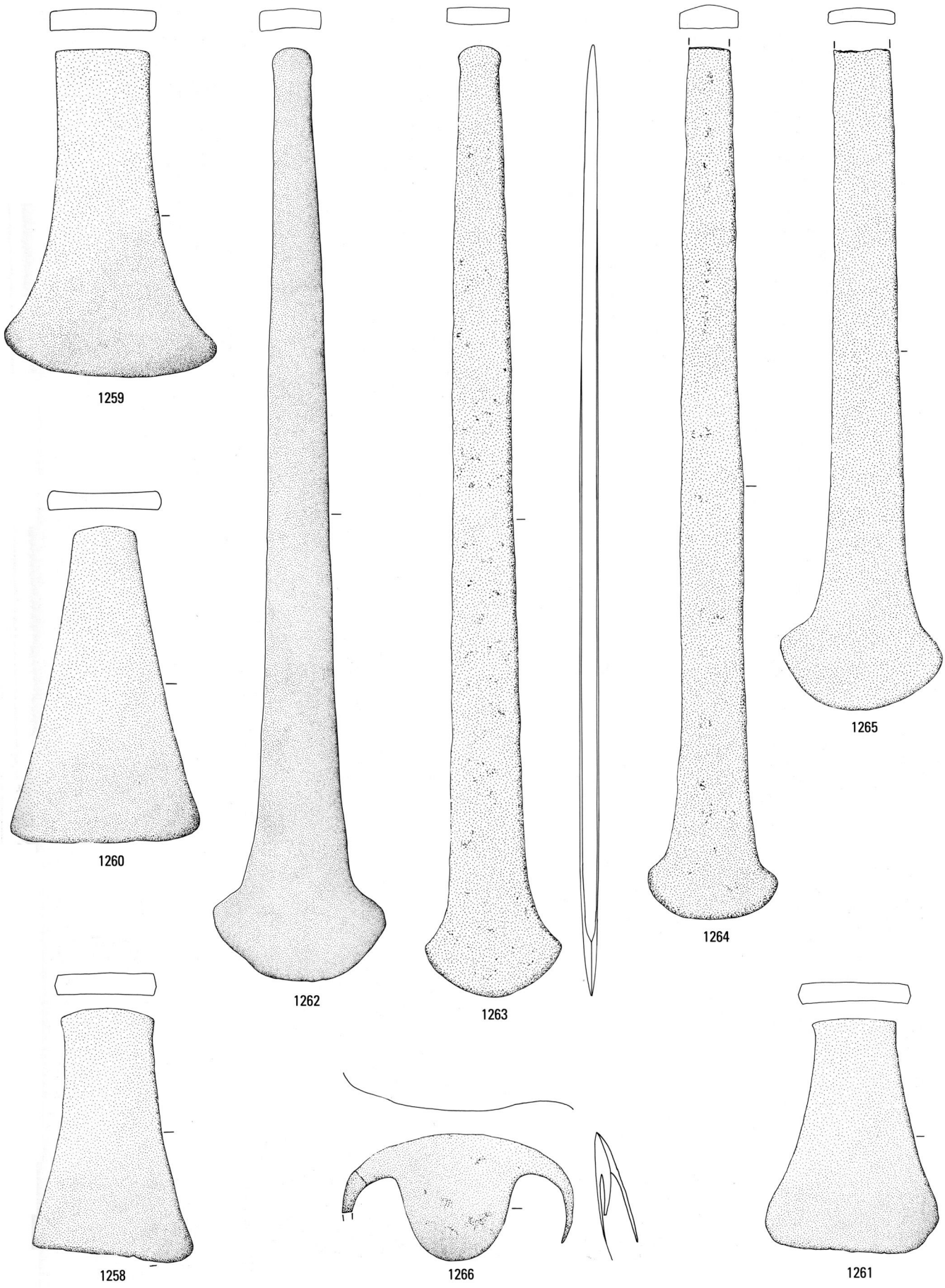


Fig. 24 1258-1266 Ghangharia. – Scale 1:3.

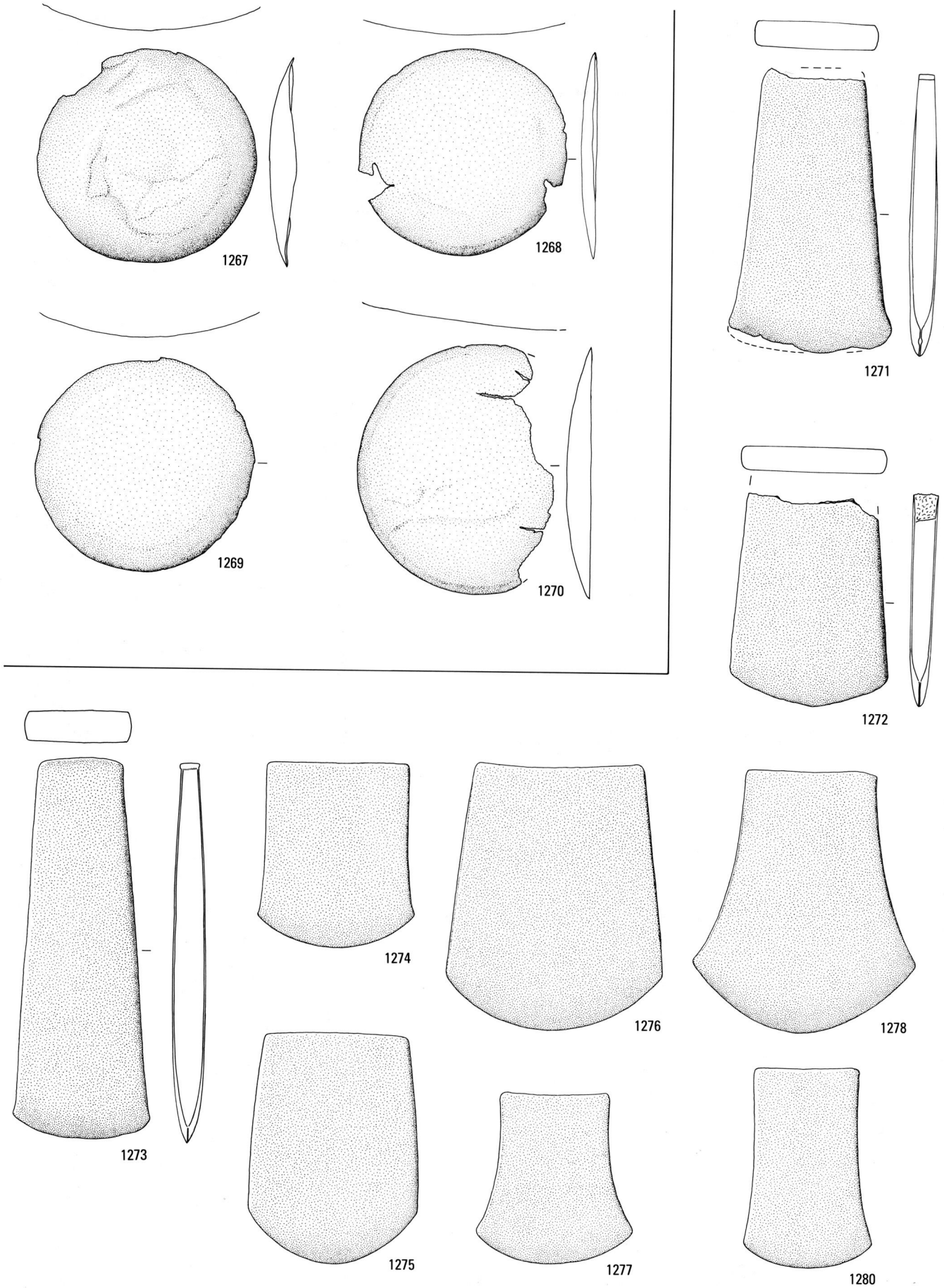


Fig. 25 1267-1270 Ghangharia. – 1271-1273 Kesli. – 1274-1278. 1280 Narsimhapur. – Scale 1:3.

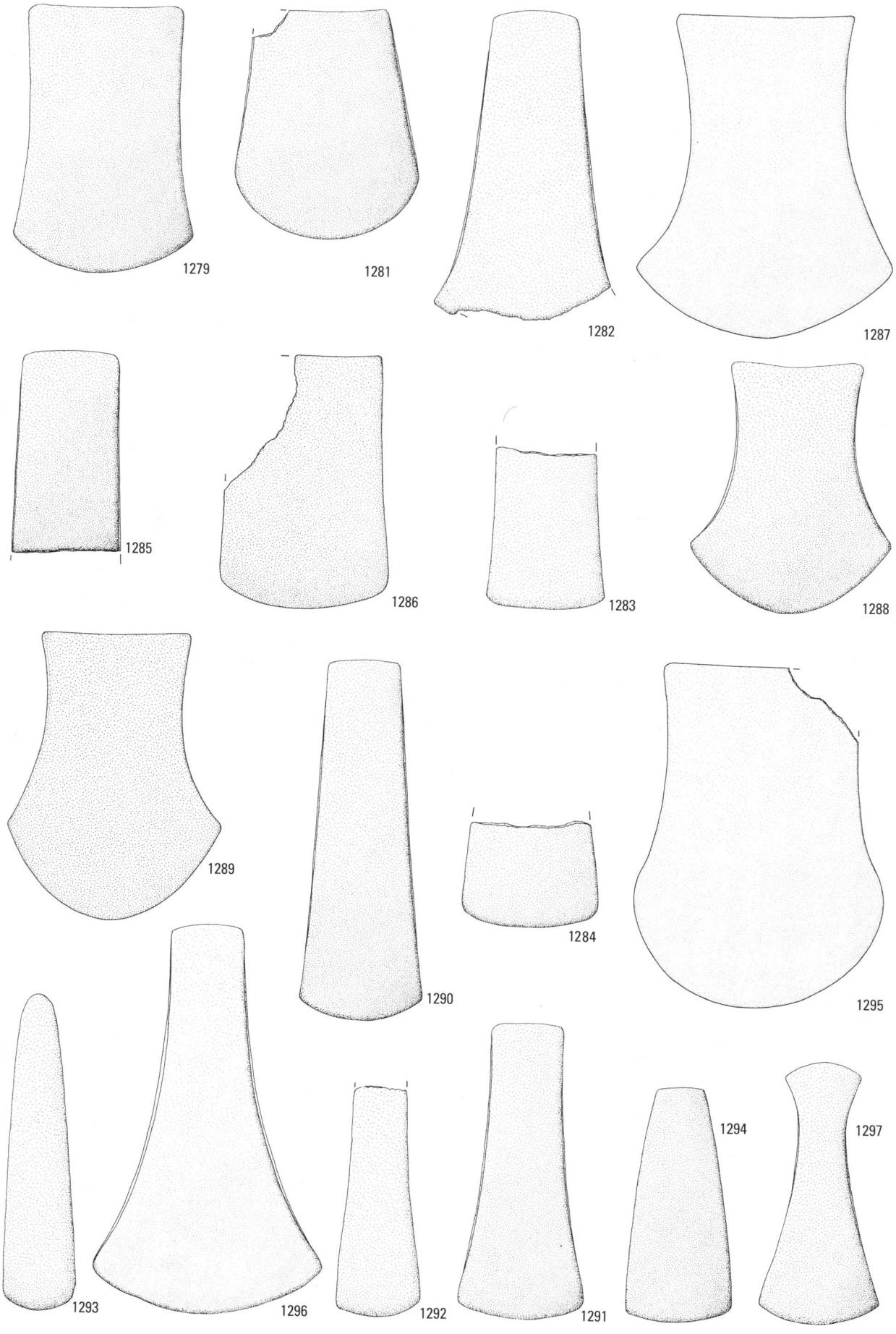


Fig. 26 1279. 1281-1297 Narsimhapur. – Scale 1:3.

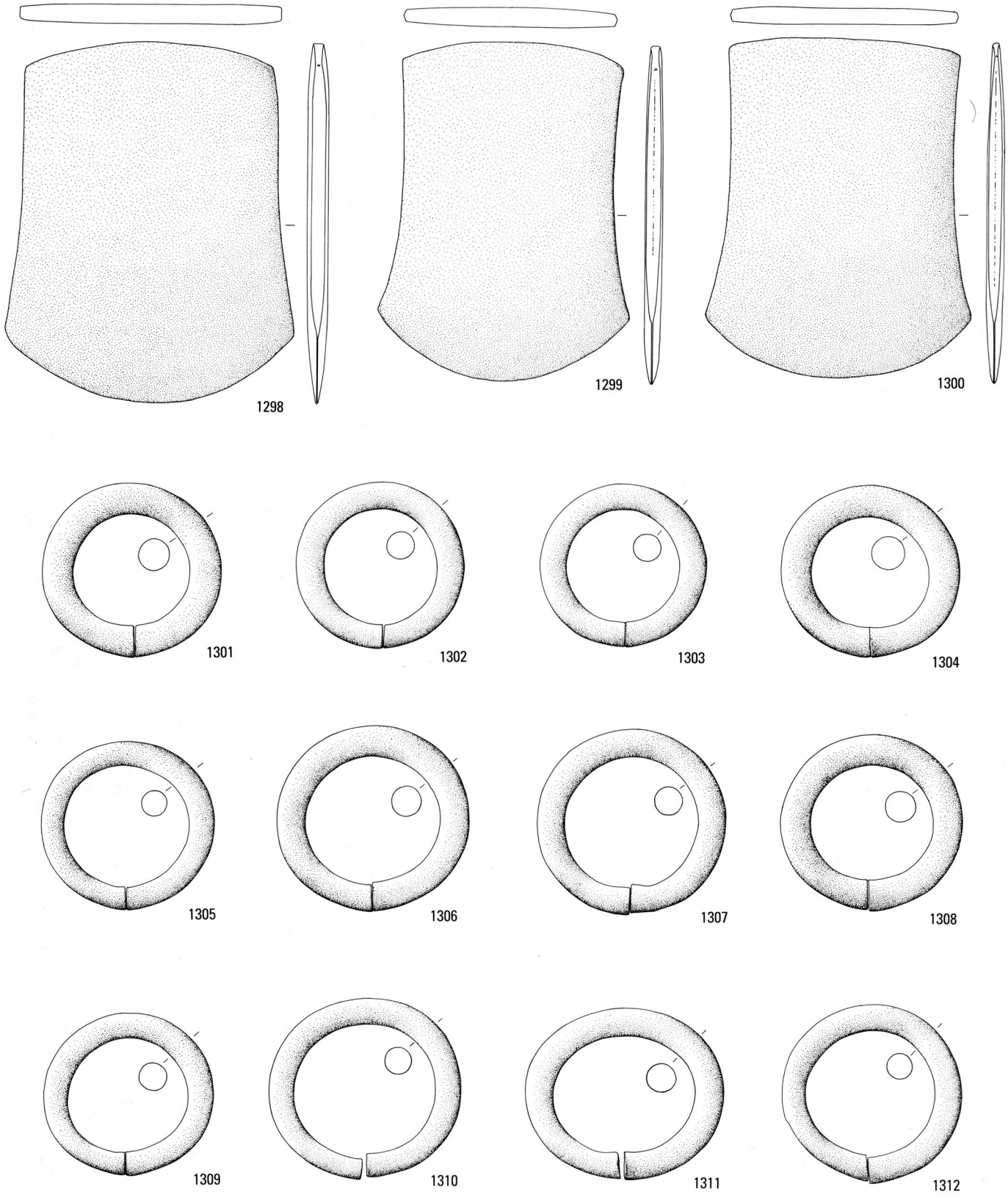


Fig. 27 1298-1312 Pondi. – Scale 1:3.

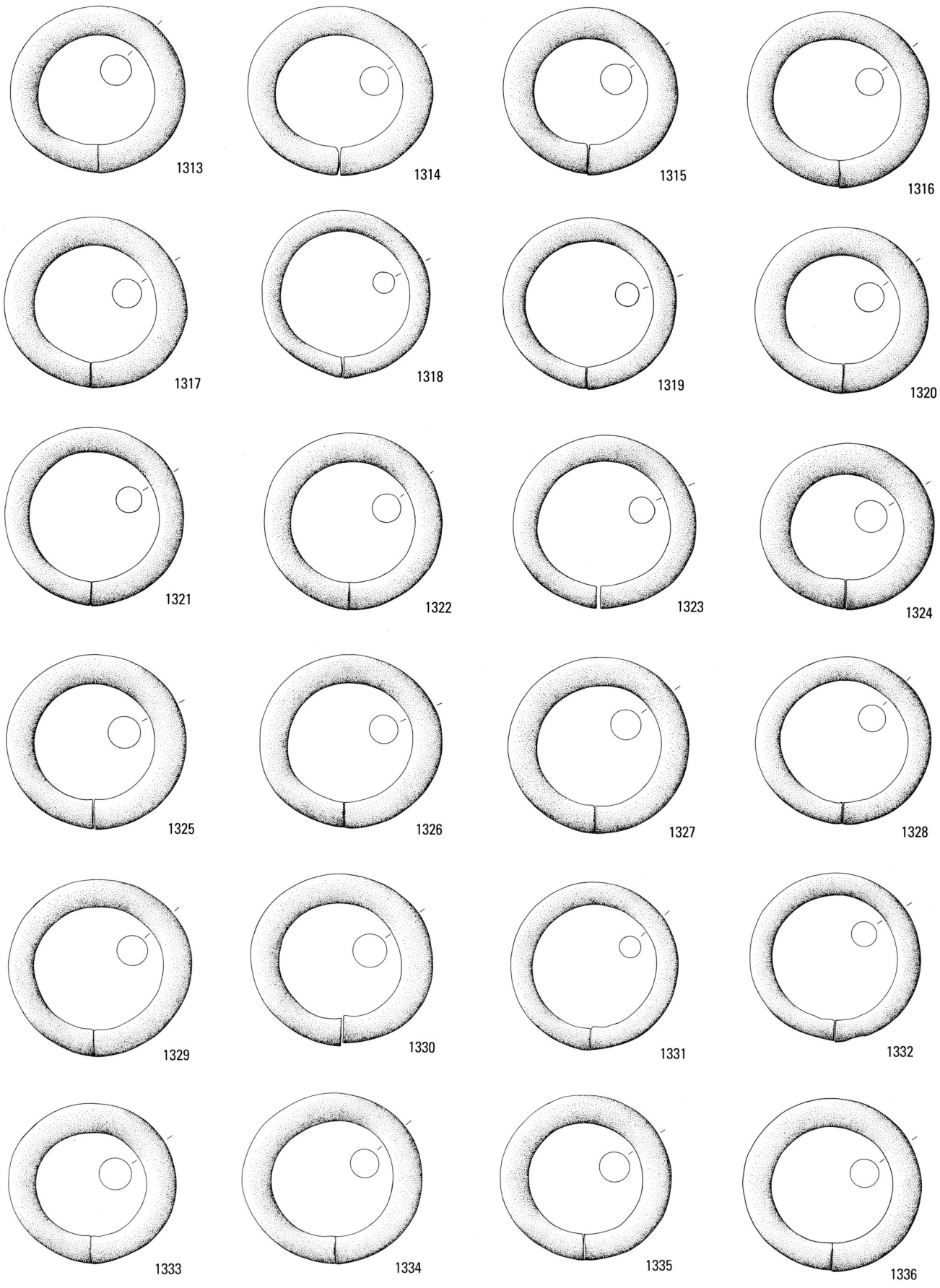


Fig. 28 1313-1336 Pondi. – Scale 1:3.

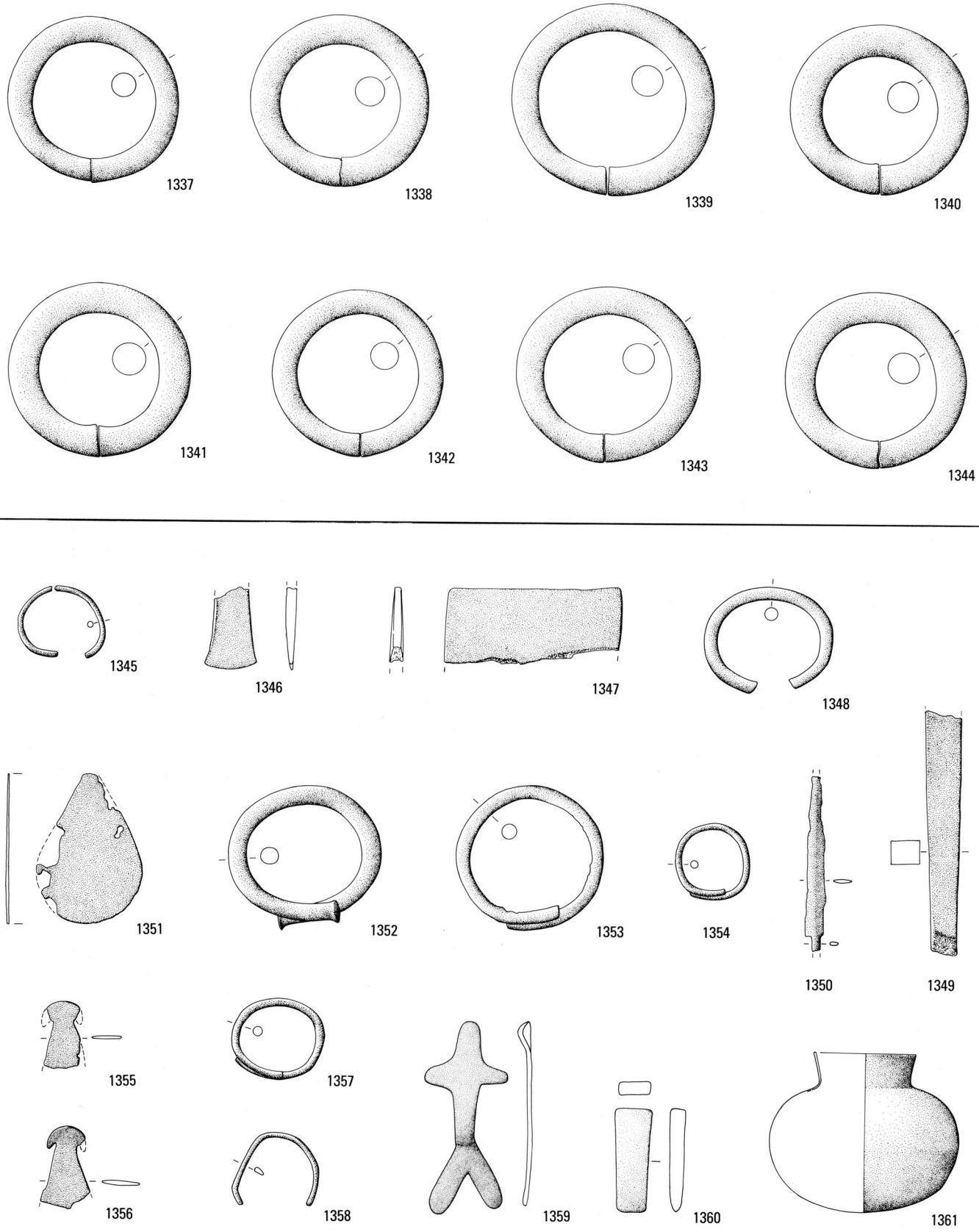


Fig. 29 1337-1344 Pondi. – 1345-1358 Daimabad. – 1359 »Ganges Plain«. – 1360-1361 Shahabad. – Scale 1:3.

APPENDIX 1

CHEMICAL ANALYSES OF PREHISTORIC METAL ARTEFACTS FROM THE INDIAN SUBCONTINENT

by Andreas Hauptmann

From the collection of copper/bronze objects described herein and in 1985[165] all in all 79 were submitted for metallographic and chemical analysis. The principal objective was to establish the types of alloys which the North Indian hoards represent more precisely than the simple visual identification hitherto available. Due to the limited amount of the samples available for our work, metallographic investigations to gain information on production and treatment of the metal were carried out only in isolated instances. Of the above-mentioned samples, a second collection of metal artefacts presented here include 35 items of the hoard found at Ghangharia in the 19th century which consists altogether of 424 copper/bronze implements. The collection located in the Department of Oriental Antiquities in the British Museum comprises 23 flat axes, nine bar chisels and two antennae swords. Yule has suggested that the solid unworked castings of the axes and bar chisels show them to be ingots, i. e., a convenient form to store and transport the raw copper[166].
A few metal artefacts of the Copper Hoard culture have been analyzed by Nautiyal, Agrawal and Krishnamurthy[167] to study the alloying patterns in this and earlier cultures. Their analyses were only partial, however, since they measured only arsenic, tin and nickel in the copper objects. Bhardwaj[168] has discussed early copper-arsenic alloys in India, including the raw materials, extraction of arsenic and production of copper-arsenic alloys and their metallurgical and mechanical properties. Agrawal and his coworkers continued research on the problem of copper and copper based alloys in the Indian Copper Hoard Culture[169]. They also believed that tin bronze first appears in the Harappa-Culture and is somewhat more abundant in the upper levels of Mohenjo Daro. But also here 70% of the tools found were pure copper which suggests the scarcity of tin on the Indian Subcontinent. The practice and extent of deliberate arsenic alloying is a mysterious chapter in the archaeometallurgy also of this region, because the borderline between unalloyed copper and intentionally produced arsenical copper is not at all clear as indicated in the literature of several authors. Altogether it seems not to have been very frequent in the Copper Hoard Culture and artefacts made of »pure« copper prevail.

1. Analytical techniques

The artefacts were sampled by drilling with a steel microdrill, the samples so obtained weighing 10-50 milligrammes. On artefacts that were too thin to be satisfactorily drilled scrapings of metal were taken with a scalpel. In both cases the corroded layers were first removed as far it was possible. The samples were analyzed using atomic absorption spectrometry. Artefacts from the Ghangharia hoard were analyzed in the British Museum Research Laboratory (Table 5) following the guidelines worked out by Hughes and coworkers[170]. They are included in the discussion but are described in detail in Appendix 2 by M. J. Hughes. The items were analyzed in the Institute of Archaeometallurgy of the Deutsches Bergbau-Museum (Table 4) using a standard flame, heated graphite furnace and hydride system. The sulphur

165 Yule, P. 1985.
166 Yule, P. 1985, 72-83, 103.
167 Nautiyal, V./D. P. Agrawal/R. V. Krishnamurthy 1981.
168 Bhardwaj, H. C. 1980.
169 Agrawal, D. P. 1969-70. – *Ibid.* 1971. – *Ibid.*/R.V. Krishnamurthy/S. Kusumgar/L.A. Narain/M.M. Sarin 1974. 170
170 Hughes, M.J./M.R. Cowell/P. Craddock 1976.

	Cat. No.	Provenance	Typ	Cu %	Fe %	Fe ppm	Pb %	Pb ppm	Zn ppm	Ag ppm	Co ppm	Ni %	Ni ppm	%	Sn ppm	As %	As ppm	Sb ppm	Bi ppm	S %
Doab	724	Khera Manpur	Lance head	97.5	–	<250	–	10	<30	29	<30	0.6	–	–	<20	1.7	–	750	60	n.d.
	326	Resgavaon	Axe-ingot V	96.9	–	<250	–	742	<30	30	<30	–	870	–	75	0.2	–	1500	122	0.1
	1118	Bithur	Harpoon I	95.8	0.32	–	–	16	<30	40	<30	–	800	–	<20	1.7	–	31	249	<0.1
	1133	Saipai	Lance head	96.0	0.3	–	1.2	–	<30	70	<30	–	252	–	<20	1.8	–	944	186	n.s.
S. Haryana/N. Rajasthan	540	Hansi	Axe I	75.7	23.6	–	–	40	125	<2	960	0.1	–	–	<20	0.3	–	88	<10	0.2
	577	Rewari	Axe II	92.7	0.5	–	0.2	–	43	150	180	0.1	–	0.55	–	1.9	–	626	178	0.1
	668	Rewari	Axe III a	66.2	32.9	–	–	100	119	5	680	–	591	–	<20	–	530	25	67	n.d.
	681	Hansi	Axe III e	98.9	–	<250	–	195	<30	155	<30	–	<30	–	<20	–	<10	<10	50	0.1
	697	Rewari	Axe IVa	95.8	0.4	–	–	330	<30	118	40	–	408	–	380	2.5	–	718	138	0.1
	714	Bhiwani	Axe IVb	71.8	25.8	–	–	50	112	<2	315	–	470	–	<20	–	270	35	85	0.4
	750	Rewari	Axe IVc	88.0	8.4	–	–	30	139	15	1800	0.1	–	–	56	0.7	–	<10	<10	0.2
	767	Rewari	Axe IVe	93.0	0.5	–	1.2	–	155	479	33	–	455	2.68	–	1.2	–	179	110	0.1
	770	Rewari	Axe IVf	99.4	–	296	–	80	570	19	42	–	74	–	236	–	46	22	<10	0.1
	792	Rewari	Axe VI	98.0	–	<250	–	40	<30	111	22	–	904	–	<20	1.1	–	67	50	0.1
	796	Bhiwani	Axe misc.	76.7	20.6	–	–	50	430	5	165	–	239	–	<20	–	760	25	<10	0.2
	960	Hansi (Narnaond)	Bar	97.5	–	<250	–	30	<30	165	53	0.6	–	–	<20	1.4	–	21	71	n.d.
	1004	Rewari	Chisel	97.6	–	<250	–	<10	<30	300	30	–	877	–	<20	1.1	–	16	50	n.d.
	1019	Mitathal	Harpoon II	95.5	–	<250	0.1	–	<30	83	39	–	550	–	<20	1.9	–	117	127	0.1
	1038	Hansi (Narnaond)	Harpoon III	94.6	–	<250	–	<10	<30	74	44	–	579	–	<20	2.4	–	28	157	0.1
	1048	Rewari	Sword I var.	97.9	–	<250	0.2	–	<30	87	164	–	995	–	<20	0.3	–	467	727	n.s.
	1103	Rewari	Sword III	94.7	0.1	–	2.1	–	<30	57	41	0.2	–	0.1	–	3.2	–	144	79	n.s.
	—	Rewari	Bangle I	95.1	–	650	–	20	<30	82	100	0.2	–	–	<20	4.9	–	25	183	0.1
	—	Rewari	Bangle II	99.0	–	<250	–	30	<30	91	282	0.6	–	–	<20	–	843	<10	<10	0.1
	—	Rewari	Bangle III	88.2	–	<250	–	<10	<30	148	158	0.2	–	–	<20	3.8	–	13	13	0.1
Chota Nagpur and Surroundings	794	Chota Nagpur	Axe VII	98.7	–	350	–	560	<30	113	40	0.1	–	–	<20	0.3	–	66	225	0.1
	828	P. S. Bassia	Axe-ingot I a	98.6	–	<250	–	<10	<30	85	30	0.3	–	–	<20	–	118	10	118	0.1
	834	Dist. Manbhum	Axe-ingot II	96.8	–	<250	–	<10	<30	103	30	–	686	–	<20	–	<10	<10	<10	0.1
	853	Chota Nagpur	Axe-ingot III	93.6	–	<250	1.3	–	<30	482	30	–	89	–	<20	–	556	135	457	0.2
	865	Chota Nagpur	Axe-ingot III	93.5	–	<250	–	<10	<30	21	30	–	195	–	25	0.4	–	<10	143	0.1
	910	Chota Nagpur	Axe-ingot IV	99.7	–	<250	0.1	–	<30	606	30	–	95	–	<20	–	459	<10	184	n.d.
	920	Chota Nagpur	Axe-ingot VI	96.1	0.3	–	–	<10	<30	82	110	0.2	–	–	51	–	155	<10	82	0.2
	994	Chota Nagpur	Bar celt-ing.	99.2	–	<250	–	50	<30	138	30	–	971	–	<20	–	111	<10	83	0.1
	996	Chota Nagpur	Bar celt-ing.	93.9	–	<250	1.8	–	115	784	30	–	62	–	<20	0.9	–	94	572	0.1
	—	Sankarjang	Bangle V	90.6	–	<250	–	220	<30	127	62	0.3	–	–	<20	5.7	–	65	154	0.2
	1190	Akhuldoba	Axe-ingot I b	95.4	–	<250	–	30	<30	62	30	–	877	–	<20	–	556	11	223	0.1
	1191	Bamanghati Subd.	Axe-ingot I a	99.1	–	<250	–	23	<30	132	30	0.2	–	–	<20	–	<10	<10	104	n.s.
	1193	Bamanghati Subd.	Axe-ingot I	98.6	–	<250	–	100	<30	58	30	0.1	–	–	<20	–	243	<10	73	n.d.
	1204	Kesna	Bar	98.5	0.1	–	–	30	<30	82	30	–	456	–	<20	–	60	<10	73	0.1
M.P.	1250	Ghangharia	Axe VII	97.9	–	<250	1.3	–	<30	874	30	–	43	–	<20	–	47	84	1000	n.s.
	1264	Ghangharia	Bar celt	99.2	–	<250	–	50	<30	109	30	0.1	–	–	<20	–	101	<10	99	n.s.
	1272	Kesli	Axe III e	98.8	0.3	–	–	30	34	17	390	–	833	–	68	0.3	–	<10	14	0.1

Table 4 (for the Table caption see next page)

Table 4 AAS Analyses of Prehistoric Indian Metallic Artefacts Ordered by Their Regional Provenance. – n.d. = not detected; n.s. = not sought (insufficient material); detection limits: Zn 0.003%, Pb 0.001%, Ag 2ppm, Sb 0.001%, As 0.001%, Fe 0.025%, Co 0.003%, Ni 0.003%, Sn 0.002%, Bi 0.001%.

Cat. No.	Provenance	Type	Cu %	Fe %	Pb %	Zn %	Ag %	Co %	Ni %	Sn %	As %	Sb %	Bi %
443	Ghangharia	Axe III a	99.4	0.12	0.09	<0.01	0.16	0.01	0.01	0.06	0.02	0.02	0.02
444	Ghangharia	Axe IV d	98.0	0.13	0.08	<0.01	<0.01	0.01	0.02	0.08	0.01	<0.03	0.01
445	Ghangharia	Axe IV f	98.9	0.49	0.01	<0.10	0.08	0.01	0.05	0.06	<0.01	<0.03	0.01
447	Ghangharia	Axe Va	98.2	0.89	0.13	<0.01	0.05	0.01	0.15	0.07	0.27	0.03	0.02
448	Ghangharia	Axe Va	97.4	0.31	0.07	<0.01	0.06	0.01	0.05	0.06	0.06	0.03	0.01
449	Ghangharia	Axe Va	95.4	0.34	0.11	<0.01	0.10	0.01	0.05	0.24	0.26	0.03	0.02
450	Ghangharia	Axe Va	97.9	0.31	0.27	<0.01	0.04	0.01	0.06	0.09	0.43	0.03	0.02
456	Ghangharia	Axe VII	94.6	0.04	3.11	<0.01	0.08	0.01	0.01	0.18	<0.01	0.05	0.06
457	Ghangharia	Axe VII	95.9	0.44	2.24	<0.01	0.08	0.01	0.05	0.16	<0.01	0.02	0.02
458	Ghangharia	Axe VII	96.5	0.28	2.58	<0.01	0.13	0.01	0.03	0.16	<0.01	0.05	0.09
459	Ghangharia	Axe VII	96.9	0.58	1.42	<0.01	0.12	0.01	0.06	0.18	<0.01	0.02	0.13
460	Ghangharia	Axe VII	96.7	0.04	0.36	<0.01	0.11	0.01	0.01	0.18	<0.01	0.03	0.24
461	Ghangharia	Axe VII	97.3	0.18	1.10	<0.02	0.14	0.01	0.01	0.28	<0.01	0.02	0.05
462	Ghangharia	Axe VII	97.1	0.18	1.15	<0.01	0.10	0.01	0.01	0.07	<0.01	<0.03	0.03
463	Ghangharia	Axe VII	98.0	0.16	1.71	<0.01	0.16	0.01	0.01	0.07	0.07	<0.03	0.01
464	Ghangharia	Axe VII	96.2	0.25	1.66	<0.01	<0.01	0.01	0.02	0.19	0.02	0.03	0.17
465	Ghangharia	Axe VII	96.9	0.24	1.71	<0.01	0.23	0.01	0.02	0.13	0.01	0.02	0.03
480	Ghangharia	Axe VII	98.7	0.37	0.44	<0.01	0.22	0.01	0.04	0.07	<0.01	0.03	0.03
481	Ghangharia	Axe-ingot IV	98.7	0.09	0.47	< 0.10	0.34	0.01	0.05	0.06	<0.01	0.03	0.04
482	Ghangharia	Axe-ingot IV	99.0	0.19	0.37	<0.01	0.10	0.01	0.02	0.07	<0.01	<0.03	0.03
483	Ghangharia	Axe-ingot IV	98.2	0.73	0.55	<0.01	0.16	0.01	0.10	0.11	0.52	0.03	0.04
484	Ghangharia	Axe-ingot IV	96.9	0.99	1.44	<0.01	0.17	0.01	0.12	0.02	0.01	0.02	0.06
485	Ghangharia	Axe-ingot IV	99.9	0.28	0.02	<0.01	<0.01	0.01	0.09	0.04	0.01	0.02	0.02
490	Ghangharia	Bar celt	96.5	0.25	0.09	<0.01	0.05	0.01	0.08	0.17	0.08	0.03	0.02
491	Ghangharia	Bar celt	97.0	0.12	0.94	<0.01	0.10	0.01	0.02	0.17	0.10	0.08	0.05
492	Ghangharia	Bar celt	98.0	0.24	0.17	<0.02	0.04	0.01	0.07	0.15	0.66	0.02	0.02
493	Ghangharia	Bar celt	98.0	0.05	<0.01	<0.01	0.06	0.01	0.10	0.14	<0.01	0.03	0.02
494	Ghangharia	Bar celt	97.6	0.20	0.01	<0.02	0.06	0.01	0.04	0.16	0.01	0.02	0.01
495	Ghangharia	Bar celt	98.3	0.23	0.42	<0.01	0.10	0.01	0.04	0.16	0.01	0.03	0.02
496	Ghangharia	Bar celt	97.1	0.31	0.85	<0.01	0.10	0.01	0.04	0.16	<0.01	0.03	0.05
497	Ghangharia	Bar celt	97.1	0.18	0.35	<0.01	0.04	0.01	0.05	0.18	1.15	0.08	0.04
498	Ghangharia	Bar celt	69.4	24.87	0.04	<0.01	0.03	0.10	0.46	0.27	0.81	0.03	0.02
498	Ghangharia	Bar celt	66.9	28.10	0.04	<0.01	0.11	0.11	0.40	n.d.	0.73	n.d.	0.03
713	Kosam	Axe IVa var.	96.4	1.34	0.04	<0.01	0.01	0.01	0.04	0.12	1.19	0.12	0.01
1042	prov. unknown	Lance head	98.7	0.86	0.96	<0.01	0.02	0.01	0.07	0.08	0.34	0.05	0.02
1044	prov. unknown	Sword I	97.7	0.32	0.38	<0.01	0.02	0.01	0.06	0.10	0.24	0.03	0.02
1051	prov. unknwon	Sword II	87.7	0.26	<0.01	<0.01	<0.01	0.01	0.04	0.28	0.05	0.64	0.01

Table 5 AAS Analyses of Prehistoric Indian Metallic Artefacts in the British Museum gold and cadmium lay below the detection limits in all cases. – A dash in the table indicates that the element was looked for but not found; detection limits are approximately: zinc 0.005%, lead 0.01%, silver 0.01%, antimony 0.03%, gold 0.05%, arsenic 0.02% and cadmium 0.005%.

content was determined colometrically at 1400°C adding borax for fluxing. From the cuttings of three samples polished sections were made to study microscopically the structure of the metal.

2. Discussion of the results

a. Copper artefacts Most of the objects contain very little tin (Ghangharia hoard 0.02 to 0.27%, the other items mostly lower than 0.002%), so none can be described as tin bronzes. Only two samples from Rewari show remarkably high tin values reaching up to 2.68% (no. 577, axe: 0.55%; no. 767, axe: 2.68%). In these samples also noteworthy are relatively high lead and silver contents (0.21-2.06% Pb, 150-480 ppm Ag). Without any knowledge of the type of ore deposits from which the metal of these artefacts was smelted, we suppose that a certain amount of stannite (Cu_2FeSnS_2) was included in the charge. This ore occurs rarely together with other sulphidic copper ores, galena and silver ores in hydrothermal veins. It may have caused the unusual high tin content, and may be a hint for the use of ores from this kind of ore deposit rather than a deliberate addition of tin to produce an alloy as it is shown for a part of the Harappan artefacts allegedly and in upper levels Mohenjo Daro.
A group of flat axes from Ghangharia (Table 5, nos. 456-459) also contain over 2% lead, but without any correlation to higher tin contents. The addition of this metal to liquid copper increases the fluidity of the alloy and drops the smelting point. However, the relatively low values exclude a deliberate addition of lead and points to an impurity of the ore.
The amount of arsenic is generally so low as to be regarded as a common impurity in the copper. Only few artefacts with an arsenic content of more than ca. 1.5-2% perhaps could be considered as examples of deliberate alloying. The arsenic content in the objects is shown in Figs. 4 and 5. However, the border- line between impure copper and a copper-arsenic alloy not only is the central problem in understanding the composition of artefacts from copper hoards in India, but also represents a crucial point of discussion in archaeometallurgy. Recent investigations on copper ores, raw copper and artefacts from ancient smelters in Western Asia[171] shed light on this problem, and reveal an unmistakeable enrichment of arsenic from the ore to the copper on the order of factor 10 or more. This enrichment is not perfectly understood, and contrasts with the believed volatility of arsenic dioxide during smelting which has been stressed in previous discussions of this problem. Without doubt the discovery of arsenic enrichment is an important contribution in solving the problem of the origin of arsenic-copper alloys, but the solution can only be found with further analytical work on the copper ores themselves. Five artefacts with an arsenic content of 3-5% (Table 4, nos. 1038, sword; 1103, sword; two bangle fragments without a number from Rewari, a bangle fragment without a number from Sankarjang) could be deliberately produced alloys, whereby the metal was added to the copper to increase the hardness and which changes the colour of the metal from reddish to reddish-silver. From the materials science point of view arsenic-copper is especially suitable for smithing. As opposed to tin bronze which is used mainly for casting, arsenic-copper may be reheated several times in a smithing hearth without changing its properties. It is noteworthy and also readily understandable that the only artefacts examined here which most likely are of an intentionally produced alloy," are bangles. In contrast to these finished products, bar celt-ingots and axe-ingots represent copper ingots. Bangles apparently contain alloys in order to enhance their appearance.
The nickel content of all of the samples generally is low (< 0.003-0.6%), and does not exceed the level of natural impurities in the ore. The values scatter over a considerable range and are not usable as a key element for any provenance discussion as has been proposed by several authors in the past.

[171] Leese, M.N./P.T. Craddock/I.C. Freestone 1985/86. – A. Hauptmann/G. Weisgerber/H.G. Bachmann 1988. – M. Wuttmann 1986.

All other elements which form M and M-S type alloys of copper (Ag, Zn, Sb, Bi, Co) are very low and do not exceed the level of natural impurities. An exception is iron which will be discussed below. Noteworthy is a slight tendency of zinc enrichment depending on the iron content. Due to its position in the sequence of reduction/oxidation next to iron Zn shows a similar chemophysical behavior during the smelting process, and the Zn content in the metal also may be heavily influenced by the redox conditions (i.e. the CO/CO_2 ratio) in the furnace. The sulphur content of the samples analysed in the laboratory of the Institute of Archaeometallurgy were intended to yield information on the type of ore used for smelting, i.e. oxidic or sulphidic ore. This aim is connected with some problems. We have to start from the reasoned assumption that both oxidic and sulphidic ores were used together already in very early periods of metallurgy. Due to the fact that in most deposits a transitional zone exists between both types of ore, often it is impossible to unequivocally draw a definite borderline between them. Furthermore, during casting (under oxidizing conditions) the cop- per will be refined and the sulphur decreased by the factor 10-100 times because of its oxidation to sulphur-dioxide. Knowing the shape and size of raw copper produced in ancient smelting furnaces on the strength of the field evidence and many experiments as well, we therefore should assume a repeated casting to reach a standard, reproducible volume for the axe-ingots. Notwithstanding these points it is useful to consider here for purposes of discussion the proposal of Rapp[172]. Based upon statistical calculations including several trace elements and sulphur, he suggests a cut-off between high-sulphur and low-sulphur metal at 0.1% as an indicator between sulphidic or oxidic ore sources. Following this suggestion, amongst the analyzed samples (35) most should come from an oxidic ore source (25), and only 10 would have been smelted of sulfidic ore.

b. High iron objects

Six artefacts have a most unusual composition: They consist of highly ferruginous copper with 20-33% Fe, in one case 8% Fe. These artefacts (nos. 540, 668, 714, 750, 796) are axe-ingots from South Haryana and a bar celt from the Ghangharia hoard (no. 498). As yet no »finished« artefacts (e.g. bangles or tools) contain high concentrations of iron. To study the metallography of this type of alloy three polished sections were made from the axe ingots nos. 540, 668, 796. The iron content results from globules of alpha-iron suspended in a matrix of low iron-containing copper. Observed in the case of no. 668 were also tiny inclusions of copper-iron-sulphides with a composition between chalcopyrite ($CuFeS_2$) and bornite (Cu_5FeS_4). To check the distribution of the metallic copper the bar chisel was taken as an example. A small magnet was found to be attracted to the object with apparently equal force over the whole surface area of the chisel, i.e. the iron appeared to be present throughout the chisel's length. Only a few copper artefacts previously have been found by analysis to contain substantial proportions of iron. Hegde[173] found regularly ferruginous copper in Indian coins from the seventh century A.D. Over 20% iron was dissolved in some of them. Similar highly ferruginous copper ingots, six *»ramo secco«* bars, were recorded from a 7th to 3rd century BC context in Italy by Burnett et al.[174]. These distinguish themselves as the highest iron contents ever recorded in a series of ancient artefacts. Craddock and Meeks[175] in a very comprehensive study discussed the method of manufacture, microstructure and uses of such copper-iron alloys in antiquity. They conclude that these alloys were deliberately produced by charging copper ore with excessive amounts of iron ore oxide which normally is introduced as a fluxing agent, but in this case is added as a source of iron for the alloy. The furnace was driven under strongly reducing conditions by means of an overly-heavy charge of charcoal. The copper-iron alloy was tapped directly from the furnace. The authors believe that the high iron content was intended to maximize the weight of the metal obtained, even though the latter was extremely brittle and useless for any purpose.

172 Rapp, G. n.d. (in preparation).
173 Hegde, K.T.M. 1975, 180-183.
174 Burnett, A./P.T. Craddock/N. Meeks 1986.
175 Craddock, P.T./N. Meeks 1987.

It is well documented from several ancient smelting sites in Western Asia, and from smelting experiments based upon archaeological data, that iron-rich raw copper can be produced directly in the furnace; the metal shows a range or iron between 15 to 50%[176]. These alloys arise from both oxidic and sulphidic ores, and they are thought to owe their existence to an excessively reducing atmosphere during smelting which resulted in a precipitation of alpha-iron at temperatures around 1400°C, as mentioned above. This is certainly true for the smelting of oxidic copper ores with iron flux. Due to the flat run of the liquidus curve in the system Cu-Fe between 20% and 70% Fe (the temperature increases here only 100°C from 1350 to 1450°C) the large variations of iron become comprehensible. Once the smelter has reached this level of temperature, the precipitation of iron under a given gas atmosphere and with iron rich slag becomes exclusively a function of the time.
This interpretation, however, is only partly transferable to the Indian iron copper alloy presented here, not to mention the *»ramo secco«* bars. A fair share of the Indian objects and the six *»ramo secco«* bars as well were smelted of sulphidic copper ore. This not only is suggested by the relatively high level of impurities (Pb, As, Sb, Ni), but is indicated mainly by the high sulphur content. In Indian samples sulphur up to 0.4% is chemically determinable. In the axe ingot no. 668 inclusion of matte globules with a composition between chalcopyrite ($CuFeS_2$) and bornite (Cu_5FeS_4) were metallographically found, in the »ramo secco« bars inclusions of matte near $CuFeS_2$. The exploitation and smelting of sulphidic copper ores in the 3rd millennium in India due to its numerous hydrothermal veins is not surprising at all. Also the production of *»ramo secco«* bars from the 7th century BC onwards from these ores should be self-evident.
It is remarkable that all these metallic objects (with one exception), as opposed to the raw copper produced from oxidic ores mentioned above, contain iron in a limited range, i.e. between 20-30%. The reason for this particular composition is explicable by the phase relationships of the ternary system Cu-Fe-S[177], Considering the direction of tie lines in the isothermal section of the immiscibility field between the Cu- Fe side and the area between Cu_2S-$CuFeS_2$-FeS the coexistence of a matte near bornite with Cu-Fe alloys varying from $Cu_{80}Fe_{20}$ to $Cu_{65}Fe_{65}$ is recognisable. This means that this broad variation of the alloy is in equilibrium with a matte of nearly constant composition, and may be produced from it only with the removal of the sulphur. The production of matte of this composition as an intermediate product seems to have been the rule in smelting mixed copper-iron-sulphides in ancient time. This is indicated by numerous investigations of early smelters in the Old World. We therefore seem to have a more or less constant original material for the production of the copper-iron alloy independent of the regions where it is found. The desulphurization of the matte (except roasting!) in a smelting furnace may be caused by overheating which leads to a decomposition of sulphides in the liquid state. As suggested for medieval copper smelting in all of Oman[178] a decrease of sulphur in matte is possible too in the solid state by unintentional roasting in the upper part of a furnace. Hereby particularly the FeS content of the matte is oxidized to iron oxide and the bulk composition of the matte is shifted into the area of the immiscibility field between the metal-rich and sulphur-rich parts of the system Cu-Fe-S. In the lower half of the furnace the temperature and reducing atmosphere increase and lead to a reduction of the iron oxides and to a separation of the metallic alloy from the sulphides in their liquid state which is possible even at a temperature of only 1150-1250°C. In Oman the production of highly ferruginous copper in medieval times has to be seen as an undesirable consequence of the spread a new kind of furnace across the entire land for which little experience yet existed, Examples of analogous difficulties are recorded from other periods in Middle Europe[179].

176 Hauptmann, A. 1985. – Merkel, J. 1983. – Tylecote, R.F./ P.J. Boydell 1978. – Bamberger, M./P. Wincierz/H.G. Bachmann/B. Rothenberg 1986.
177 Schlegel, H./A. Schüller 1952. – Chang, Y.A./Y.E. Lee/J. P. Neumann 1976. – Craddock and Meeks hesitated to use the phase diagram Cu-Fe-S as a basis to explain the *»ramo secco«* bars because of probable missing equilibria during smelting in the furnace. On the other hand, they were ready to discuss the system Cu-Fe. The discussion of phase diagrams (even established under equilibria conditions in the laboratory) is one of the most useful tools in understanding slags and metals, and should not be neglected in archaeometallurgy.
178 Hauptmann, A. 1985.
179 Czedik-Eysenberg, F. 1958.

3. Conclusions

The impurity and trace element pattern of the copper artefacts analyzed and the metallography of a few items is the basis for the following statements:
– Most of the artefacts are unalloyed copper. There are no tin bronzes amongst the artefacts analyzed. Nor does clear evidence exist for a deliberate alloying of copper with lead.
– A limited number of artefacts (5) seem to be deliberately produced copper-arsenic alloys (nos. 697, 1083, 1103, bangle type III from Rewari, bangle type V from Sankarjang). A correlation between artefact types and alloys is random, and does not allow the determination of any rule of the production in space and time. In other cases (1.5-2% As) a deliberate alloying with arsenic is not clear. The borderline between natural arsenic impurity and alloying is ambiguous. It is generally set at ca. 1.5%.
– Only in a few cases is the use of sulphidic ores determinable. Otherwise both sulphidic and oxidic ores presumably were smelted.
– Most unusual is the production of several high ferruginous copper alloys. Such alloys are known only from a few sites as currency bars *(»ramo secco«* bars from Italy, 7^{th} -3^{rd} century BC) and in the form of coins (Paunar, 7^{th} century AD).

The alloys identified here contain 20-30% Fe, in one case 8%. They occur in axe-ingots, a miscellaneous axe, and a bar celt. Before these analyses were available it was easy to distinguish »functional« from »non- functional« objects. The former had cutting edges and showed traces of wear. The added dimension of unpractical alloys in both categories raises the problem of finished implements which could hardly be used. These high iron alloys are attestable in different localities in South Haryana and in the implements from the Ghangharia hoard. It is suggested that such alloys are the result of a not fully controlled smelting process perhaps at the beginning of new furnace types rather than a deliberate production.
A lack of information with regard to the copper deposits precludes any statement concerning the provenance of particular metal objects and regional groups of artefacts. In recent years it has become readily apparent through numerous investigations on this problem with regard to Aegean and Anatolian material that any kind of statistical evaluation of data is generally useless until it is buttressed by detailed chemical and mineralogical/geological investigations of the ore deposits in question. At these deposits from the period for which the artefacts belong ample field evidence for ancient mining activities must be sought, not to mention a secure base of lead isotopes of both ores and metals.

APPENDIX 2

ATOMIC ABSORPTION ANALYSIS OF INDIAN COPPER HOARD IMPLEMENTS IN THE BRITISH MUSEUM COLLECTIONS

by M. J. Hughes

Of the hoard of 424 copper/bronze implements found at Ghangharia in the 19th century there are 32 items in the collections of the Department of Oriental Antiquities in the British Museum: 23 flat axes and 10 bar celts (Tab. 5). Two antennae swords (nos. 1044 and 1051) have no closer provenance but are undoubtedly on the basis of similar pieces both prehistoric and Indian. A type VIIa variant palstave from Kosam (no. 713) and a tanged lance/spearhead (no. 1042) complete the collection of Indian hoard implements. Yule catalogued these objects in 1985. He suggests that the solid unworked castings of the bar celts

and most axes are actually ingots, i.e. a convenient form to store and transport the raw copper. Because of their importance for the understanding of the early metallurgy of India, a limited technical examination, namely chemical analysis, was made of the entire collection. The principal objective was to replace the existing simple visual identifications of the alloys with firm data.
A few artefacts of the Copper Hoard cultures have been analysed by Nautiyal, Agrawal and Krishnamurthy (1981) to study the alloying patterns of this and earlier Indian cultures. Their analyses were only partial, however, since they measured only arsenic, tin and nickel in the copper objects. Bhardwaj (1980) has discussed early copper-arsenic alloys in India, including the raw materials, extraction of arsenic and production of copper-arsenic alloys and their metallurgical and mechanical properties. Agrawal (1971) includes a number of analyses in his monograph on the same subject and concludes that copper hoards were probably of pure copper only.

1. Technique of Analysis

With the help of a microdrill small drillings were taken from each object, the samples so obtained weighing an average of 10-15 milligrams. These were analysed by means of atomic absorption spectrometry for the normal range of elements determined by the Research Laboratory in ancient copper alloys (Hughes, Cowell and Craddock 1976). The results, together with brief descriptions of the objects analysed appear in Table 5. During the course of the drilling it was noted that the metal of many of the implements was quite hard. The presence of hammer-marks on the surfaces of the objects indicates that they were extensively worked subsequent to casting, in order to raise their hardness to a level appropriate to their function.

2. Discussion

All of the objects contain such low percentages of tin that none can be described as tin-bronzes. A group of flat axes (nos. 456-458) contain over 2% lead which is their main impurity. The amount of arsenic is generally so low as to be regarded as an impurity in the copper. Only the bar celt no. 497 (1.15% AS) and the flat axe no. 713 (1.19%) could be considered alloyed deliberately with arsenic. Comparison with the analyses in table 4 for a broader spectrum of Indian hoard objects shows the same general trends in composition, namely fairly pure copper with very low percentages of tin, low percentages of lead but with occasional examples of about 1-2% lead in the copper. Otherwise the trace elements are all at low values, except the few copper/iron alloys (see below). Occasional arsenical coppers occur (3-6% arsenic), which are absent in the analysed group from Ghangharia. These represent borderline cases and may actually be of impure copper rather than intentional alloys. Apart from the bar celt no. 498 (see below) these objects all appear to be made of copper smelted without any alloying metals being present. Some groupings may become apparent on further study (e.g. those axes with over 2% lead), but no very obvious distinctions can be made at the moment. The lead is probably an accidental impurity from the smelting process. There is no conclusive evidence that any of the analysed objects have been deliberately alloyed.

3. Bar celt no. 498

This implement evidences a most unusual composition, replicated in a second analysis in Table 5. 25% of the content is iron and the rest copper with other elements being present in only trace quantities. Other copper artefacts previously have been found by analysis to contain substantial proportions of iron (typically 20-40%). Craddock and Meeks (1987) have collected the available analyses and have discussed the method of manufacture, microstructure, and uses of such copper-iron alloys in antiquity. The bar celt no. 498 seems entirely typical of the composition which commonly occurs: a simple copper-iron alloy with only small amounts of tin and lead (occasionally a few percent tin) and minor percentages of all other elements. Craddock and Meeks conclude from examination of the microstructure of two Italian

»*ramo secco*« currency bars (6^{th}-3^{rd} centuries BC) and two experimentally produced alloy samples that this alloy was deliberately produced by charging excessive amounts of charcoal to produce strongly reducing conditions together with copper ore and an excess of iron oxide ore which normally is introduced as a fluxing agent to purge impurities. But in this case it is added as a source of iron for the alloy. Under strongly reducing conditions near a tuyere tip (forced air supply) in the reaction zone, iron oxide can be reduced directly to metallic iron which dissolves in the copper thus forming the alloy. No subsequent reforming of the alloy takes place – it is simply run from the furnace and cast. Craddock and Meeks suggest its use in currency bars since the iron content substantially increased the weight of a standard size casting of copper.
At first glance the present bar celt is paradoxical in terms of its use as a implement or as an ingot/currency bar. Its metallurgical properties would, however, have made it extremely difficult to smith (i.e. shape) from its original last shape. In an attempt to establish whether localized areas of iron-rich copper were present, the bar celt was examined visually. This revealed the present of »rust« blisters at several discrete points. But it is possible that these represent areas where corrosion has begun, rather than those of a different composition. A small magnet adhered to the implement with apparently equal force over the entire surface, i.e. iron appears to be present throughout the artefact's entire length. Although a metallographic examination would be needed in order to conclusively establish the homogeneity of the metal, it does appear that the bar celt is of a copper-iron alloy containing a very substantial but slightly variable (two separate samples yielded respectively 24.9 and 28.1% iron) percentage of iron. Copper-iron alloys are actually mixtures of alpha-copper and alpha-iron which are present as two immiscible phases (similar to copper-lead alloys), so segregating effects are likely during cooling of the molten metal. Why this single- ton is the only analysed item in the hoard with this alloy is not clear. One possibility is that it represents the product of a single over-zealous charging of the smelting furnace with charcoal and iron oxide flux, and that the iron-rich copper was run off as usual into a casting-pit next to the furnace into a ready-shaped mould of bar celt shape.

4. Conclusion

The artefacts all appear with a single exception to be of impure copper unalloyed with other metals. Visual evidence suggests that their hardness (evident during sampling by drilling) was enhanced by working with a hammer. The bar celt no. 498 is of an exceptionally rare alloy of copper with about 25% iron and was produced during the smelting of the copper ore under very strongly reducing conditions in the presence of an excess of iron oxide flux. Other prehistoric implements from India are known (Table 3), namely a type III axe from Rewari (668), a IVb axe from Bhiwani (714) and another axe from Bhiwani (796). Given the rarity of this alloy it is suggested that it was accidentally produced.

Addendum

Following the type setting of our article, in Rojdi phase C (late mature Harappan in Gujarat) among other metallic implements a type II double axe came to light (G. Possehl/M. H. Raval 1989, p. 162 fig. 77) which helps date this artefactual type more precisely. It compares in its shape with others from Ahar (no. 103), Mitathal IIB (no. 211) and from the Kurada hoard (nos. 198-201). This anchoring point provides a reference with which to fix the date of the Kurada hoard to approximately 2100 BCE.

BIBLIOGRAPHY

Bibliographical items cited in the text which do not appear below are to be found in Yule, P. 1985.

Aachen: Vergessene Städte am Indus. Frühe Kulturen in Pakistan vom 8.-2. Jahrtausend v. Chr. (Mainz 1987).

Abels, B.-U.: Die Randleistenbeile in Baden-Württemberg, dem Elsaß, der Franche Comte und der Schweiz. Prähist. Bronzefunde IX,4 (Munich 1972).

Acharya, P. P.: Notes on the Archaeological Sites and Temples at Khiching. In: *ibid.* Studies in Orissan History. Archaeology and Archives (Cuttack 1969) 328-331.

Agrawal, D. P, *et al.:* Alloying in the Copper Hoards. Bull. Mus. Arch. U.P. 14, 1974, 14-18.

Agrawal, D. P. / S. Kusumgar: Prehistoric Chronology and Radiocarbon Dating in India (Bombay 1973).

Agrawal, R. C.: Khurdi (?) Copper Hoard from Rajasthan. Man and Environ. 4, 1980, 89-92.

Agrawal, R. C. / V. Kumar: Ganeshwar-Jodhpura Culture. New Traits in Indian Archaeology. In: Harappan Civ. 125-134.

Allchin, F. R.: The Neolithic Stone Industry of the Santal Parganas. Bull. School Or. Afr. Stud. 25, 1962, 306-330. Rev. Yule 1985: Antiquity 62, 1988, 805-806.

Anon. Aarsberetning 1838: Det kongelige nordiske Oldskrift-Selskab 1839, 12-13.

Anon. Appendix: The First Printed Annual Report of the Working of the Provincial Museum, Orissa, Cuttack for the Year Ending the 31st March 1941. In: Subas Pani (ed.), Our Cultural Heritage Souvenir Published on the Occasion of the Golden Jubilee

Celebrations of the Orissa State Museum 1984 (Bhubaneshwar 1984) 1-36.

Anon. Acquisition notice-Indian Museum: Ind. Arch. Rev. 1982-83 (1984) 152.

Anon. Find notice-Jajmo: Ind. Arch. Rev. 1982-83 (1985) 216.

Anon. Strategic Rare and Precious Metals/Minerals: Tin: Geological Survey India News, Northern Region 4, 1, 1984, 1.

Anon. Strategic and Rare Materials, Tin Ore: Geol. Surv. India News, Central Headquarters 16,5, 1985, 13-14.

Bamberger, M. / P. Wincierz / H. G. Bachmann / B. Rothenberg: Ancient Smelting of Oxide Ore – Archaeological Evidence at

Timna an Experimental Approach. Metall 11, 1986, 1166-1174.

Beames, J.: On a Copper-Plate Grant from Balasore (A.D. 1483). Indian Antiquary 1, 1872, 355-356.

Bhardwaj, H. C.: Early Indian Arsenical Copper. Vijnana Parishad Anusadham Patrika 23,3, 1980, 235-247.

Birket-Smith, K.: Geschichte der Kultur, eine allgemeine Ethnologie (Zurich 1946).

Blajer, W.: Die Arm- und Beinbergen in Polen. Prähist. Bronzefunde X,2 (Munich 1984).

Bodding, P. O.: Shoulder Head Axes and Other Forms of Stone Implements in the Santal Parganas. Jour. Asiat. Soc. Bengal (NS) 3, 1904, 128-130.

Böhne, C.: Zur Frage der Härtung von Kupferwaffen und Geräten. Technische Beiträge II (Mainz 1965) 126-130.

Born, H.: Korrosionsbilder auf ausgegrabenen Bronzen – Informationen für den Museumsbesucher. In: H. Born (ed.), Archäologische Bronzen, antike Kunst, moderne Technik (Berlin 1985) 86-96.

Bose, S.: Copper Hoard Sites in West Bengal (unpubl. paper 1985).

Briard, J.: Les civilisations de l'age du bronze en Armorique. In: J. Guilaine (ed.), La prehistoire frangaise 2 (Paris 1976) 561-574.

Brown, J. Coggin: Further Relics of the Copper Age. Jour. Bihar Orissa Res. Soc. 2, 1916, 386-387.

v. Brunn, W. A.: Mineldeutsche Hortfunde der jüngeren Bronzezeit. Röm.-Germ. Forsch. 29 (Berlin 1968).

Burnett, A. / P. T. Craddock/N. Meeks: Italien Currency Bars. In: E. Swaddling (ed.), Italian Iron Age Artefacts (London 1986) 127-130.

Census of India 1981, Rajasthan: District Census Handbook, Ajmer District (Jaipur 1983).

Census of India 1971, Madhya Pradesh: District Census Handbook, Balaghat District (Bhopal 1974).

Census of India 1971, West Bengal: District Census Hand- book, Birbhum District (Calcutta 1972).

Census of India 1981, Rajasthan: District Census Handbook, Bharatpur District (Jaipur 1983).

Census of India 1981, Rajasthan: District Census Handbook, Bikaner District (Jaipur 1983).

Census of India 1971, Bihar: District Census Handbook, Dhanbad District (Patna 1972).

Census of India 1971, Orissa: District Census Handbook, Dhenkanal District (Cuttack 1972).

Census of India 1971, Bihar: District Census Handbook, Gaya District (Patna 1972).

Census of India 1981, Rajasthan: District Census Handbook, Jaipur District (Jaipur 1983).

Census of India 1971, Rajasthan: District Census Handbook, Jhunjhunun District Qaipur 1972).

Census of India 1961, Unar Pradesh: District Census Handbook, Kanpur District (Varanasi 1962).

Census of India 1971, Orissa: Disr.rict Census Handbook, Keonjhar District (Cuttack 1972).

Census of India 1961, Orissa: District Census Handbook, Mayurbanj (Cuttack 1967).

Census of India 1971, Orissa: District Census Handbook, Mayurbanj District (Cuttack 1972).

Census of India 1961, West Bengal: District Census Handbook, Midnapur District (Calcutta 1967).

Census of India 1971, West Bengal: District Census Hand- book, Midnapur District (Calcutta 1973).

Census of India 1971, Uttar Pradesh: District Census Hand- book, Moradabad District (Lucknow 1976).

Census of India 1971, Bihar: District Census Handbook, Palamau District (Patna 1972).

Census of India 1971, Bihar: District Census Handbook, Ranchi District (Patna 1972).

Census of India 1971, Madhya Pradesh: District Census Handbook, Rewa District (Bhopal 1972).

Census of India 1961, Madhya Pradesh: District Census Handbook, Sagar District (Bhopal 1967).

Census of India 1971, Bihar: District Census Handbook, Santal Parganas District (Patna 1972).

Census of India 1971, Bihar: District Census Handbook, Singhbhum District (Patna 1972).

Chakrabarty, D. K.: The Problem of Tin in Early India – A Preliminary Survey. Man and Environ. 3, 1979, 61-74.

Chakrabarty, D.K./R.K. Chattopadhyay: Parihati: A Medieval Smelting Site in Midnapur District. Puratattva 12, 1980-81 (1983) 161-163.

Chang, Y. A. / Y. E. Lee / J. P. Neumann: Phase Relationships and Thermodynamics of the Ternary Copper-Iron-Sulfur System. In: J. C. Jannopoulos / J. C. Agrawal (eds.), Extractive Metallurgy of Copper, vol. 1 (New York 1976) 21-48.

Chardenoux, M. B. / J. C. Courtois: Les haches dans la France meridionale. PBF IX, 11 (Munich 1979).

Coffey, G.: Irish Copper Celts. Jour. Roy. Anthr. Inst. Great Britain and Ireland 31, 1901, Z65-279.

Craddock, P. T. / N. D. Meeks: Iron in Ancient Copper. Archaeometry 29,2, 1987, 187-204.

Czedik-Eysenberg, F.: Beiträge zur Metallurgie des Kupfers in der Urzeit. Archaeologia Austriaca, Beih. 3 (Vienna 1958) 1-18.

Devashayam, N.: The Unearthерd Copper Antenna Sword of Tamil Nadu. Puratattva 12, 1980-81 (1983) 128 + pl.

Dey, R. C. / R. B. S. Rao: On the Possibilities of Copper Ore Localisation in Southwestern Haryana. Indian Minerals 34,2, 1980 (1981) 11-20.

Dikshit, K. N.: The Copper Hoards in Light of Recent Dis- coveries. Bull. Anc. Ind. Hist. Arch. [Sagar] 2, 1968, 43-50.

Dikshit, M. G.: Collection of Prehistoric Antiquities in the Central Museum Nagpur. In: M. G. Dikshit / P. M. Joshi / V. V. Mirashi (eds.), Satabda

– Kaumudi Centenary Volume (Nagpur 1964) 90-113.

Dunn, J. A.: Copper. Bull. Geol. Surv. India no. 23, Ser. A (Delhi 1965).

Francfort, H.-P. *et al.:* Prospections archeologiques au nord- ouest de l'Inde. Rapport preliminaire 1983-1984. Travaux de la Mission archeologique franqaise en Inde no. 1. Editions recherches sur les civilisations 6Z (Paris 1985).

Geißlinger, H.: Depotfund. In: J. Hoops (ed.), Reallexikon der germanischen Altertumskunde 5 (2. Aufl., Berlin 1984) 320-338.

Gordon, D. H.: The Prehistoric Background of Indian Culture (Bombay 1958).

Gupta, P. L.: Copper Hoards in India. In: H. H. Loofs-Wissowa (ed.), The Diffusion of Material Culture. Proc. of Seminar in Canberra 1974. Asian and Pacific Archaeology Ser. 9 (Manoa 1980) 297-331.

Gupta, S. P.: 'Copper Hoard' Implements in the National Museum Collection 1986. Puratattva 1985-86 (1987) 45- 46, 97-100, pls. 10I-X.

Harbison, P.: The Axes of the Early Bronze Age in Ireland. Prähist. Bronzefunde IX,1 (Munich 1969).

Hauptmann, A.: Die Bildung von metallischem Eisen in altem Kupfer bei der Verhüttung von Kupfer-Eisensulfiden. Fortschritte d. Mineral. 63, Beih. 1, 1985, 89.

5000 Jahre Kupfer in Oman, vol. 1: Die Entwicklung der Kupfermetallurgie vom 3.Jahrtausend bis zur Neuzeit. Der Anschnitt, Beih. 1 (Bochum 1985).

Hauptmann, A. / G. Weisgerber: Vom Kupfer zur Bronze: Beiträge zum frühesten Berg- und Hüttenwesen. In: Born, H. (ed.), Archäologische Bronzen, antike Kunst, moderne Technik (Berlin 1985) 16-36.

Hauptmann, A. / G. Weisgerber / H. G. Bachmann: Early Copper Metallurgy in Oman. In: R. Maddin (ed.), The Beginning of the Use of Metals and Alloys (Cambridge, MA 1988) 34-51.

Census of India 1971, Bihar: District Census Handbook, Gaya District (Patna 1972).

Census of India 1981, Rajasthan: District Census Handbook, Jaipur District (Jaipur 1983).

Census of India 1971, Rajasthan: District Census Handbook, Jhunjhunun District Jaipur 1972).

Census of India 1961, Unar Pradesh: District Census Handbook, Kanpur District (Varanasi 1962).

Census of India 1971, Orissa: District Census Handbook, Keonjhar District (Cuttack 1972).

Census of India 1961, Orissa: District Census Handbook, Mayurbanj (Cuttack 1967).

Census of India 1971, Orissa: District Census Handbook, Mayurbanj District (Cuttack 1972).

Census of India 1961, West Bengal: District Census Handbook, Midnapur District (Calcutta 1967).

Census of India 1971, West Bengal: District Census Hand- book, Midnapur District (Calcutta 1973).

Census of India 1971, Uttar Pradesh: District Census Hand- book, Moradabad District (Lucknow 1976).

Census of India 1971, Bihar: District Census Handbook, Palamau District (Patna 1972).

Census of India 1971, Bihar: District Census Handbook, Ranchi District (Patna 1972).

Census of India 1971, Madhya Pradesh: District Census Handbook, Rewa District (Bhopal 1972).

Census of India 1961, Madhya Pradesh: District Census Handbook, Sagar District (Bhopal 1967).

Census of India 1971, Bihar: District Census Handbook, Santal Parganas District (Patna 1972).

Census of India 1971, Bihar: District Census Handbook, Singhbhum District (Patna 1972).

Chakrabarty, D. K.: The Problem of Tin in Early India – A Preliminary Survey. Man and Environ. 3, 1979, 61-74.

Chakrabarty, D.K./R.K. Chattopadhyay: Parihati: A Medieval Smelting Site in Midnapur District. Puratattva 12, 1980-81 (1983) 161-163.

Chang, Y. A. / Y. E. Lee / J. P. Neumann: Phase Relationships and Thermodynamics of the Ternary Copper-Iron-Sulfur System. In: J. C. Jannopoulos / J. C. Agrawal (eds.), Extractive Metallurgy of Copper, vol. 1 (New York 1976) 21-48.

Chardenoux, M. B. / J. C. Courtois: Les haches dans la France meridionale. PBF IX, 11 (Munich 1979).

Coffey, G.: Irish Copper Celts. Jour. Roy. Anthr. Inst. Great Britain and Ireland 31, 1901, Z65-279.

Craddock, P. T. / N. D. Meeks: Iron in Ancient Copper. Archaeometry 29,2, 1987, 187-204.

Czedik-Eysenberg, F.: Beiträge zur Metallurgie des Kupfers in der Urzeit. Archaeologia Austriaca, Beih. 3 (Vienna 1958) 1-18.

Devashayam, N.: The Unearthерd Copper Antenna Sword of Tamil Nadu. Puratattva 12, 1980-81 (1983) 128 + pl.

Dey, R. C. / R. B. S. Rao: On the Possibilities of Copper Ore Localisation in Southwestern Haryana. Indian Minerals 34,2, 1980 (1981) 11-20.

Dikshit, K. N.: The Copper Hoards in Light of Recent Dis- coveries. Bull. Anc. Ind. Hist. Arch. [Sagar] 2, 1968, 43-50.

Dikshit, M. G.: Collection of Prehistoric Antiquities in the Central Museum Nagpur. In: M. G. Dikshit / P. M. Joshi / V. V. Mirashi (eds.), Satabda

– Kaumudi Centenary Volume (Nagpur 1964) 90-113.

Dunn, J. A.: Copper. Bull. Geol. Surv. India no. 23, Ser. A (Delhi 1965).

Francfort, H.-P. *et al.:* Prospections archeologiques au nord- ouest de l'Inde. Rapport preliminaire 1983-1984. Travaux de la Mission archeologique franqaise en Inde no. 1. Editions recherches sur les civilisations 6Z (Paris 1985).

Geißlinger, H.: Depotfund. In: J. Hoops (ed.), Reallexikon der germanischen Altertumskunde 5 (2. Aufl., Berlin 1984) 320-338.

Gordon, D. H.: The Prehistoric Background of Indian Culture (Bombay 1958).

Gupta, P. L.: Copper Hoards in India. In: H. H. Loofs-Wissowa (ed.), The Diffusion of Material Culture. Proc. of Seminar in Canberra 1974. Asian and Pacific Archaeology Ser. 9 (Manoa 1980) 297-331.

Gupta, S. P.: 'Copper Hoard' Implements in the National Museum Collection 1986. Puratattva 1985-86 (1987) 45- 46, 97-100, pls. 10I-X.

Harbison, P.: The Axes of the Early Bronze Age in Ireland. Prähist. Bronzefunde IX,1 (Munich 1969).

Hauptmann, A.: Die Bildung von metallischem Eisen in altem Kupfer bei der Verhüttung von Kupfer-Eisensulfiden. Fortschritte d. Mineral. 63, Beih. 1, 1985, 89.

5000 Jahre Kupfer in Oman, vol. 1: Die Entwicklung der Kupfermetallurgie vom 3.Jahrtausend bis zur Neuzeit. Der Anschnitt, Beih. 1 (Bochum 1985).

Hauptmann, A. / G. Weisgerber: Vom Kupfer zur Bronze: Beiträge zum frühesten Berg- und Hüttenwesen. In: Born, H. (ed.), Archäologische Bronzen, antike Kunst, moderne Technik (Berlin 1985) 16-36.

Hauptmann, A. / G. Weisgerber / H. G. Bachmann: Early Copper Metallurgy in Oman. In: R. Maddin (ed.), The Beginning of the Use of Metals and Alloys (Cambridge, MA 1988) 34-51.

Hegde, K. T. M.: Analytical Study of Paunar Coins. Journ. Numismatic Society of India 37, 1975, 180-183.

Hildebrandt, A.: Ritual-Literatur vedische Opfer und Zauber. In: G. Büler (ed.), Grundriß der indo-arischen Philologie und Altertumskunde (Strassburg 1897).

Hughes, M. J. / M. R. Cowell and P. T. Craddock: Atomic Absorption Techniques in Archaeology. Archaeometry 18,1, 1976, 19-37.

Jankuhn, H.: Zur Deutung der Moorleichenfunde von Windeby. Prähist. Zeitschr. 36, 1958, 189-219.

Kibbert, K.: Die Äxte und Beile im mittleren Westdeutschland. Prähist. Bronzefunde IX,10 (Munich 1980).

Kirchner, H.: Bemerkungen zu einer systematischen Opferfundforschung. In: Claus, M. / W. Haarnagel (K. Raddatz (eds.), Studien zur europäischen Vor- und Frühgeschichte (Festschr. H. Jankuhn) (Neumünster 1968) 379-389.

Kramer, K. S.: Die Dingbeseelung in der germanischen Überlieferung. Beitr. z. Volkstumforschung 5 (Munich 1940) 89-105.

Kubach, W.: Deponierungen in Mooren der südhessischen Oberrheinebene. Jahresber. Inst. f. Vorgesch. Frankfurt a. M. 1978-79 (1980) 189-310.

Einzel- und Mehrstückdeponierungen und ihre Fundplätze. Arch. Korrbl. 15, 1985, 179-185.

Lal, M.: Copper Hoard Culture of India: A Reassessment. Puratattva 12, 1980-81 (1983) 65-77.

Settlement History and Rise of Civilization in Ganga-Yamuna Doab (Delhi 1984).

Lamberg-Karlovsky, C. C.: Third Millennium Modes of Exchange and Modes of Production. In: Sabloff, J. / C. C. Lamberg-Karlovsky (eds.),

Ancient Civilization and Trade (Albuquerque 1975) 341-368.

Lang, E. M.: Asiatische Naßhörner. In: B. Grzimek (ed.), Grzimeks Tierleben. Enzyklopädie des Tierreiches vol. 4 (Berlin 1968) 42-63.

Leese, M. N. / P. T. Craddock / J. C. Freestone: The Composition of Ores and Metal Objects from Timna, Israel. Wiener Berichte über Naturwissenschaften in der Kunst 2-3, 1985-86, 90-120.

Manna, Sibendu: Rev. Yule 1985. In: Man in India 67, 3, 1987, 291-294.

Merkel, J. F.: Reconstruction of Bronze Age Copper Smelting. Experiments Based on Archaeological Evidence from Timna, Israel. Ph. D. Thesis University of London (1983).

Misra, V. N. / V. S. Mate (eds.): Indian Prehistory 1964. Proceedings of the Seminar on Indian Prehistory and Protohistory (Pune 1965).

Mitra, D.: Buddhist Monuments (Calcutta 1980).

Mohapatra, G. C.: The Stone Age Cultures of Orissa (Pune 1962).

Monteagudo, L.: Die Beile auf der iberischen Halbinsel. Prähist. Bronzefunde IX, 6 (Munich 1977).

Müller, D. W.: Rev. of Yule 1985. In: Jahresschr. f. Mitteldeutsche Vorgesch. 71, 1988, 309.

Müller-Karpe, H.: Beiträge zur Chronologie der Urnenfelderzeit nördlich und südlich der Alpen. Röm.-Germ. Forsch. 22 (Berlin 1959).

Einführung in die Vorgeschichte (Munich 1975).

Handbuch der Vorgeschichte III. Kupferzeit (Munich 1974).

Narasimhaiah, B. *et al.:* Excavation notice-Ramapuram. Ind. Arch. Rev. 1980-81 (1983) 3-7.

Excavation notice-Ramapuram. Ind. Arch. Rev. 1982-83 (1985) 3-6.

Parida, A. N.: Archaeological Sites and Monuments of Orissa (A Brief Survey). In: M. N. Das (ed.), Sidelights on History and Culture of Orissa (Cuttack 1977) 486-497.

Patay, Kupferzeitliche Meißel, Beile und Äxte in Ungarn. Prähist. Bronzefunde IX, 15 (Munich 1984).

Pauli, L.: Einige Anmerkungen zum Problem der Hortfunde. Arch. Korrbl. 15, 1985, 195-206.

Possehl, G.: Radiocarbon Dates for South Asian Archaeology (Philadelphia 1989).

Possehl, G./M. H. Raval: Harappan Civilization and Rojdi (Dehli 1989).

Prasad, A. K.: The Remains of Chalcolithic Culture at Taradih. Man and Environ. 8, 1984, 92-93.

Raghu Nandan, K. R. / B. K. Dhruva Rao/M.L. Singhal: Bull. Geol. Surv. India no. 47. Exploration for Copper, Lead and Zinc Ores in India, Ser. A. (Calcutta 1981).

Rapp, George Jr.: Determining the Origins of Sulfide Smelting. In: A. Hauptmann / E. Pernicka / G. A. Wagner (eds.), Old World Archaeometallurgy. Proc. Internat. Conf. Old World Archaeometallurgy, Heidelberg 1987. Der Anschnitt, in preparation.

Ray, P. K.: Archaeological Treasures of Orissa. In: Subas Pani (ed.), Our Cultural Heritage, Souvenir Published on Occasion of the Golden Jubilee... (Bhubaneshwar 1984) 9- 14.

Recent Archaeological Excavations in Orissa. In: M. N. Das (ed.), Sidelights on History and Culture in Orissa (Cuttack 1977) 539-540.

Richter, I.: Der Arm- und Beinschmuck der Bronze- und Urnenfelderzeit in Hessen und Rheinhessen. Prähist. Bronzefunde X, 1 (Munich 1970).

Roeder, G.: Patina. In: M. Ebert (ed.), Reallexikon der Vorgeschichte 10 (Berlin 1928) 48-50.

Sahu, B. P.: Evidence for a Prehistoric (?) Metal Stage and Related Problems in Orissa. Jour. Orissa Hist. 3,1, 1982, 4-7.

Prehistoric Cultures of Orissa. In: M.N. Das (ed.), Sidelights on Hist. and Culture in Orissa(Cuttack 1977) 44-55.

Sahu, N. K. (ed.): Utkal University History of Orissa (Cuttack 1964).

Sahu, N. K. / P. K. Mishra / J. K. Sahu: History of Orissa (Cuttack 1979).

Sali, S. A.: Daimabad 1976-1979. Mem. Arch. Surv. Ind. 83 (Delhi 1986).

Schlegel, H. / A. Schüller: Die Schmelz- und Kristallisations-gleichgewichte im System Cu-Fe-S und ihre Bedeutung für die Kupfergewinnung. Freiberger Forschungshefte, Ser. B, 2, 1952, 1-32.

Schmidt, P. K. / C. B. Burgess: The Axes of Scotland and North England. PBF IX, 7 (Munich 1981).

Schumacher, K.: Neolithische Depotfunde im westlichen Deutschland. Prähist. Zeitschr. 6, 1914, 29-56.

Sharma, R. C.: Mathura Museum and Art (Mathura 1971).

Sinha, B. P. / B. S. Verma: Sonpur Excavations 1956 and 1959-62 (Patna 1977).

Srivastava, A. K.: Treasure Trove Finds from Mathura District. Bull. Mus. Arch. U.P. 11-12, 1973, 37-41.

Stein, F.: Bronzezeitliche Hortfunde in Süddeutschland. Beiträge zur Interpretation einer Quellengattung. Saarbrücker Beitr. Altkd. 23 (Bonn 1976).

Steiner, L.: Indien. Bundesanstalt für Geowissenschaften und Rohstoffe Hannover. Rohstoffliche Länderberichte 20, 1979, 119-155.

Stjernquist, B.: Präliminarien zu einer Untersuchung von Opferfunden. Begriffsbestimmung und Theoriebildung. Meddelanden Fran Lunds Universitets Historika Museum 1962-63, 5-64.

Stuiver, M./P.J. Reimer: Calib and Display Computer Programmes (Seattle 1986).

Time-Life Books: Barbarian Tides Time Frame 1500-600 BC (Alexandria 1987).

Torbrügge, W.: Über Horte und Hortdeutung. Arch. Korrbl. 15, 1985, 17-23.

Tylecote, R. F. / P. J. Boydell: Experiments on Copper Smel- ting Based on Early Furnaces found at Timna. In: B. Rothenberg (ed.), Chalcolithic Copper Smelting. Inst. of Archaeometallurgical Stud. Monographs 1 (London 1978).

Ullrich, D.: Zur Chemie und Mineralogie von Korrosionser-scheinungen an Bronzen. In: H. Born (ed.), Archäologische Bronzen, antike Kunst, moderne Technik (Berlin 1985) 96-104.

Verma, B. S.: Excavations notice – Chirand. Ind. Arch. Rev. 1970-71 (1974) 6-7.

Watson, P. J.: The Idea of Ethnoarchaeology: Notes and Comments. In: C. Kramer (ed.), Ethnoarchaeology, Implications of Ethnography for Archaeology (New York 1979) 277-287.

Wegner, G.: Die vorgeschichtlichen Flußfunde aus dem Rhein bei Mainz (Kallmünz/Opf. 1976).

Willroth, K.-H.: Die Hortfunde der älteren Bronzezeit in Südschweden und auf den dänischen Inseln. Offa NF 55 (Neumünster 1985).

Wuttmann, M.: Analyse et etude du metal cuivreux de certains objets. In: M. Vallogia, Balat I, Le mastaba de Medou-Nefer, FIFAO vol. 31,1 (1986) Annexe III 215- 222.

Yule, P.: The Bronze Age Metalwork of India. Prähist. Bronzefunde XX,8 (Munich 1985).

On the Function of the Prehistoric Copper Hoards of the Indian Subcontinent. In: J. Schotsmans / M. Taddei (eds.), South Asian Archaeology 1983 (Naples 1985) 495-508.

Prehistoric Copper Hoard Objects in the State Museum Lucknow. Bull. Museums and Archaeol. U. P. 33-34, 1984, 1-7.

Yule P. / M. Bemmann, Klangsteine aus Orissa – Die frühesten Musikinstrumente Indiens? Archaeologia musicalis 2, 1988, 41-50.

Yule, P. / B. K. Rath / K. Højgaard: Sankarjang – ein metallzeitlicher Bestattungsplatz im Dhenkanal-Vorgebirge Ostindiens. Anthropos 84, 1989, 107-132.

Yule, P. / M. Thiel-Horstmann: The Prehistoric Metal Objects in the S.C. Roy Collection, Ranchi. Man in India 65, 1985, 121-138.

LIST OF MUSEUMS AND COLLECTIONS

FINDSPOTS OF NEW FINDS

NEW FINDS BY TYPE