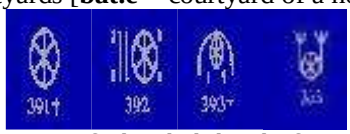
Harappa: reconstructed platform close-up (white colouring is caused by salt seepage) Signs 391-393 and 355 of the script are reminiscent of this circle-shaped platform. Workshop Platforms at Harappa are located both inside houses and in courtyards [**bat.e** = courtyard of a house (Santali.lex.)].

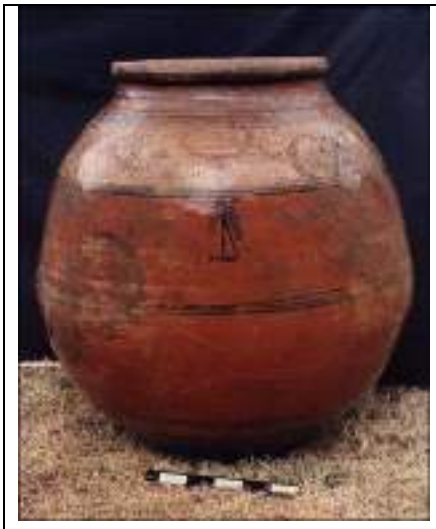


Part of the brick platform on which the original timber (?warehouse) of Mohenjo-daro once stood. The lower figures show how the commodities brought in from the river banks were hauled up on to the main loading platform; the other figure (top left) is crouching in the opening of one of the ventilation ducts.The heavily reinforced platform could have been used to store both ores and metal artefacts as well as fire-wood and charcoal needed for metal-working (cf. Fig. 51 in: Mortimer Wheeler, 1976, *My archaeological mission to India and Pakistan*, London, Thames and Hudson).

The surmise that the circular platform might have been used by a metalsmith is substantiatedat a small, early Harappan site of Padri. (See: Vasant Shinde, Excavations at the Harappan site of Padri (Bhavnagar District, Gujarat) 1990-91 to 1995-96.http://www.picatype.com/dig/dl/dl0aa15.htm#back01)

The village, Padri-Gohil-ni (Lat. 22°22'N; Long. 72°95'E) in Bhavnagar District, Gujarat, is located around 55 km to the south of the District headquarters. The ancient site is 2 km to the south of the present village and is spread over an area of 5 ha with a habitational deposit 3.5 m thick.Remains of 3 cultural periods were found, namely:Period I – Early Harappan (c. 3000 – 2600 B.C.), eriod II – Mature Harappan (c. 2500 – 2000 B.C.) and Period III – Early Historic (200 B.C. – 200 A.D.).

"One of the most significant discoveries is a copper fish-hook, which is 14 cm long and weights 41 gm. A copper fish-hook of such a magnitude has not been reported from any other site so far... The other material equipment include a seal on a stud handle engraved with fish motif, Harappan letters engraved on pot-sherds, cubical chert weights, micro steatite beads, beads of terracotta, carnelian, agate, etc."



Padri: Storage Jar with painting of a horned head-dress: Mature Harappan Phase (c.2,500-2,000 B.C.) The majestic, curved horns of a buffalo, of the type shown on a seated person on a Mohenjodaro seal are painted on the jar.

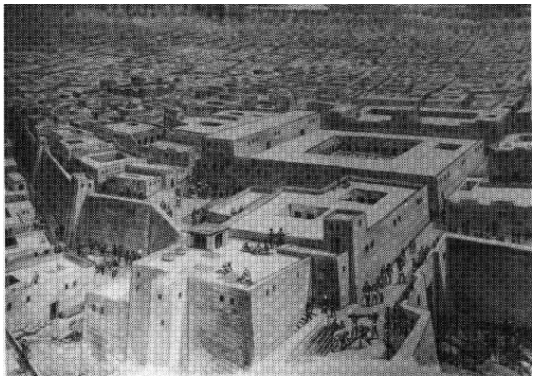
Padri: Structure Complex: Rooms including a coppersmith's room with a circular platform,circular furnace and copper implements. Early Harappan Phase (c.3,000-2,600 BCE).

"Early Harappan Phase.It is for the first time that a separate horizon of the Early Harappan has been discovered in Saurashtra consisting of a 60 cm thick deposit at the base of the site. The Early Harappan period has been dated on the basis of C14 determination to between 3000 and 2600 B.C. Two structural phases were noticed in the Early Harappan levels. The first phase is represented by very well made rectangular mud structures. Most structures were residential, possessing cooking and storage facilities. The house of a lapidary was identified and yielded a bead polisher and beads in different stages of manufacture. Large-scale excavation in the subsequent level yielded a large multi-roomed structure complex, ten rooms of which have been exposed so far. Some of the walls of the complex were made of bricks in a size ratio very close to 4:2:1. Some walls were made of sticky black clay and yellow silt. A large part of the complex was used for storage as it yielded a couple of stone-topped mud platforms for supporting storage bins and a number of storage jars of a coarser variety. Some of the rooms were occupied by craftsmen such as coppersmiths and flint-knappers. The room of the former individual yielded a circular furnace, a platform and a number of copper implements. The room of the flint-knapper yielded a small fire-place probably for heating the raw material and a number of waste flakes and finished tools. No evidence of cooking or other domestic activities was found."

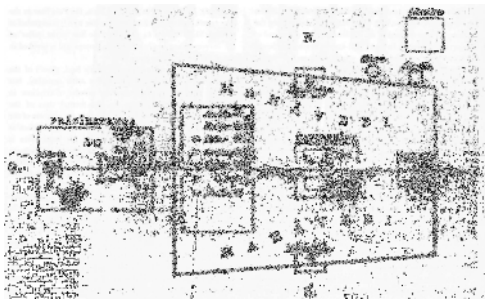
The 'imageries' of circular workers' platforms from Harappa and Padri evoke the semantic categories: 'circular' and 'course of bricks'; these may be explained by ancient forms of the following lexemes of the linguistic area, ca. 3000 B.C. (the lexemes also explain the concept of a 'workshop' of a brazier).

Glyph: **bat.i** = a small brass bow (Santali)

bha_t.i_ furnace (Skt.) pa_tri_ = a small portable furnace (Skt.) pat.t.a a flat orlevel surface of anything (Skt.) **bat.** to trim, make level, straighten (Santali.lex.) vat.t.i, vat.t.ika_ circumference, rim, brim (Pali); varti projecting rim (Skt.); vatti edge, limit (Pkt.); vatti edge of bank or river (Si.)(CDIAL 11360). Image: tire of a wheel: pat.t.e the outer iron rim of a wheel (Ka.)(Ka.lex.) pat.ru tire of a wheel (S.); pat.ru band of iron to tighten anything, tire of a wheel (S.)(CDIAL 7733).



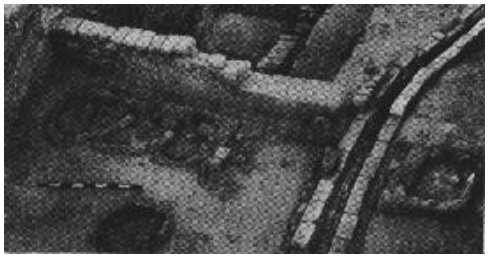
pat.a = course of bricks (Ta.); pat.ukka = to lay stones, build (Ma.)(DEDR 3852) pat.t.at.ai = a layer or course of earthwork, as in raising mud-wall (Ta.);pat.t.ad.a = workshop (Te.)(DEDR 3865) d.a_ = anvil (Te.); at.t.e = a stand, a support (Tu.)(DEDR 86) [cf. cakra-va_t.a = lamp stand (Skt.)] pat.ukkai = anvil; pat.t.at.ai = anvil; smithy, forge; kollan2 pat.t.at.ai = anvil;at.aikal = stone base; anvil;



at.aikur-at.u = anvil; tongs(Cologne Tamil Online Lexicon) [pa_t.aka = a flight of steps leading to the water (Skt.); pat.i =step, stair (Ma.)(DEDR 3850) pat.t.am = tank, pond (Ta.)(DEDR 3856)] va_t.a = m. an enclosure ,(either) a fence , wall , (or) a piece of enclosed ground , garden , park , plantation MBh. Ka1v. &c. (Skt.) va_t.aka site of a house,enclosure (Skt.)

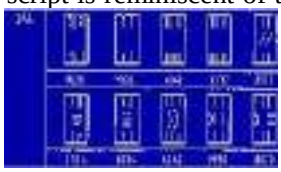
bat.araka = n. pl. circular lines of light which appear before the closed eye AitA_r (Cologne Digital Sanskrit Lexicon) vat.t.am = circle, circular form (Ta.); vartula = n. round , circular , globular BhP. Vet. Hcat. (Skt.)

Dhis.n.ya (fireplaces) of the seven sacrificial priests. Vedic Soma Yajn~a. [After W. Caland and V. Henry, 1906-7, *L'Agnis.t.oma: description complete de la forme normale du sacrifice de soma dans le culte vedique*, I-II, Paris: I, pl. 4]

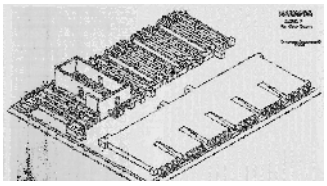


A row of seven(?) 'fire altars', clay-lined pits containing ash, charcoal, the remains of a clay stele (cylindrical and 30-40 cm. high) in the middle; Kalibangan; Thapar 1985: 55.

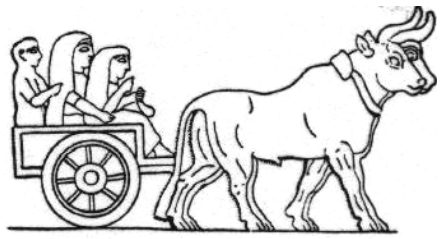
Kalibangan: well in the courtyard of a lower town house.

Sign 244 used in script is reminiscent of this building Sign 244 has variants:  Harappa, granary? Warehouse?

An isometric view (After Vats). Between the citadel mound and the old river bank is a series of brick platforms for two rows of six warehouses, each 6m by 6 m (with a combined floor space of about 800 sq. m. To the south of this granary was an area of working floors with rows of circular brick platforms perhaps for threshing grain (wheat and barley chaff were found in the crevices of the floors).



The cultural markers of legacy of the civilization



Assyria, two yoked oxen pulling a cart (G. Contenau, Manuel d'archeologie Orientale, A. Picard, 93, Vol. III, p. 2 5). "Cappadocian texts dating from the end of the third millennium have been discovered to be contacts between large firms and caravan drivers." (Maurice Daumas, opcit, p. 29). Chariot with solid wheels, shown on the Ur standard.

Ur, Chariot, Photo G. Contenau, from: Maurice Daumas (ed.), *A History of Technology and Invention*, New York, Crown Publishers, 1962, p. 130). The onager or wild donkey is seen on the tablets of Mesopotamia; skeletons of this animal have also been found in the royal tombs at Ur. "The Kingdom of Judea exported copper anr horses; at the beginning of the first millennium BC, King Solomon appears as a great merchant doing business through his port of Ezion-Geber, north of the Red Sea. The American excavations at Megiddo have uncovered the remains of large stables for the temporary housing of the horses. The horse was ridden with a simple saddle blanket, without stirrups; it was used almost exclusively for the war chariot, which was originally a seat on large wheels, and later a box that held from two to four occupants. The wagon, which had either two to four wheels, was sometimes pulled by oxen. The investigations of Lefebvre des Nouettes into harnessing practices in antiquity indicate that for the horse there existed only the neck collar, which strangled the animal when it pulled hard; the absence of the breech band still further diminished the usefulness of the horse as a draft animal. It is possible that the Asian (or so-called Przhevalski's) horse is one of the ancestors of the Assyrian variety." (Maurice Daumas, opcit, pp. 129-131).

Chariot. Italian (c. 550 BCE). Bronze plates on wood. Metropolitan Museum. "Originally chariots were only used in war to bring the warriors quickly and without fatigue to the place of battle. The warrior then dismounted and fought on foot, while the charioteer stayed by to assist in the pursuit if he was victorious or in retreat if he was defeated. Cyrus was the first to change this and make use of the momentum of the weight and speed of the chariot and horses. He invented a

new sort of chariot with wheels of great strength so as not to be easily broken, and with a long axle to prevent its being overturned. The driver's seat was like a turret of strong timber. Scythes, about three feet long, were attached to each end of the axletree, some horizontal and others pointing toward the ground, evidently to prevent an enemy from seeking safety by falling down and allowing the chariot to pass over him. The horses and driver were clad in complete armour. Somewhat similar chariots continued in use for several centuries. Lighter and smaller chariots were also used." [GC Stone, Fig. 220, p. 176].

Alternative view. Chariot, ca. 550-525 BCE. Etruscan. Bronze, ivory. 51 9/16 in. high. In Mesopotamia the chariot had been preceded by disk-wheeled vehicles with both two and four wheels, pulled by onagers. As noted by Piggott, innovations gave the true chariot its superiority: the spoked wheel; the exclusive use of horse draft (with an adaptation of the yoke for this purpose); the replacement of the old nose-ring control by a proper horse bit; the use of the bow as a primary chariot weapon; and proportions permitting a crew of two to stand abreast.

Solid-wheel, ox-drawn cart. Harappa. (After Shari Clark and Laura Miller/Courtesy Department of Archaeology and Museums, Government of Pakistan).

http://bosei.cc.u-tokai.ac.jp/~indus/english/2_2_03.html

Apart from the boats plying on the River Sindhu which are comparable to the boat depicted on a seal of the civilization, the toy cart models unearthed during excavations are not unlike the carts in use even today in Sindh province. Clay model of a cart (pole, posts and axle reconstructed), with a top view of the chassis, Chanhudaro, Sarasvati-Sindhu valley, ca. 2,000 BCE. The axle turns with the solid, non-spoked wheels.

Copper model of a passenger box on a cart, Chanhudaro, ca. 2,000 BCE.

This Chanhudaro passenger box finds a remarkable parallel in the **copper model of a chariot** with four onagers found at Tell Agrab, Mesopotamia (See below: the X-shaped re-inforcement on the box).

"Recent excavations at Banawali in Harayana have brought to light a very good terracotta model of a ploughshare. It consists of a curved beam and a sharp-ended 'shoe' (Bisht, 1987: Pl. 26). More or less similar ploughshares are still in use, not only in Haryana but also in the …neighbouring areas.

"A terracotta model of an axe fitted to a handle found at Mohenjodar (Mackay, 1938, Vol. II, Pl. CXII,1) reminds one of the use of similar axes even nowadays in the countryside for cutting fire-wood for cooking purposes as also for felling trees in the jungle. Similar to what are in use today are fish-hooks found at almost all Harappan sites (for example, Marshall, 1931: Vol. III, Pl. CXLIII, 24-25).

"The usual pattern of an average Harappan house (not of the more than fastidious ones in the big cities) was to have an open courtyard surrounded on three sides with living rooms and having a large frontal entrance into the courtyard through which bullock-carts and cattle could get in. In the courtyard have also been found troughs for keeping fodder and lower parts of large pots for holding water – all meant for the cattle (cf. Lal, 1979: 83-5). Immediately outside the house, flanking the gate, were platforms evidently for people to sit on and chat. The roofs of the rooms were flat, made of wooden beams and

reed-matting interspersed with earth. Cooking was usually done in the courtyard. This patter of house-plan still persists in the rural areas of Haryana, Punjab etc.

Mohenjo-daro. Terracotta model axe. Mackay, FEM, Pl. CXII,

"Even certain items relating to cooking seem to have survived the millennia. For example, the present-day overground and underground **tandu_rs** in northern Rajasthan, Haryana and Punjab may well be said to go back to the pre-Harappan times. This is duly vouchsafed by the examples encountered at Kalibangan (Lal, 1979, 68-9). The three-legged **pa_ta_** (also called chakala_) used for preparing the bread these days has surprisingly its counterpart in the Harappan milieu. (See, for example, *Indian Archaeology 1958-59—A Review*, Pl. LXVC, for a Harappan specimen from Alamgirpour in Uttar Pradesh). Even the saddle querns and mullers used these days in the villages are not much different from their Harappan ancestors.

"Though the Harappan pottery forms had started changing in the late phases and were no longer to be seen, except for a few examples, in the transformed cultural milieu, yet some forms have strangely survived till today. For example, the **kaman.d.alu** (Mackay, 1938, Vol. II, Pl. LXVI,22,28) and small nozzled vessel used for feeding children with milk (Mackay, 1938, Vol. II, Pl. LXVI,1) have their counterparts even today. (BB Lal, 2000, opcit.)

An exquisite example of bronze sculpture in the civilization is this statue from Mohenjodaro attesting to the competence of the metallurgists of this major trading centre of the Sarasvati-Sindhu doab. The cire perdue technique used to produce this bronze statue is practiced even today by the sthapati-s who produce bronze mu_rti-s in Swa_mimalai
near Kumbakonam. At this place which is celebrated as one of the six sacred pilgrimage sites of Subrahman.ya (Ka_rttikeya ar-upat.ai vi_t.u lit. six army camps) the deity is named E_raka subrahman.ya. The term 'e_raka' is intriguing suggesting it to be a possible cognate with era copper.

Samples of bronze/copper, gold, silver ornaments and beads. (Mohenjo-daro).

Beads and stoneware bowl, Harappa [Discovered in 1996].

More bead samples of the civilization with soldered metal joiners.

Toiletry and ornaments

'...Harappa yielded an interesting toilet set. It consisted of a pricker, a narrow knife, and a pair of tweezers. The butt of each implement had been hammered out into wire, which was bent back and twisted round the stem to form a loop. The triad of interlaced implements forms an almost exact counterpart to the Sumerian reticules, and show that the idea of the knot-head was familiar on the Indus.

'Elaborate metal plugs made in two pieces were worn in the ears. Strings of spherical, barrel-shaped, tubular and rounded lenticular beads off cornelian, jadeite, ivory, gold, silver, variegated stone, shell, or fayence were hung round the neck or worn as girdles. Multiple necklaces of five strings, separated by spacers, seems to have been specially popular. Some of the barrel-shaped beads are divided into segments by deep cuts. The arms and ankles of the women were encircled with bangles and anklets of gold, silver, fayence, or shell. These ornaments are often of the penannular type, not otherwise represented in the most ancient east, but very popular in Europe during the bronze age.' (Childe, opcit., p. 208).

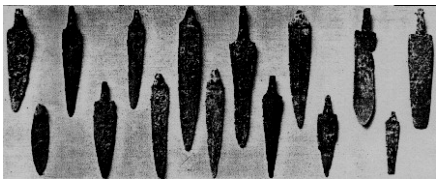
'The Sumerian and Indus toilet-sets are in principle identical, and each show the same peculiar construction of the looped head. Artistic devices like the use of shell inlays connect the two regions strikingly. Motives like the trefoil and the rosette, even religious themes such as monsters, are common to both countries. It is fantastic to suggest that the wheel and carts had been independently invented in both lands...Were the innovations and discoveries that characterized proto-Sumerian civilization not native developments on Babylonian soil but the results of Indian inspiration? If so, had the Sumerians themselves come from the Indus or at least from some region within its immediate sphere of influence?...A minority from the Indus or saturated with its inspiration might well have been the bringers of wheeled vehicles, toilet-sets, monochrome pottery, mother-of-pearl, and other Sumerian specialities to Southern Babylonia. Yet the Sumerian script is not that of the Indus despite agreements. The Indus art and religion point already as distinctly to historical Indian ideals and cults as do the earliest Sumerian art and iconography foreshadow the classical Babylonian.

"The painted pottery from Harappa and Baluchistan, despite material and significant differences in technique, forms, and decoration, must in the long run belong to the same family as that described as the Prediluvian in Iran. In fact several distinctive motives are common to both groups: the rosette, the dot-ringed circle, concentric semicircles, the step-pattern, the sloping oval, the 'double-axe'. Tell Kaudeni in the Zhob valley very truly links the two provinces with its Indian elephant and its Persian lapis. Were Harappa and Mohenjo Daro offshoots from the prediluvian highland culture like Eridu and al 'Ubaid? Or was the highland culture itself an early branch from the same tree, that, rooted in India, grew into the

Indus civilization? It would be sheer guess-work to attempt to choose between these alternatives or to decide whether either suffices to explain those similarities between Sindh and Sumer that presuppose racial kinship. Remember that hair was worn in a bun at the back even in the prediluvian village of al 'Ubaid. The second alternative has this to recommend it that it could be harmonized with those hints of an immensely ancient province in the south, rooted in Lower Palaeolithic traditions of industry, where agriculture originated. But with such a speculation we leave at once all hold on the solid world of fact.' (Childe, opcit., pp. 211- 213).

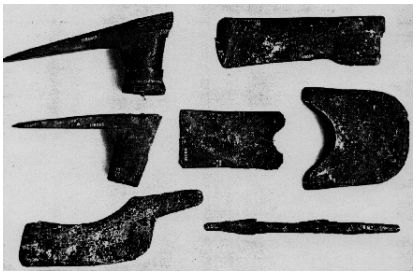
Bull's head from Al'Ubaid, made of copper; ca. 2800 BCE. British Museum. Smelted copper has been found at Al'Ubaid near to Ur, dated to 3400 BCE.

Bronze head of a bull from a wooden lyre found in PG 1332. The head was cast by the lost wax process; the eyes are inset with lapis lazuli and shell (UPM 30-12-696; Ht. 12 cm). The same lost wax process has been used to cast the bronze statuette of a lady with bangles and anklets in Mohenjodaro.



Bronze blade from a ceremonial axe with an openwork representation of an ibex. The blade is dated to the 18th dynasty and is said to be from the eastern delta. New York, Brooklyn Museum.

Dagger blades found at Ur; early dynastic period; British Museum.



Socketed and wedge-headed bronze axes, found at Ur; early dynastic period. British Museum.

Impression of an Akkadian cylinder seal (ca. 2350-2100 BCE) variously interpreted as potting or cheese-making (after Boehmer 1965: no.693). Another interpretation could be that a man is offering a sword to the eagle-person. The three animals following this man could denote some metallurgical objects. The brazier is inscribing a vessel at the top-left.

'Part of the commerce between the Indus and the Euphrates was surely conducted by sea as throughout histoic times...Now, throughout historical times the southern coasts of Arabia and especially the region of Oman have been the homes of bold sailors trading with Ethiopia, SIndh and gulf ports. The Arabian Sea is named after them. The author of the *Periplus of the Erythraean Sea* extols their exploits and mentions how the commerce of India and Egypt met in their ports. The Babylonian records from Sargon of Agade onwards make mention of the land of Magan, whence diorite and metals were obtained. [Diorite = a speckled, coarse-grained igneous rock consisting typically of plagioclase, feldspar, and hornblende]. It was inhabited by sea-faring people, and has been plausibly located in Oman. It is perfectly legitimate to infer that such centres of maritime commerce flourished even in the fourth millennium. Only so does the peculiar indirectness of the relations between Sumer and Egypt in Late Predynastic times becomes intelligible. It can hardly be fortuitous that on the later coinage of Arabia appears a distorted version of the twin-serpent motive that constituted one of the links between the Nile and the Euphrates. And Yemen, certainly the source of frankincense, is just as likely as Somaliland to have been the original Land of Punt, that figures so priminently in the oldest Egyptian traditions.' (Childe, opcit., pp. 24-2 5).

'The first investigators of the Elamite and the Indus scripts were alike struck with the resemblance of many signs to the Minoan. Such a similarity would be intelligible if the respective scripts went back to a common system in use among early nautical merchants. The Phoenicians preserved to the time of Herodotus a tradition that they had come from the Persian Gulf-- a tradition quite as worthy of credence as that referring to the foundation of Melqart's sanctuary that excavation has partially verified. It is thus quite possible that the sudden rise of a brilliant maritime civilization on the Mediterranean was due in part to the transplantation across the Isthmus of Suez of some of the coastal culture of the Arabian Sea... The cities of Babylonia throughout history have owed their prosperity to their position at junctions of the great overland routes to India and Inner Asia on the one hand, and to Syria and the Mediterranean on the other, with the maritime route to India and Abyssinia...

'...it looks as if some catastrophe overtook the cities of the Indus basin shortly after 3000 BCE. Mohenjo Daro was deserted about that time, Harappa even earlier. Hence Sumer lost her civilized partner in the commerce of the East.' (Childe, opcit., pp. 216-217).

Raquet pin, Ur. [V. Gordon Childe, 929, *The Most Ancient East: the oriental prelude to European prehistory*, London, Kegan Paul, Trench, Trubner and Co. Ltd., Fig. 82]. 'The hairpin with raquet-shaped heas dhown is another type that recurs in Central Europe; Woolley is no doubt right in suggesting that the tube formed by rolling over the head was designed to support two feathers.' (Childe, opcit., pp. 89- 90).

'Pins fastened the garments or adorned the hair. Favourite types are the bead-headed variety attributed also to the Second Prediluvian culture and the toggle-pin in which the shaft is flattened round the eyelet, and at Kish sometimes decorated with an engraved pattern that recurs on pins of the same family in Central Europe. (Fig. 81,3). Less common are the pins with a stylized bull's head, represented at Kish, while one surmounted by an ape from Ur is unique' (Childe, opcit., p. 189).

Gold toilet set and case, Ur (U. 9340; [V. Gordon Childe, 929, *The Most Ancient East: the oriental prelude to European prehistory*, London, Kegan Paul, Trench, Trubner and Co. Ltd., Plate XIX b.]

'For the toilet the Sumerians were indeed well provided. The facial hair was removed with razors, flat oval blades with a short tang... 'Cutters', narrow copper strips with an edge at one end and turned over or rounded at the other, seemed to have served a similar purpose, and tweezers were also in use. The latter were combined with prickers and earscoops in regular reticules. The three instruments were attached to a ring and enclosed in a case. The looped head of each instrument, through which the common ring passes, has been formed by hammering out the upper end of the implement into wire and then twisting this wire back upon itself and coiling it round the shaft -- in a word, on the principle of the knot-headed pin.' (Childe, opcit., p. 188-189).

'The arms were decked with bracelets and the fingers with rings, but these ornaments were always of the simplest type. The ear-rings, necklaces, diadems, and pendants illustrate better than anything else the supreme skill of the Sumerian goldsmiths and so give a welcome indication of the level of civilization attained.' (Childe, opcit., p. 190).

Copper bracelets and ear-rings with flattened ends, Kish A, Fig. 83].

Jewellery from graves at Ur [V. Gordon Childe, 1929, *The Most Ancient East: the oriental prelude to European prehistory*, London, Kegan Paul, Trench, Trubner and Co. Ltd.,Plate XXII a,b,c]. 'In the ears were hung helical rings the ends of which have generally been flattened out to a boat-form (Plate XXII). The execution of these little coils and their mounting attests the consummate skill of the goldsmith. No less admirable are the amulets in the form of bulls, some represented as wearing a false beard, birds pecking at fruit, sheep, deer, fishes, and other animals. Lapis, cornelian, gold and silver and fayence (the latter substance not in the oldest cemeteries at Ur) were the commonest material for beads, though shell and various less valuable stones were used. Discs, cylinders, long bicones, barrels and tabular or biconical faceted beads are the commonest types, but there are multitubular and other spacers, gadrooned globes and barrels (at Kish as in Protodynastic Egypt) and compounds -- for instance two axially gadrooned globulars united by a segmented tube. The splendour of the head-dresses of the queen and harem beauties from the older tombs at Ur baffles description.' (Childe, opcit., pp. 190-191).

Earrings and pendants from graves at Ur. [V. Gordon Childe, 1929, *The Most Ancient East: the oriental prelude to European prehistory*, London, Kegan Paul, Trench, Trubner and Co. Ltd., Pl. XXI b].

Processing of minerals

Chalcolithic (Copper-Stone) Age, used pure copper (along with its predecessor tool-making material, stone). Use of copper was known in eastern Anatolia ca. 6000 B.C. and by the mid- 4th millennium, a rapidly developing copper metallurgy, with cast tools and weapons led to urbanization in Mesopotamia.

Bronze Age of proto-historic times is a cultural revolution perhaps second in importance only to the Industrial Revolution of modern times.

"The fabrication of bronze represented man's first industrial revolution centering in the use of fire...Stannite on smelting yields a natural bronze. This generally steel-gray to grayish-black ore frequently has the appearance of bronze and indeed is called 'bell metal' ore. Stannite fits with the hypothesis that metallurgy was born in a polymetallic setting, where interfluxing and interalloying of ores could occur. This would most generally be a gossan cap on a copper deposit, also containing arsenopyrites and lead-silver...In Egypt in 1976, we relived the experience of predynastic prospectors for gold: of finding cassiterite in the decayed quartzes or greisens, extensions of the gold ones. It was especially rewarding to follow the trail of the bright black placer crystals up the riffles in the wadis. There can now be little question in our minds that cassiterite (SnO2) was the ore that led toward the identification of tin and the ultimate naming of the metal as *ana_ku* in Akkadian. Stannite could not have performed this function...The several hundred translated tablets from Kultepe and Mari containing references to trade in *ana_ku* from the east, suggesting an origin for tin in Elam or Iran. After a long debate over the logogram *ana_ku*, it seemed that the trade item must concern tin rather than lead or exotic glazes. The reference of the geographer Strabo to tin in Drangiana, or Seistan, which tin had been exhausted." (Theodore A. Wertime, The search for ancient tin: the geographic and historic boundaries, in: Alan D. Franklin, Jacqueline S. Olin and Theodore A. Wertime, eds., 1977, *The Search for Ancient Tin*, Washington D.C., US Government Printing Office; See Theodore W. Wertime, In search of Ana_ku, bronze-age mystery, *Mid-East* 8, May-June 1968, pp. 10-20; J.D. Muhly, Tin trade routes of the bronze age, *American Scientist* 61, July-August 1973, pp. 403-13).

The mineral Cassiterite (SnO2) or tinstone is usually deep brown to black in colour, but is sometimes red (ruby tin), yellow (rosin tin), and may even be colourless. Heating the tin oxide in charcoal fire or furnace yields metallic tin. The metal melts at the low temperature of 232 C, but the ore requires a smelting temperature of about 100 C. Tinstone is found in the same alluvial gravel deposits as gold; it is probable that when was being sought, the tinstone would have been noticed and the alluvial ore discovered thus.

"In the Late Bronze Age the alloy normally contained 10% Sn, but lead was introduced into castings...tin is found mainly as the mineral cassiterite (SnO2) which is white in the pure state, but is more often contaminated with greater or lesser amounts of iron which render it brown or black...(Bronzes at Mohenjodaro--2500-2000 BC) cover a range of 3 to 26.9% Sn and it would seem that tin was sometimes available in the 500 years of occupation on this site. At Mundigak, in Afghanistan, only one out of a total of five shaft-hole axes analysed contained as much as 5% Sn...The Early Bronze Age seems to have lasted to about 300 BCE in the Ganges Basin and the Deccan. In the former, Harappa-type cultures have produced a few bronzes containing 3.8 to 13.3%Sn. A site at Jorwe in the Deccan, dated to before 300 BC, produced six very simple flat axes or rectangular form and one copper bangle...Considering that India is near the well known tin deposits of Burma and Malaya, one would not be surprised to see a difference in the use of tin there, and particularly in the quantity used in the Early Bronze Age, compared with the use made of it in places not so close to known tin deposits...It is generally accepted that the Iron Age started in Asia Minor where iron using people have occupied the area from about 2000 BCE. During the Bronze Age copper ores would have been smelted with the aid of iron fluxes, and there would be a distinct possibility of iron being reduced in the bottom of the furnace." (R.F. Tylecote, 1976, *A History of Metallurgy*, London, The Metals Society).

The pin at Tepe Hissar 1 (ca. 3900-2900 BC) had 1.74% Sn; dagge at Geoy Tepe (ca. 2000 BC) had 0.5% Sn; dagger at Tepe Yahya (ca. 3000 BC) had 3.0% Sn; the blade and pin at Ur (ca. 2800-2500BC) had 2.4 and 1.0% Sn respectively; the fragment at Mohenjodaro (ca. 2100-1700 BC) had 1.2% Sn; dagger at Tel Asmar (ca. 2500 BC) had 2.63%Sn. There are indications that bronze was being made by 'cementing' copper with tin oxide in the Late Bronze Age. At Tepe Hissar (ca. 2100-1800 BC), only alloys containing 0.78% to 2.24%Sn were found. At Susa, alloys did not exceed

1.63% tin content even as late as 1800 BCE. However, the 'Luristan Bronzes' (1500-700 BC) show the true flowering of the Bronze Age in Iran. In Crete, dilute bronzes (3.14, 3.16% Sn) appear only during the Middle Minoan I (2000 BC). Cretan Minoan double axes are mostly tin bronze (3 to 18%Sn). Moulds for these objects were found at Malli and on Melos.Evidence for trade in tin or cassiterite comes from the wreck found off the coast of Cape Gelidonia in southern Turkey; this find is dated to the Late Bronze Age (1200 BC). About 16 kg of white material containing 14% SnO_2 and 71% $CaCO_3$ were recovered from the sea bed. This may represent corroded material from a tin ingot having a cross-section of about 6 cm sq. The cargo included copper and bronze ingots and scrap metal. The ship was travelling in a westerly direction and the suggestion is that it was a Syrian ship taking copper from Cyprus to the Mycenaen civilizations in Crete or Greece. This tin was certainly not obtained in Cyprus and should have been traded from more distant places and picked up at one of the ports of call. (Tylecote, opcit., p.15).

Susa, Tepe Yahya, Sahr-i-Soktha

"...(Sumerians of the Late Uruk period) established a colony on the acropolis of Susa (biblical Shushan, modern Shush), where the southern Iranian trade route to northwestern India began. Its original purpose was to obtain carnelian, the only ancient source of which was the Gujarat Peninsula. The presence of Uruk pottery at Yahya Tepe, the most important caravan city on that road, reveals that city's links with Susa. After about 3000 the so-called Proto-Elamites took over Susa, Godin Tepe, and other sites in Iran...One of the sites, Shahr-i-Sokhte, was located near an important area of tin deposits. With the start of the Bronze Age, tin became a major object of international trade, and Elam controlled its supply for a long time afterward... a long-lasting connection by land and sea was established between lower Mesopotamia and the Indus basin (which the Sumerians and Akkadians called Melukkha)." (Michael C. Astour, 1995, Overland trade routes in ancient Western Asia, in: Jack M. Sasson (ed.), *Civilizations of the Ancient Near East*, Vol. I, pp. 1401-1420).

Lead, tin, silver and gold

"In the ancient Near East... when working gold by streaming, nodules of cassiterite (or tin-stone SnO_2) were found. This cassiterite was reduced by workers already proficient in the production of gold, silver and lead. The metal obtained was held to be a kind of lead. [In Sanskrit, the term for lead is: **na_ga**. In Akkadian, the term for tin is: **anakku**). Lead and antimony were already used to increase the ease with which copper could be cast, but neither of them improved in its other qualities, notably the tensile strength. From trials with the new kind of 'lead', it would be learnt that this mixture was now improved in tensile strength as well as in ease of casting. Nor was it necessary to produce this new metal first; unrefined copper had only to be smelted with charcoal and stream-tin to produce a new kind of 'copper' (ayas in Rigveda), namely bronze, with superior qualities for tools and weapons. At the same time, certain naturally mixed ores were also worked, and were found to give the better kind of 'copper' directly. We have no proof that the tin compound of these mixed ores was ever isolated or recognized. Furthermore, at this early stage the tin content of the bronze could not be adequately controlled, and therefore varied between fairly wide limits." (Adapted from: R.J.Forbes, 1954, Extracting, smelting and alloying, in: Charles Singer, E.J.Holmyard and AR Hall (eds.), 1954, *A History of Technology*, Oxford, Clarendon Press).

***Na_ga*, lead ore**

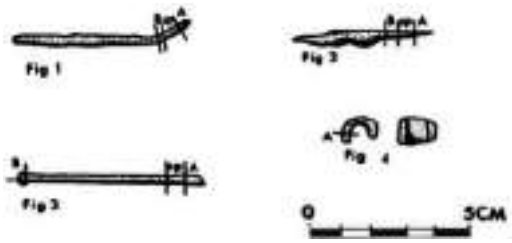
An early bead necklace found buried with a young woman in Level VIA at Catal Huyuk in Turkey (ca. 6000 BCE) was made of galena mineral (lead sulfide).

"The best evidence for the existence of a smelting technology comes with the use of lead, not copper. Native lead is extremely rare, so it is most likely that any ancient land artifact was made of lead smelted from various lead ores, including galena (lead sulfide), the most common lead ore and one that occasionally contained silver, This silver was extracted from the lead by a process known as cupellation. It is commonly argued that all metallic lead found in Bronze Age or earlier contexts was produced as the inevitable by-product of the recovery of silver. This cannot be correct, for many early lead artifacts contain too much trace-element silver for their lead ever to have been desilvered. The earliest known lead artifacts also come from a time that must predate the first use of the cupellation process. It has to be accepted that, in the Bronze Age and earlier, lead ores were being smelted in order to obtain metallic lead." (James D. Muhly, 1995, Mining and Metalwork in Ancient Western Asia, in: Jack M. Sasson, ed. 1995, *Civilizations of the Ancient Near East*, Vol. III, New York, Charles Scribner's Sons, pp. 1501-1521).[4]

By 3000 BCE the use of copper was well known in the Middle East, had extended westward into the Mediterranean area, and was beginning to infiltrate the Neolithic cultures of Europe .

Copper objects

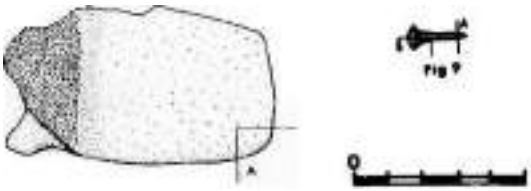
Tepe Yahya XC 3, 1973 is a small period VI (4,500-4,000 BCE) copper and 5.6 cm. In length X a maximum of .3 cm in width; the deformation visible in cross section indicates extensive hammering.



T. Yahya C-7-15, 1969 (fig. 8.2) is a pin, circular in cross section with a sharp and slightly deformed point. The section of the point area is deformed by cold hammering.

The knob-headed pin, XC 8b-40 (fig. 8.3), circular in cross section

T. Yhya C 115-3 1970 (fig. 8.4) is a copper bead fragment 1.1 cm in width totally corroded with malachite and cuperite layers.



Tepe Yahya flat ax, XC tt1-7 1970 (fig. 8.8) appears to have been cast into single-piece rod. It is 7.7 cm in length X 3.5 cm in width X .1 cm thick. The blade edge is wide and has rounded corners. Period VA (3500-3200 BCE). Copper nail, XC tt-2-2-5 1971 (fig. 8.9) is 1.6 cm in length X 1 cm in dia at the head X .05 cm in dia at the point. This nail, cast into shape and slightly retouched by hammering and annealing, was slowly cooled after the last anneal. All the metallurgical techniques used for the succeeding 2000 years were introduced at Tepe Yahya during this period. '…appearance of weathered native copper and copper-arsenides suggests the use of copper-arsenide minerals along with native copper. Native copper, which had been hammered, is documented in 5th and 4th millennia Iran. The use of copper-arsenic alloys during the first introduction of true metallurgy has also been documented here. The rapid spread of copper-arsenic mineral utilization throughout Iran attests to the success of the alloy, to experimentation and observation by the ancient smiths, and to the communication network of technological ideas/concepts of early 4th millennium Iran…Tin bronze…was present at Tepe Yahya only in 3rd millennium contexts and then in very limited quantities…Tin bronze was extensively used in the

contemporary Indus Valley civilization and in the preceding Nal Cemetery and Mundigak III contexts. The presence in period IVA at Tepe Yahya of an Indus seal impression and two etched carnelian beads is suggestive…The metal objects comprised both tools and ornaments, with tools predominant.' (pp. 259-261).

Copper bracelet with a hook, XBE tt1-10 1973 (fig. 8.11) is roughly rectangular in cross section.More than 20 metal objects (pins – some elaborately decorated--, bracelets, decorative items, spatulas, nails and beads) were recovered from the context of Period IV C (3200-2900 BCE) which also saw the use of copper arsenic alloying.

Knife blade fragment, XBE tt1-2 1973 (fig. 8.23), measures 4 cm. In length and 7 cm. In maximum width; transverse section through the blade reveals a rounded blade edge. The blade was cast and then cold worked and annealed, was worked after the final anneal.

Large well-made projectile point, B-BW tt2-12 1970 (fig. 8.24) has a beveled blade edge and incised tang. There is also a slight midrib. IT is 10 cm. Long X 3.7 cm. In maximum width at the blade-tang junction. The incised decoration on the tang was cast with a piece and then grooves were chiseled out. Period IVA (2400-1800 BCE) saww the presence of two etched carnelian beads, a stamp-sealing on a sherd of Harappan script, and a Harappan terra-cotta cake with a stamp seal of a dancing cross-legged man. This latter material is the only evidence on the Iranian plateau which indicates contact and contemporaneity with the Sarasvati-Sindhu Civilization.

[Dennis Heskel and Carl Clifford Lamberg-Karlovsky, 1980, An Alternative sequence for development of metallurgy: Tepe Yahya, Iran, in: Theodore A. Wertime and James D. Muhly (eds.), *The coming of the age of iron*, New Haven, Yale University Press, pp. 229-265]

It wasn't until approximately 3800 B.C. that bronze was produced in Tepe Yahya, Iran from the accidental blending of copper with other metals. This new mixture exhibited better properties than copper alone. Metal workers quickly found that bronze was more durable and easier to cast than copper. They found it could be bent and reworked back into its original cast shape.

The most important development in the making of bronze was the evolution of the tin-copper alloys. Depending on the tin content, these bronzes provide a wide range of valuable properties, such as hardness, toughness, or ease of casting. To make them requires a deliberate addition of tin to the copper metal. To make a significantly valuable tin-bronze, about five percent of tin is required-more if various specific properties are desired. The tin can be introduced into the copper in several ways. The simlest method is by "cementation," i.e., adding tin ore of reasonably high grade to molten copper along with charcoal. The most controllable method is to add the tin as metal to the copper.

Tin is not widely distributed and is really a semiprecious metal. Tin hardly ever occurs "native" as metal. Its only really significant ore is cassiterite (SnO_2), which is normally a dull drab brown material that is difficult to distinguish from ordinary rock unless sensitive methods are used. Cassiterite has two specific properties that are useful for its separation and identification. It is very dense and if crystals of the ore are present it can have a bright sparkle because of its high refractive

index. Occasionally a lump of cassiterite is found in a lode, but this is not at all common. Rich ore holds about 5.0% metal, good ore about 2.0%, and skilled miners in western England work down to about 0.2% from stream detrital deposits. Tin also occurs in the mineral stannite (Cu2SnFeS4), but this is quite rare and is not considered an important ore. Tin ore is virtually always found associated in some way with an "acid"-high silica content-rock. The density of cassiterite ranges from ca. 6.99 to 7.0 g/cc, gold from 12.0 to 20.0 g/cc, and hematite (an iron ore [Fe203] that is found associated with the Turkish tin ore) 5.26 g/cc. The typical waste-gangue-minerals with this ore are quartz, 2.65 g/cc, and calcite, 2.71 g/cc. These densities indicate the relative ease of separation by a "washing" process. There are considerable similarities in the initial stages of the mining and dressing (concentrating) of tin and gold. Similar to gold, cassiterite is usually found entrapped in gangue mineral if it is in the original lode containing the ore. A lode occurs like the cheese in a sandwich, where the cheese is the orestuff and the bread on either side the surrounding country rock. The lodestuff has to undergo several treatments. To be worked it must first be mined out, crushed to release the valuable material, and then dressed, usually by using moving water to displace the lighter gangue minerals leaving a rich head of the heavy particles of cassiterite or gold.

If the tin-gold ores have been broken down out of the lodes by weathering, the material is often carried to a stream along with the gangue, usually in gravel or sand-like debris. Often the ores can be obtained by washing, but in some cases crushing is needed to release them.

The washing can be done in a number of ways. Using a pan or similar vessel such as conical bowl-a batea-is one method, or the orestuff can be thrown into running water flowing in some form of trough or inclined plane, often with a prepared surface so that the heavy ore particles settle out of the water apart from the waste. In very dry districts winnowing can be used to make an initial separation.

A much used assay for cassiterite developed in western England's metalliferous region: a powdered sample of orestuff is swirled with water on the blade of a shovel and then given a series of upward flicking motions. The heavy cassiterite is tossed up through the water and appears as a crescent shaped patch at the top of the charge with the lighter waste below. The size of the cassiterite head indicates the richness of the ore. This technique, known as "vanning," was still in use at a major tin mine until 1985. It was a highly practical assay. It had the advantage of separating the cassiterite that could actually be recovered by washing techniques. A skilled vanner can detect down to 0.1% cassiterite in the lodestuff. The introduction of the very effective tin flotation dressing method has shown that vanning undervalues the ore.

(Extracts from the article which originally appeared in The Oriental Institute News and Notes, No. 146, Summer 1995, and is made available electronically with the permission of the editor. *Tin Smelting at the Oriental Institute*, By Bryan Earl, Metals Specialist, and K. Aslihan Yener, Assistant Professor, The Oriental Institute and the Department of Near Eastern Languages and Civilizations The University of Chicago)

[The winnowing etc. processes are reminiscent of the Soma processing described in the Rigveda. See lexemes in the link and interpretation of Soma as electrum by Kalyanaraman in his forthcoming book (in press): *Indian Alchemy, Soma in the Veda*, Munshiram Manoharlal, Delhi.]

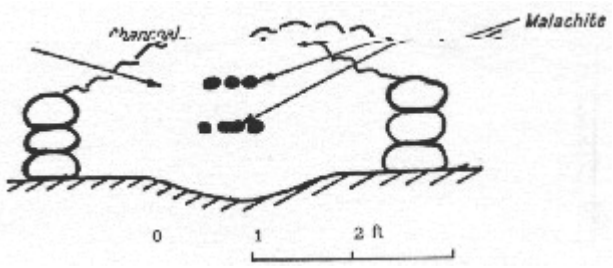
"In the ancient Near East... when working gold by streaming, nodules of cassiterite (or tin-stone SnO2) were found. This cassiterite was reduced by workers already proficient in the production of gold, silver and lead. The metal obtained was held to be a kind of lead. [In Sanskrit, the term for lead is: na_ga. In

Akkadian, the term for tin is: anakku). Lead and antimony were already used to increase the ease with which copper could be cast, but neither of them improved in its other qualities, notably the tensile strength. From trials with the new kind of 'lead', it would be learnt that this mixture was now improved in tensile strength as well as in ease of casting. Nor was it necessary to produce this new metal first; unrefined copper had only to be smelted with charcoal and stream-tin to produce a new kind of 'copper' (ayas in Rigveda), namely bronze, with superior qualities for tools and weapons. At the same time, certain naturally mixed ores were also worked, and were found to give the better kind of 'copper' directly. We have no proof that the tin compound of these mixed ores was ever isolated or recognized. Furthermore, at this early stage the tin content of the bronze could not be adequately controlled, and therefore varied between fairly wide limits." (Adapted from: R.J.Forbes, 1954, Extracting, smelting and alloying, in: Charles Singer, E.J.Holmyard and AR Hall (eds.), 1954, *A History of Technology*, Oxford, Clarendon Press).

Arsenic alloying preceded tin alloying in West Asia. Tin alloys started in Iran only during the third millennium B.C. Lollingite (FeAs2) samples were found in Nal (Southern Baluchistan). It is likely that arsenic might have been used both as hardener of copper and as a deoxidiser. Lead was used as a flux. Tin has always been found as an alloy with copper in almost all the sites of the civilization during the mature-Harappan phase. The percentage of tin in bronze averages from 6 to 13 percent (MIC, I, 30).

Words for Copper

Open fire as an experimental copper-smelting hearth. Tylecote, 1962, p.26. Charcoal will burn to carbon monoxide and malachite will be reduced. Roasting and melting process may have to be repeated until practically pure cuprous sulphide is obtained from copper pyrites, a mixed sulphide of copper and iron. The 'matte', that is, the copper sulphide, when sufficiently freed from iron, may be dead roasted; converted into the oxide and then reduced to the metal with charcoal.(After Fig. 1 in H.H. Coghlan, 1975, *Notes on the prehistoric metallurgy of copper and bronze in the old world*, Oxford, OUP).



"...the studies which have appeared on the subject of Bronze Age trade have been severely limited in scope, both chronologically and geographically. They have been written principally by archaeologists, as philologists have shown a remarkable lack of interest in fields beyond grammar and lexicography, and they have been based upon the evidence beloved by all archaeologists, the typology and distribution of pots, figurines and metal implements. and weapons. The historian finds himself in a peculiar and precarious position. Being neither archaeologist nor philologist, he must still attempt in some way to master and utilize the data from both disciplines and to create from this data a meaningful historical synthesis which does justice both to the texts and to the pots...

"The basic ores of copper are classified as either oxide, carbonate, or sulphide. In brief, the principal ore minerals are oxide ores: cuprite (red oxide), melaconite; carbonate ores: malachite (green basic carbonate), azurite (blue basic carbonate); sulphide ores: chalconite (copper glance), covellite. There are also sulphide ores containing large amounts of iron, the main minerals being chalcopyrites (copper pyrites), bornite (peacock ore)...Technically, the sulphide ore must first be roasted in an oxidizing atmosphere, in order to produce a copper oxide. Then the copper oxide reacts with the copper sulphide to produce copper and sulphur dioxide. If the initial process is incomplete, thus producing a material known as *matte*, an impure mixture of copper and copper sulphide, this *matte* must be fully roasted to oxide and

reduced with carbon, like a simple oxide ore, to produce pure copper...it is now clear that sulphide ores were already being utilized by the fifth millennium BCE. They were used without any real change in the technique of refining the ore and the result was a copper contaminated with sulphur. Such crude copper or matte seems to be the 'black copper' referred to in Old Assyrian and Greek texts. [Note: It is likely that the reference to kr.s.n.a_yasa in Vedic texts may also refer to *matte*]. This means that the very earliest coppers will be the purest coppers, being either native copper or copper smelted from oxide and carbonate ores. (s'ya_ma_yasa)...

"Etymology has often been used to determine the origin of the metals used by a particular group of people, and even the origin of the peoples themselves. Unfortunately, such studies have only too often been based upon questionable philology and have proceeded with a total disregard for archaeological and historical considerations. They have been dominated by theories of substrate and proto-languages and by a common tendency to attribute consequences of major significance to the widespread migration of obscure peoples. The English word *copper* belongs to the same language family as German *Kupfer*, French *cuivre*, Swedish *koppar*, and Danish *Kobber* as well as many other words, all deriving from Latin *cuprum*...The original form is *cyprius*, an absolute form of the adjective *cyprius, -a, -um*, "of or pertaining to Cyprus." The form *cuprum* is an artificial formation in *-um*, based upon othe rmetal names in Latin, such as *aurum*, "gold", *argentum*, "silver", and *ferrum*, "iron"...The true explanation is not quite so simple...The common Greek word for copper is □□□□□s which now appears as *ka-ko* in the Myceneaean Linear B tablets. Also, the common Latin word for coper is not *cuprum*, but *aes, aeris*...It was only in the Roman period that the island (Cyprus) became famous for its copper mines. At that time there developed the expression *aes cyprium*, "Cyprian copper," which is found in Pliny. By ellipsis the expression *aes cyprium* becomes first *cyprium* and then *cuprum*, meaning simply "copper". [Note: these elaborations apply equally to the Vedic word: *ayas*, copper]...the word □□□□□s may be a name for metals in general, rather than for any specific metal. This is suggested both by a possible connection with Proto Indo-European **ghel (?)gh-*, "Metallbezeichnung," and by the use of the world itself in Greek texts. Greek does not distinguish between copper and bronze, using □□□□□s for both, but it does seem that □□□□□s originally designated copper and arguments based upon the precise meaning "bronze" are open to question. Latin *aes*, and such related words as Gothic *aiz*, go back to a reconstructed Proto Indo-European **ajos*, which again designates "copper," "bronze," and "metal" in general. The related Sanskrit form *ayah*, also designates 'metal' and seems to represent 'iron' in particular [Note: an erroneous reconstruction by Mayrhofer]. (Mayrhofer, M., *Kurzgefasstes etymologisches Worterbuch des Altindischen*, I, Heidelberg, 1953, p.46). The word **ajos* has played a major role in various arguments relating to the question of the original homeland of the Indo-European peoples. It is supposed to represent one of those elements such as the beech tree, the salmon, and the turtle, present in the original homeland. (A. Nehring, in *Die Indogermanen und Germanenfrage, Neue H'ege zu ihrer Losung*, Salzburg, Leipzig, 1936; A. Scherer, *Kratylos*, X (1965), 1-24). **Ajos* has been compared with *i_sarnon*, the Celtic word for iron, but this is probably false. (E. Benveniste, *Celtica*, III (1956) 279-283. Benveniste argues that **i_sarno-* means 'the divine (metal)' and that the word is related to *aisar*, the Etruscan word for god)...(For a list of the words for copper in the modern Indo-European languages see J.R. Marechal, *Ogam*, XVIII (1966), 203-211, p. 209). In the effort to establish a background for **ajos* it was suggested that it must be related to the name *Alas'iya*, thought to be the name of the island of Cyrpus in the second millennium BCE. Both *Kypros* and its predecessor *Alas'iya* were assumed to mean the 'Copper Island'. (see G. Dossin, *Academie Royale des Sciences des Lettres et des Beaux Arts de Belgique, Classe des lettres et des sciences morales et politiques, Bulletin*, 5 Serie, XXXV (1949) 310-315)....As already pointed out above, the foundation of the argument is false, as *Kypros* has nothing to do with copper. The superstructure is equally false. It is now recognized that Egyptian **-es-ja (*or *'i-s-y)* as, *Ajasja* is now transcribed, and *'a-la-s'a* (or 'i-r-s') *Alas'iya*, represented two distinct countries, and that neither one has any connection with copper. (A. Nehring, opcit., p.30)...The Proto Indo-European **ajos* seems to go back to a period when it was not necessary to distinguish between the various base metals. As copper was the first basic metal, **ajos* must originally have stood for 'copper'. Then, as first bronze,

and finally iron became the predominant metal, the meaning of **ajos* and its derivatives, was expanded to include these new materials...

"The Hittite word for copper is *ku(wa)nnan-*. [J. Friedrich, Hethitisches Worterbuch, Heidelberg, 1952, p. 122, s.v. *kuuanna(n*)]. It designates objects made of copper, alternating with Sumerian URUDU, and also appears in lists which combine metals and precious stones. But *ku(wa)nnan-* also appears with the determinative for stone (Sumerian NA4) and clearly designates a substance from which beads are made, beads which are even engraved. This suggests a comparison with Greek *kyanos*, a dark blue glass-paste used as a substitute for lapis lazuli...Are *ku(wa)nnan-*, 'copper', and *ku(wa)nnan-*, 'blue glass-paste' accidental homonyms or are they somehow related? It may be that the common factor here is the blue color. This could mean that the Hittites first obtained their copper from the blue basic carbonate ore called azurite and also that the Hittite scribes recognized that such copper salts contributed the blue color to the glass-paste mixture...The Hittite word for bronze is *haras'u-*, a word of unknown derivation...

"The Sumerian and Akkadian cuneiform texts provide extensive evidence for the distinction between copper and bronze, but the words involved give no indication of the source of the metals in question. The Sumerian URUDU (better URUD), 'copper', is said to be derived from an original *BURUDA, which is supposed to mean 'mine'. However, there is no evidence to support such an etymology...The Akkadian *eru (<werium)*, 'copper', has been compared with *ma_t H'arium*, known as an early Old Babylonian name for the kingdom whose capital was at Es'nunna...As for *eru*, it has been associated with Eridu, the name of the oldest Sumerian city. None of these proposals can be taken seriously...Nothing more is known about the words for bronze. Sumerian *zabar* (<*sipar*), Akkadian *siparrum*, could perhaps be related to the name of the city of Sippar...Finally, it should be pointed out that a lack of distinction between copper and bronze is characteristic of the Indo-European languages, while all the languages of the Ancient Near East make a distinction between the metal and its alloy. This suggests that bronze developed early, and first became imortant, in the Ancient Near East...In Europe, bronze was rather a late-comer and was not known to the early inhabitants. This is also the reconstruction suggested by the archaeologicla evidence...

Coppper from Meluhha

"The lexical series HAR-ra-hubullu contains the following section:

urudu Ni.TUKki til ma nu u
urudu NI.TUKki-as nu u
urudu ma-gan-na ma ak ka nu u
urudu me-luh-ha me luh hu u
(The reference to three lands: Tilmun, Magan, and Meluhha, are associated with copper)...

"The main copper deposits in Afghanistan are in the Shah Maksud mountain range. There is also copper in India and in Baluchistan. The major copper deposits seem to be those in the region of Rajasthan, east of the Indus river. Yet the general opinion has long been that metallurgy never really caught the imagination of the craftsmen of the Indus Valley and that the area was never a significant metal working center. This is the interpretation given by Sir Mortimer Wheeler:

Copper seems never whole heartedly to have occupied the genius of the Indus craftsmen; as a relatively costly import, it was used with economy, although, in addition to implements, bowls, cups, and dishes were sometimes made of the material. The ore may have been obtained overland from Rajasthan or from Afghanistan, but supplementary imports by sea may be suspected, and tin was almost certainly introduced in this manner.

...This is also the opinion of C.C. Lamberg-Karlovsky[5], who believes that the copper used in the Indus Valley came from the Oman area in the Persian Gulf.

"However, it is now realized that metallurgy developed quite early in the region and there seems to be a relationship between known centers of metallurgy and known mineral deposits. Of all the areas bordering on the Indus river, Afghanistan seems to be the richest in mineral deposits and it is here that the first evidence of metal is to be found. At Mundigak in southern Afghanistan, metal first appears in level I4, in a context to be placed at the end of the fourth millennium BCE...The early appearance of tin-bronze at Mundigak reflects the existence of tin deposits in Afghanistan.

"It is in the Harappan period proper that the relations with Sargonic Mesopotamia are firmly established and the references to the ships of Meluhha appear in the Old Akkadian royal inscriptions...In the Harappan period metallurgy seems to have been introduced fully developed at such sites as Harappa and Mohenjodaro. The existence of copper, tin, and bronze are amply attested by copper and tin ingots from Harappa and bronze ingots from Chanhu-daro. Bronze is used not only for weapons and implements, but also for figurines. The bronze dancing girl from Mohenjo-daro, cast by means of the cire perdue process, is the most famous. In addition to tin, some of the Harappan metal objects, especially those from Harappa itself, have a high arsenic content.

"The archaeological evidence suggests that Mohenjodaro was an actual center for the manufacture of metal objects. A brick-lined pit containing copper ore was excavated there and this has been interpreted as a reducing pit for copper. From Harappa comes a furnace with channels through which a bellows must have forced a blast of air. From the Harappan levels at Chanhudaro come stone moulds for the casting of flat axes. Yet is maintained that, while the metal may have been melted and cast at the major Harappan sites themselves, the metal itself, and perhaps even the raw copper ore, was imported from the outside. The reason for this is that the copper and bronze objects from the Harappan civilization have a high nickel content. The presence of nickel as a trace element is said to mark the use of a copper ore from the Oman region.

"The actual significance, or better, the lack of significance of the presence of nickel as a trace element has already been discussed. The basi cpoint is that nickel is so common that it cannot possibly be used to identify an ore from a specific source...The excavator (of Lothal) S.R. Rao states:

The occurrence of bun-shaped ingots with 96.46% to 99.8% Mohenjodaro and Lothal suggests that copper was imported from sources, among which may be counted Susa and Oman. Bun-shaped ingots were found on third- to second-millennium sites in Oman (Hauptmann et al. 1988: 41, fig. 4:6); this is the shape in which Omani copper was traded in the Near East. Five circular bun-shaped ingots of copper were included in the mid-third-millennium BCE 'Vase a la Cachette' excavated at Susa. They have been associated with ingots of this shape found in the Gulf and in Indus Valley settlements (Tallon 1987: nos. 687-92, pls. 262-4). Two bun-shaped ingots were found in a contemporary context at Tell Chuera in Syria (moortgat and Moortgat-Correns 1978: 66ff., fig. 29a-b). Oxhide-shaped ingots were characteristic of the Mediterranean trade in copper in the Late Bronze Age.

"...North of Lothal are the copper mines of Rajasthan. Communication between Rajasthan and Lothal is by means of the great Sabarmati river. Between Rajasthan and Lothal is the province of Gujarat. D.H.Gordon suggeste that the distribution of Harappan sites along the Sabarmati river reflected the importance of the copper from Rajasthan. This suggestion can now be amplified on the basis of the material from the excavations at Rangpur in Gujarat...the ingots from Lothal show a high purity with no trace of arsenic present. The same lack of arsenic is characteristic of the bronzes from Rangpur...it is interesting that the province of Gujarat has been identified as the Meluhha of the Mesopotamian cuneiform texts. This would mean that references to the copper of Meluhha refer to the copper of

Rajasthan shipped to Mesopotamia through the port of Lothal. Such a suggestion demands a trade which is the exact opposite of that generally held today. It would present Lothal as a port engaged in the export of copper whereas, as pointed above, it is generally assumed that Lothal served as a port for receiving copper imports...The name Meluhha, as used in these (cuneiform) texts, refers not to any particular deposit of copper ore, but to the area of the port from which this copper was shipped to Mesopotamia. The best evidence at the present time for such a port is said to come from the excavations at Lothal in the Gulf of Cambay..." (J.D. Muhly, 1973, *Copper and Tin*, Hamden, Connecticut, Archon Books, pp. 168-179; 121).

Antennae swords

Many types of Copper Hoard objects have been found: 1. anthropomorphic figure, Sheorajpur; 2,3. antennae swords, Fatehgarh; 4,5. harpoons, Sarthauli and Bisauli; 6. ring, Pondi; 7. hooks.

"Casal expressed his private expectation that in course of time a Copper-Bronze Age civilization would be discovered in South India…At the Fourth Conference of South Asian Archaeologists held at Naples in July 1977, V.I. Sarianidi showed an illustration of a copper or bronze sword, acquired in Kabul, but almost certainly emanating from the Dashli region of north-west Afghanistan. This piece has a form which is almost identical to that of one of the common types found in the Doab copper hoards. It is 50 cms. Long, with maximum blade width of 4 cms. And width of antennae of c. 3.25 cms. Both the length and ratio of length to width of antennae are well within the range of the Indian specimens. The discovery of this piece must in our view increase the probability that the Indian series as a whole show evidence of some sort of contact with northern Iran or the Bactrian region." [F.R. Allchin, A south Indian copper sword and its significance, in: : J.E. Van Lohuizen-de Leeuw, 1979, *South Asian Archaeology 1975*, pp. 106-118).

"Thermoluminiscence (TL) dates for the Ochre Colour Ware (OCW/OCP) from four sites, viz., Atanjikhera, Lal Qila, Jhinjhana and Nasirpur, in the Ganga-Yamuna valley indicate that these sites may have been contemporary, if somewhat late, with many of the Harappan settlements in the west. Of the eight TL dates, three fall between 2500 BCE and 2000 BCE, three between 2000 BCE and 1500 BCE and only two are slightly younger than 1500 BCE. At saipai, a site further southeast of Atranjikhera, this pottery has been demonstrated, by means of an excavation, to have been associated with the well-known Copper Hoards. While Saipai yielded some of the key-types, viz. harpoons, anthropomorphic figures, hooked spearheds, etc., the other types falling in this category are: antennae-hilt swords, simple as well as shouldered axes, bar-celts, rings. In this context it is worth recording that from the point of view not only of their typology, but also of metallic composition and manufacturing techniques, these Copper Hoards stand quite apart from the Harappan metal tools.

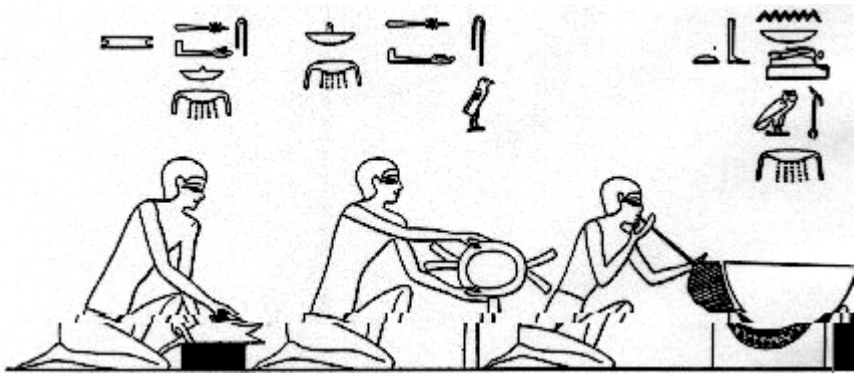
"Ganeshwar in Sikar District of Rajasthan. The area, well known for its Khetri group of copper mines, is drained by several rivers, one of which, viz. Ka_ntli_, seems to have joined the Chauta_ng in ancient times, and another, the Sota_, provides a link with the Yamuna_ via the Sa_bi_. These mines seem to have been exploited since antiquity and may well have provided copper to the Indus civilization.

"A chance find of as many as sixty copper celts at Ganeshwar led to an excavation, as a result of which not only more celts but chisels, spearheads, arrowheaqds, bangles and spiral-headed pins were also found, some of which are reminiscent of the Harappan types (Agrawala, RC and Kumar 1982). It must, however, be stated that, though black-on-red, the Ganeshwar pottery does nto fall in the Harappan category. Likewise, the absence of any typical Copper Hoard artifacts, such as the harpoon or the anthropomorphic figure, keeps Ganeshwar apart from the Hoards. As to the chronological horizon, the excavators assign the Ganeshwar complex to the second and third quarters of the third millennium BCE.

"Southwest of Ganeshwar, at the tail end of the Aravallis, are Ahar, Balathal and Gilund yielding a chalcolithic complex characterized by a white-painted black-and-red ware…Ahar has been known as Ta_mbavati Nagari, i.e.a 'Copper city', which implies local copper smelting, of which the excavation also gave some evidence (Sankalia et al. 1969). Radiocarbon dates from Ahar and Balathal place this culture between c. 2500 BCE and 1500 BCE…Bagor in District Bhilwara (Misra 1973), goes back to the mesolithic times (Period I), for which four radiocarbon dates, ranging from 5232 BCE to 3353 BCE are available, the site continued even upto the Iron Age. During Period II, which may be placed in the third millennium BCE, copper tools, including three hollow-based arrowheads and a broken spearhead, were found." [B.B. Lal, 1997, *The earliest civilization of South Asia*, Delhi, Aryan books International, 23-25].

Silver

According to Ratnagar, "thre was no indigenous production of silver in India until a fairly late period, and that the Harappan silver came from Mesopotamia." (Ratnagar, Shireen, 1981, *Encounters*, Delhi). Chakrbarti disagrees: "This statement does not appreciate the extent to which we have argentiferous galena in the lead-zinc deposits of Zawar and Agucha in Rajasthan. Besides, silver deposits are found as early as Nal." …[Dilip K. Chakrabarti, 1990, *The External trade of the Indus civilization*, Delhi, Munshiram Manoharlal Publishers Pvt. Ltd., p.143].



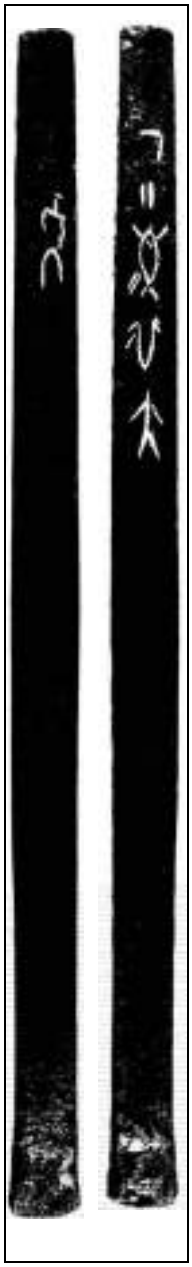
Egyptian goldsmith at work. Detail from grave-relief at Sakkara, mid-third millennium BCE. Smelting and kindred processes were developed in Egypt during the fourth millennium BC, including the use of blow-pipe to attain temperatures of just over 1000 F needed to melt electrum ores. Beaten thin sheet of gold was 'plated' on to stone or wood in pre-dynastic times. Early third millennium BCE saw the development of furnaces for smelting.

Cementation to assay silver

http://members.xoom.com/mspong/metallurgy.html "The cupel must be heated red-hot for half an hour before any metal is put upon them, by which all moisture is expelled. When the cupel is almost white by heat the lead is put into it, and the fire increased till the lead becomes redhot, smoking, and agitated by a motion of all its parts, called its circulation. Then the silver is to be put on the cupel, and the fire continued till the silver has entered the lead; and when the mass circulates well, the heat must be diminished by closing more or less the door of the assay furnace. The heat should be so regulated, that the metal on its surface may appear convex and ardent, while the cupel is less red; that the smoke shall rise to the roof of the muffle; that undulations shall be made in all directions; and that the middle of the metal shall appear smooth, with a small circle of litharge, which is continually imbibed by the cupel. By this treatment the lead and alloy will be entirely absorbed by the cupel, and the silver become bright and shining, when it is said to lighten; after which, if the operation has been well performed, the silver will be covered with rainbow colors, which quickly

undulate and cross each other, and then the button becomes fixed and solid.The diminution of weight shows the quantity of alloy. As all lead contains a small portion of silver, an equal weight with that used in the assay is tested off, and the product deducted from the assay-weight. This portion is called the witness. - Richardson's *Metallic Arts.*"

http://www.library.upenn.edu/etext/smith/ercker/index.html#TOC See also Ercker's Treatise on mineralogy and metallurgy (1598) [A self-stoking furnace for cementation] [Furnaces for reducing calcined copper matte and alloying with lead for direct casting of liquation cakes] [Crucibles and molds for parting gold with antimony] [Furnaces for the fusion assay of copper ores] [Furnace for melting copper and lead, and casting liquation cakes] Furnaces for roasting and quenching gold ores] [Multiple muffle furnace for refining silver on tests]



"Historical Development

"Perhaps as early as 4000 BC, metalworkers in the Middle East discovered that certain copper ores could be heated to produce a metal that was harder than copper, had a lower melting temperature, and was easier to cast. The ores contained tin and the alloy produced was bronze. The Bronze Age was born.

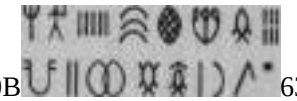
"By 3000 BC copper-arsenic, copper-gold, and lead-tin alloys were also in use. Brass, made from copper and zinc ores, appeared between 2000 and 1000 BC, but was not important until the Romans began to use it to make coins in about 200 BC. Great progress in metallurgy occurred under the Roman Empire. Medieval alchemists, attempting without success to transform other metals into gold, found many new alloys."(*Compton's Encyclopaedia Online*)

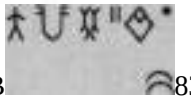
Indigenous technological framework

From the archaeological record, a substantially indigenous technological framework is apparent for the cultural development of the Sarasvati Sindhu River Basins. The archaeological record also provides evidence for close contacts, across the Persian Gulf, with the Mesopotamian civilization area ca. 3300-1500 BCE. Pre-urban settlements in the plains of the Sindhu in Sind province, the Sindhu and her tributaries in Punjab and the Sarasvati in the Marusthali_/Cholistan desert, in Rann of Kutch, in Saura_s.t.ra region, of Gujarat and close to the Gulf of Khambat, provide the context of the Civilization of Bha_rata, a process which began in the first half of the fourth millennium BCE.

Inscribed weapons and tools

c-39A1c39A2  Sign 214 (turned vertically, to look like an X with top and bottom lines, similar to the sign which occurs on Anau stone seal) and Sign 211

c40Ac40B  6306 [Mahadevan corpus Text Number]

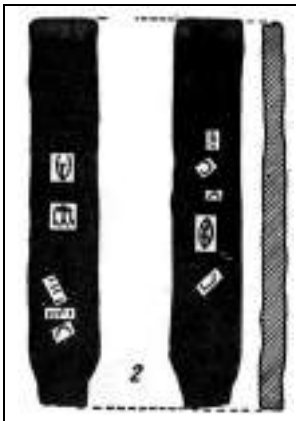
k121Ak121B  8302

k122A  k122A2  8301

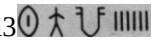
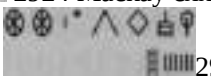
Mackay, E., 1943, *Chanhu-daro Excavations*, 1935-1936, American Oriental Society, New Haven, Connecticut]

Chanhu-daro Ivory comb with dotted circles. Chanhudaro. [After Mackay, 1943; Fig. 4, Pl. XCI.]

Linga-stone. Chanhudaro [After Mackay, 1943; Fig. 11, Pl. XCI.]



Mackay cxxvi2  2923

Mackay xvi3  2924 Mackay cxxvi5  2925

Mackay cxxvii1 [Four slanted strokes; 7 short numeral strokes]

[See: J.S. Pettersson, 1999, Indus Numerals on Metal tools, in: *Indian Journal of History of Science*, 34(2), pp. 89-108. "By internal evidence, then number of times a numeral can occur in sequence appears to be bound by eight. That is, if the different numerals together formed a system, as supposed here, that system was octal…it demolishes the hypothesis that the numerals represent weight units, at least the common units described by Hemmy (1938)."

Hemmy, A.S., 1938, System of Weights, in Mackay, 1938, pp. 601-612.
Hemmy, A.S., 1938, Appendix II. Relations to Egyptian and Susian Weights. In Mackay, 1938, pp. 672-678.
Mackay, E., 1938, *Further Excavations in Mohenjodaro*, Vol. I and II

Chanhu-daro. Buildings of Harappa_ II occupation, from north-east. [After Mackay, 943; Fig. , Pl. XV.]

Chanhujo-daro. Models of chariot-box (copper/bronze), wheels, cart-frames. After Pl. LVIII, Mackay, 1943.

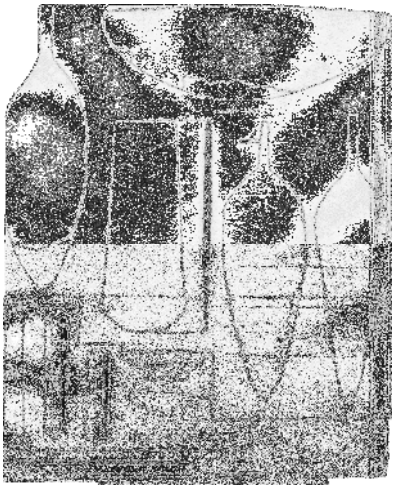
Copper and bronze tools and utensils.

Chanhujo-daro. **Item 1 is an axe blade with inscription on both sides.** After Pl. LXXIV, Mackay, 1943.

Copper and bronze implements and utensils. Chanhujo-daro. After Pl. LXXV, Mackay, 1943.

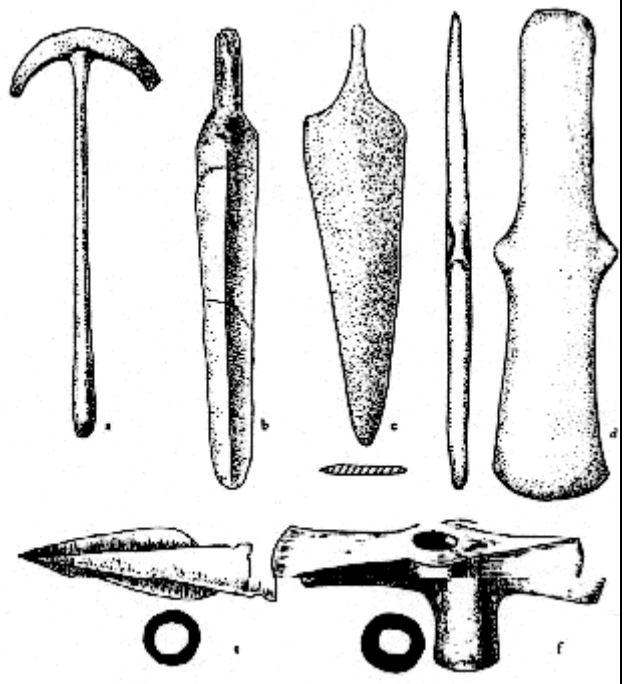
Copper and bronze implements and tools. Chanhujo-daro. After Pl. LXXVI, Mackay, 1943.

Copper and bronze tools and weapons. Chanhujo-daro. After Pl. LXIII, Mackay, 1943.



Copper and bronze tools and weapons. Chanhujo-daro. After Pl. LXII, Mackay, 1943.

Copper and bronze objects. Chanhujo-daro. After Pl. LXXIII, Mackay, 1943. [Ernest J.H. Mackay, 1943, *Chanhu-daro Excavations, 1935-36*, New Haven, American Oriental Society].



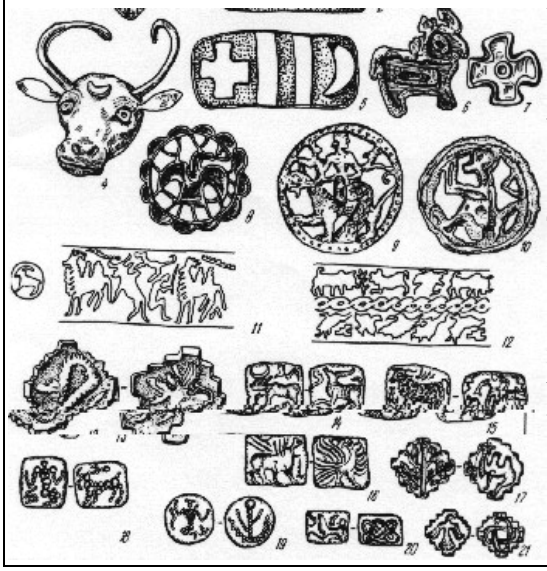
"...there is some ground to infer that the discovery of extraordinarily rich copper objects belonging to the Ganeshwar culture in a copper-rich area of the Aravallis in northeast Rajasthan underlines in some way this increased use of raw materials. This culture certainly belongs to the first half of the

third millennium BCE. Among other things, the Ganeshwar-type of artifacts have been found in the early Harappan assemblage at Kalibangan and at the mesolithic level at Bagor in southeast Rajasthan. The point is that this small site in Rajasthan yielded more than a thousand copper artifacts and there are forty-six Ganeshwar-type sites in the list prepared by J.P. Joshi, Madhu Bala and J. Ram (1994). The presence of reserved-slip ware at these sites strongly suggests a Harappan link, and I infer that, beginning with the early Harappan level, this area of Rajasthan was a highly flourishing centre for copper metallurgy and that its relationship with the early Harappan level at Kalibangan and probably beyond, as far as Cholistan, supports my assumption of craft-specialization as a distinct variable leading to the emergence of the Indus Civilization." (Dilip K. Chakrabarti, 1995, *The archaeology of Ancient Indian Cities*, Delhi, OUP, pp. 51-52).

Independent centres of metallurgical production in the early Bronze Age of Turkmenistan are seen in the settlement of Khapuz depe where copper smelting furnaces were uncovered (Sarianidi 1976: 82-3). Pottier believes that the influence of the Indus can be detected in BMAC (Bactria Margiana Archaeological Complex) metalwork.

Weight in the Form of Standing Bull Provenance Bactria; Period Late 3rd - early 2nd millennium BCE; Materials Lead; Dimensions H-26 W-32.4
http://www.miho.or.jp/booth/html/doccon/00001220e.htm

Metal artifacts of the Bronze Age from southern Turkmenia. a,c.d Altin-depe; b Anau; e Ashkhabad; f Daina (After fig. 30 in: V.M. Masson and V.I. Sarianidi, 972, *Central Asia: Turkmenia before the Achaemen**ids*, New York, Praeger Publishers) Lead and arsenic was often added to the bronze. Some objects from Namazga-depe contained as much as 8-0 lead and in one case the artifact was even made of brass (an alloy of copper and zinc). Twin moulds were used for casting; precious metals including gold and silver were also used. There are analogies of metal artifacts in the Harappan assemblages; for example, flag daggers without a midrib which were quite atypical for Hissar, were very widespread both in southern Turkmenia and in the Indus Valley.



Artifacts including golden head of bull. Southern Turkmenia, Margiana, Bactria: 4-7 golden head of bull and seals from Altyn depe (Developed Bronze Age); 8-21 seals and amulets of

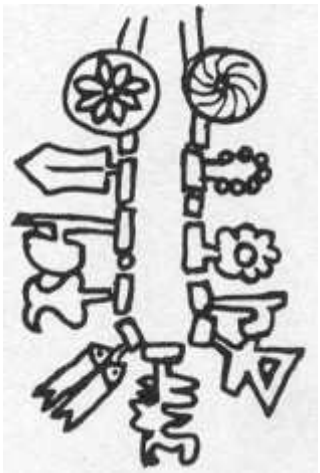
Bactria and Margiana (After Fig.4 in L.P'yankova, Central Asia in the Bronze Age: sedentary and nomadic cultures, in: *Antiquity* 68 (1994): 355-372).4.4 golden head of a bull with a turquoise sickle inlaid in the forehead; 4.5: steatite plate with an image of cross and half-moon.

Map of Central Asia during the Bronze Age

Tradition of sacred weapons

Iconography of weapons and epigraphs on weapons

In the development of Indian iconography, a notable feature is the weapons – a_yudha_ni -- which adorn many deities. The story of Indian art and architecture can be told by an analysis of the evolution of weapons and accoutrements of the s'ilpa's and the adornments on ancient buildings, temples and be_ra (mu_rti or idols) carved in stone and moulded in bronze. Bha_rat Kala_ Bhavan of Banaras Hindu University, Varanasi has a collection of arms and armour in the Indian tradition, mostly dated between the 16th to 19th centuries AD. It is no coincidence that the inscribed objects are mostly relatable to the products made by armourers -- weapons and equipment of a warrior. It appears that the archaeology and philology related to these objects are testimony to the battles and wars recorded in the R.gveda and the Maha_bha_rata. The inscribed objects were thus either bills of lading containing the products of the armoury or lists of weapons and accoutrements of a warrior or of a metalsmith who possessed the inscribed object. The recording of property transactions on copper plates is an ancient Indian historical tradition. It appears that this is a legacy of the practice of the armourers of the Indian civilization at Mohenjo-daro recording the weapon lists on copper plates. There are also inscriptions incised on arms themselves (on copper blades, on knives, on bronze rods) -- a process which could have been accomplished only by metal-workers. Many products made by armourers were traded in neighbouring civilizations, in Mesopotamia, in particular. The tradition of Bha_rata records the events related to battles and wars in the Great Indian Epic, the Maha_bha_rata and also in the R.gveda. The tradition also dates the start of the Kaliyuga from 3012 BC, a date close to the great war recorded in the epic. The war was fought on the banks of the River Sarasvati. It is on the banks of the same river system (including the tributary S'utudri_), archaeological sites such as Rakhigarhi, Banawali, Kunal, Kalibangan, Rupar and Dholavira have yielded inscribed objects containing many pictographs (over 100 field symbols) and signs (over 400).



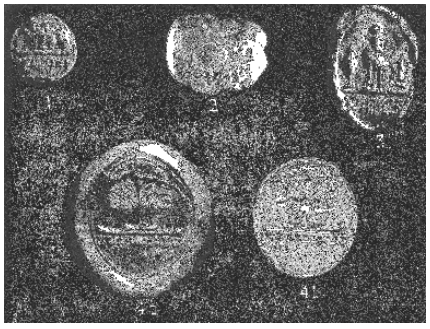
Mahis.a_suramardini. North India, 5th cent. AD, Reddish-brown terracotta, 9.6 X 12 cm. MIK I 10143. Note the sword in Durga_'s right hand and the shield on her left. The two symbols adorn, as pendants, the as.t.aman:galaka ha_ra of the Sa_n~ci yaks.i.

"This female figure armed with sword and shield, is a depiction of Durga_. In popular myths she is described as an annihilating (mardini) godess who destroys the buffalo demon (Mahis.a_sura). The figure of Durga in the act of slaying the buffalo demon is always depicted with many arms. From the Gupta period onwards, she is shown holding weapons than in earlier images. The bow and arrow, especially the trident (tris'u_la), and as in this image, the sword and shield, are her typical attributes. A terracotta find depicting the Mahis.a_sura-mardini theme dating from the 1st cent. BCE (Srivastava SK 1996,*Terracotta Art in Northern India*, Delhi: 231) establishes that Durga images are among the oldest in Hinduism. Nonetheless, as with many other deities, the full iconography of the godess evolved only in the Gupta era. The presence of a large number of images underline the great popularity of this godess. For a devout Hindu, the subjugation of the buffalo-demon, the embodiment of dark forces, symbolizes, above all, the triumph of good oveer evil, and it is still celebrated in many regions of India in a festival lasting ten days (Navara_tri/Durga_-Pu_ja). This small, sculptured image is remarkably expressive. Using simple means, this artist has focused on the terrifying and powerful aspects of the godess, which, by no means, are characteristic of all Durga images. Durga manifests not only the female energy of S'iva but is also the ruler of the mother godesses (Ma_tr.ka-s), who are normally described as malevolent divinities. Durga creates them on the battlefield during her combat with the demons." (*Treasures of Indian Art: Germany's Tribute to India's Cultural Heritage*, 1999, Delhi, National Museum, Roth, G., Fig.31)

Dagger-shaped pendant, ivory, Taxila, 4th-3rd centE. BC: 4.8 cms. One one side of the blade there are decorations of deeply cut parallel lines and two dotted circles. The obverse is plain. The handle has a small hole for suspension (After *Taxila*, III, pl. 199, no. 14). Most pendants of bone or ivory found are dagger-shaped pendants. Two such specimen are assigned to the Bhir mound. (After *Taxila*, II, p.654; III, pl. 199, nos. 13 and 14). Other specimen are from Sirkap and Hathial (ibid., nos. 15,16). A dagger-shaped pendant made of bone measures 4.7 cm. One side is incised with six dotted-circles on the handle and on the blade. The handle has a hole for suspension. (ibid., no. 13).

This pendant is comparable to the dagger-shape shown as a pendant on the as.t.aman:galaka-ha_ra depicted in the sa_n~ci yaks.i sculptures.

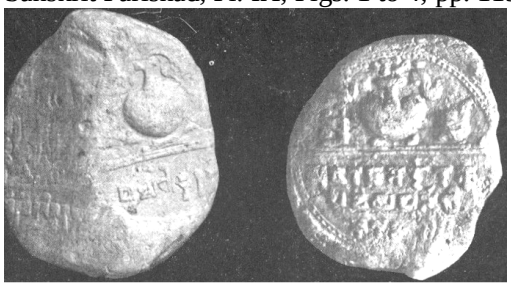
Sealing bearing the device of a lion and the legend Sena_pati In(dra)..., Bhita, Indian Museum, Calcutta, no. A 12247-NS. 1446. In front of the lion is the symbol, s'ri_vatsa.



1. Sealing of Dan.d.ana_yaka Satya (vrata?), Rajghat, Bharat Kala Bhavan, no. 6372; 2. Sealing of Dan.d.ana_yaka Anuttara, Rajghat, Bharat Kala Bhavan, no. 6376; 3. Sealing of Dan.d.ana_yaka S'an:karadatta, Bhita, Indian Museum, Calcutta, no. A. 11227-NS 1547; 4a. Seal of Dan.d.ana_yaka Ksa (Ska)nda, Rajghat, Dept. of AIH, C and Arch., BHU, no.1; 4b.

Plasticine impression of (a).

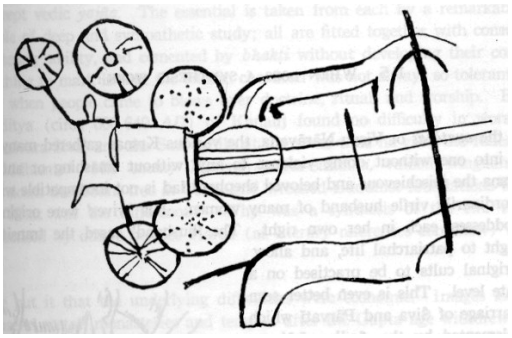
Notes: "Several clay seals and sealings from Rajghat belong to a class of officers known as dan.d.ana_yaka-s...The letter (on 4a)*ksha* is, in all probability a mistake for *ska*. The peacock, va_hana of the god Skanda, was appropriately chosen by the namesake. Another sealing from the same site with a chakra flanked by a spear on the left aqnd a crescent on the right has the legend Dan.d.ana_yaka Anuttarasya in early Gupta characters (pl. IX,2). A third of the same provenance shows a bull recumbent on the left and the legend Dan.d.ana_yaka Satya(vratasya) (pl. IX,1)...All these are obviously derived from dan.d.a which means 'army', a 'rod' as well as 'punishment'. There is no unanimity among scholars regarding the exact connotation of these words. Stein, Marshall, Vogel and Bhandarkar interpret the expression to mean a police officer; Beni Prasad, Bloch, Mookerji, Banerji, Sankrityayan and Dikshitar interpret it to stand for a judge. Raychaudhuri, Fleet, Altekar and Dr. Sircar take it to denote an 'army officer' while Marshall, elsewhere, was undecided about its exact meaning and translated it as 'chief judge' or 'chief officer of police'. If bala_dhikr.ita (also maha_bala_dhikr.ita) and dan.d.apa_s'ika were officers of the army and police respectively, it would be reasonable to suppose that the dan.d.ana_yaka, in the main, was a judicial officer. Would the symbols on these seals and sealings help us in understanding the meaning of this term and the duties and office of that officer? It is significant that the eight dan.d.ana_yaka sealings from Bhita invariably bear the bull-la_n~chana. Apart from being a S'aiva device, the bull is also symbolic of Dharma. This symbol would really be the most appropriate for a judge who has to follow the tenets of the law scrupu;lously and enforce it impartially. The bulls on the two Gupta sealings have a spherical object between their horns (Pl. IX, 3)...But the sealings from other sites noted above bear either the same device (bull) or have a chakra, peacock, etc...the chakra being reminiscent of the sudars'anachakra of Vis.n.u and the peacock of the va_hana of Maha_sena-Ka_rttikeya, the General of the Gods...In literature and later epigraphs, the term dan.d.ana_yaka (or maha_dan.d.ana_yaka) has sometimes been used to denote a military officer or an administrator. Sometimes the term is found combined with other offices (e.g. with kuma_ra_ma_tya and sa_ndhivigrahika). The office could also be hereditary. The title was also, at times, used by the feudatories, perhaps as a mere honorific." (K.K. Thaplyal, 1972, *Studies in Ancient Indian Seals*, Lucknow, Akhila Bharatiya Sanskrit Parishad, Pl. IX, Figs. 1 to 4; pp. 115-118).



Clay lump bearing impressions of the seal of the offices of (a) kuma_ra_ma_tya and (b) bala, Ahichchatra_, Antiquity section of the Arch. Surv. of India, New Delhi, no. AC II 4448; 2. Sealing of the military office attached to the Yuvara_ja-bhat.t.a_raka, Basarh, Indian Museum, Calcutta, no. A. 11315--NS 6159. (After K.K. Thaplyal, 1972, *Studies in Ancient Indian Seals*, Lucknow, Akhila Bharatiya Sanskrit Parishad, Pl. XIII, Figs. 5 and 6; pp. 110-120).

"A sealing from Ahichchatra in the Antiquity section of the ASI, New Delhi, shows a vase-and-foliage motif and the legend bala_dhi in Gupta characters...One of the impressions on a lump from the same site in the same collection has a similar device and the legend bala_dhikaran.a in characters of the same period. Another impression is that of Kuma_ra_ma_tya_dhikaran.a (Pl. XIII, 5)...Another Basarh sealing has the device of a vase with foliage in the centre, a s'an:kha to the right and the letter s'ri_ to the left. The legend reads: 1. yuvara_ja-bhat.t.a_raka-; 2. pa_di_ya bala_dhi-; 3. karan.asya 'military office attached ot the yuvara_ja bhat.t.a_raa' (Pl. XIII, 6). [Banerji, however, translates the term as '(The seal) of the office of the Commander-in-chief, equal in rank to the heir-

apparent' (AIG, 74); Bloch translates it as '(Seal) of His Highness the Yuvara_ja (and) Bhat.t.a_raka, the chief of military forces' (ASIAR, 1903-04, p. 108)]...according to the commentary of Kullu_ka on the Manusmr.ti (VII.189), the sena_pati had under him ten pattika-s (the smallest leaders of the army) while the sena_na_yaka or a bala_dhyaks.a ten sena_pati-s. In a Pa_la epigraph we find the mention of a sena_pati and a bala_dhyaks.a as two different officials." (ibid., p. 120).



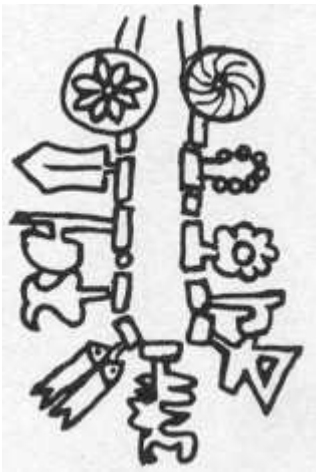
"That Kr.s.n.a had risen from the pre-Aryan people is clear from a Pa_n.inian reference (Pa_n. 4.3.98, explained away by the commentator Patan~jali) to the effect that neither Kr.s.n.a nor Arjuna counted as ks.atriyas. But his antiquity is considerable, for he is the one god who uses the sharp wheel, the missile discus, as his peculiar weapon. This particular weapon is not known to the Vedas and went out of fashion well before the time of the Buddha. Its historicity is attested only by cave paintings (fig. 1.17) in Mirza_pu_r which show raiding horse-charioteers (clearly enemies of the aboriginal stone-age artists) one of whom is about to hurl such a wheel. The event and the painting may fairly be put at about 800 BCE by which date the dark god was on the side of the angels, no longer an aborigine himself." (See JRAS 1960, 17-31, 135-144 or chapter IV of this book. for the cave painting (originally discovered by Carlleyle) Mrs. B. Allchin in Man, 58, 1958, article 207 + plate M (pp. 153-5); D.D. Kosambi, 1962, *Myth and Reality*, Bombay, Popular Prakashan, p. 26).

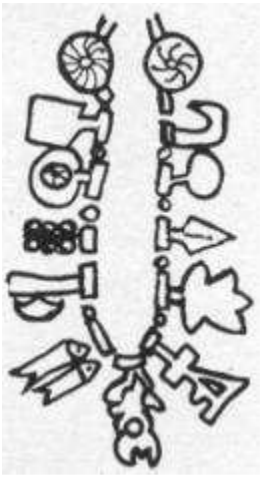
What is myth and what is reality in these opinions of Prof. DD Kosambi? Maybe, the date of the painting is 800 BCE. But is it a fact that the discus weapon was not known to the Vedas?[6]

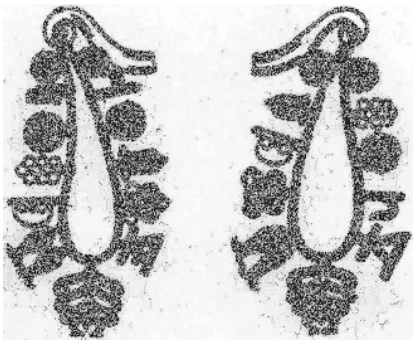
It would appear that the cakra as a weapon was attested in the R.gveda and Atharva Veda, and also in inscriptions of the Sarasvati Sindhu Civilization.

The appearance of pictographs of spoked wheels in the Civilization should come as no surprise since, in contemporary times, there was evidence for such wheels in the Near East: “The appearance of wheeled vehicles in Europe and the Near East during the 4th millennium BCE is a major socio-economic development. In the past, eminent archaeologists such as Childe (1951), Piggott (1979; 1983) and, more recently, Sherratt (1981; 1997) have argued for diffusion of wheeled vehicles from the Near East to Europe. In contrast, other archaeologists as e.g. Hausler (1992) and Vosteen (1996) stressed the local development of wheeled vehicles in Europe. The question of diffusion versus independent development is an old issue in archaeology. Judging by the archaeological data in the 1990s, it seems that wheeled vehicles developed more or less simultaneously or diffused very fast from Mesopotamia to Europe. We favour the latter possibility. It is difficult to explain how this technological transmission occurred in the 4th millennium BC, but Europe and the Near East were never isolated from each other during this period.”

[Jan Albert Bakker, Janusz Kruk, Albert Lanting, Sarunas Milisauskas, 1999, ‘The earliest evidence of wheeled vehicles in Europe and the Near East’, *Antiquity*, January 1999, Vol. 43, No. 282, p. 778].







Necklaces with a number of pendants Man:galaka ha_ra depicted on a pillar of a gateway (toran.a) at the stu_pa of Sa_n~ci, Central India, 1st century BCE. [After VS Agrawala, 1969, *The deeds of Harsha (being a cultural study of Ba_n.a's Harshacharita*, ed. By PK Agrawala, Varanasi: fig. 62] The ha_ra or necklace shows a pair of fish signs together with a number of motifs indicating weapons (cakra, paras'u, an:kus'a), including a device that parallels the standard device normally shown in many inscribed objects of SSVC in front of the one-horned bull.

(cf. Marshall, J. and Foucher, *The Monuments of Sanchi*, 3 vols., Callcutta, 1936, repr. 1982, pl. 27). The first necklace has eleven and the second one has thirteen pendants (cf. V.S. Agrawala, 1977, *Bha_rati_ya Kala_*, Varanasi, p. 169); he notes the eleven pendants as: sun, s'ukra, padmasara, an:kus'a, vaijayanti, pan:kaja, mi_na-mithuna, s'ri_vatsa, paras'u, darpan.a and kamala. "The axe (paras'u) and an:kus'a pendants are common at sites of north India and some of their finest specimens from Kausambi are in the collection of Dr. MC Dikshit of Nagpur." (Dhavalikar, M.K., 1965, *Sa_n~ci: A cultural Study*, Poona, p. 44; loc.cit. Dr.Mohini Verma, 1989, *Dress and Ornaments in Ancient India: The Maurya and S'un:ga Periods*, Varanasi, Indological Book House, p. 125).

Note that one of the pendants looks like the 'device' normally found in front of the one-horned bull, the san:gad.a, portable brazier and lathe (also meaning, battle).

On the second ha_ra, clock-wise, after in.aikkayal or mi_nayugala (twin fish), and axe, the pendant looks like a tree or a bunch of coral? **[tukir = coral, paval.am; vaicayanti = tukir-kot.i, i.e. creeper containing coral; thus a sign interpreted as a man:gala sign, i.e. vaijayanti may be connoted by this Tamil phrase: tukir-kot.i, i.e. a bunch of corals on a creeper. In Skt., vaijayanti can be interpreted as an attribute of victory].** Homonym: tukilikai = writing instrument (Ta.lex.)

This ha_ra with 13 pendants may be a combination of 8 welfare insignia (as.t.aman:gala) *plus* 5 weapons (aimpat.aitta_li). Kuber'a navanidhi also includes padma and s'an:khu. If s'an:khu connotes

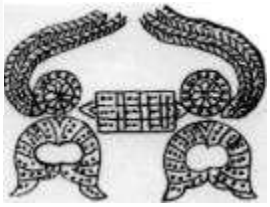
a javelin, what did padma connote in the repertoire of weapons? Or, is it just a symbol of plenty since it is said to contain many seeds. The Tamil idiom is: can:ka niti, patuma niti: "can:kaniti patumaniti iran.t.um tantu": te_va_ra. tan-ittirutta_n.t.aka. Tiruna_) explained in the Katirvel Pillai's Tamil lexicon as 'nidhi' (treasure) heaped like a s'an:kha and like a padma.

[Pl.4,J to P, Amaravati punch-marked coin symbols]

[Pl. 5, h, I, Kaus'a_mbi_ punch-marked local coin symbols]

Dva_rapa_la. Stu_pa , Sa_n~ci , East Gateway, c. 300 BCE [cf. 'Monuments of Sanchi', Voll. II, Pl. 66a]

aimpat.aitta_li = a gold pendant worn by children in a necklace bearing in relief the five weapons of Vis.n.u, as an amulet (aimpat.aitta_li...kur-unat.aip putalvarkku: Man.i. 7,56)(Ta.lex.).



Aimpat.aitta_li: five weapons worn on the man:gal.asu_tra -- or protective necklaces -- parallels the tradition of as.t.aman:gal.a (eight symbols of welfare)

Note the necklace and bracelets on the right arm worn by the warrior holding a javelin on his left hand. The pendants strung on the necklace are not clearly legible on this photograph.

A Comprehensive Etymological Dictionary of the Tamil Language (TED), Vol. I, Part III, 1997. aimpat.aitta_li = gold pendant worn by children in a necklace bearing in relief of five weapons of Vis.n.u, as an amulet (aimpat.aitta_li kur-unat.aip putalvarkku: Man.i 7.56; can:ku, cakkaram, vil, va_l. mar-attan.tu (katai) incised in ta_li or man:galasu_tra) The picture on p. 327 of TED shows these five weapons in the central part of the lotus-bud shaped pendant.

On both the ha_ra, the padma is depicted as a circle with petals.

[Note: Hopefully, sharper photographs may help identify the weapons displayed as pendants more precisely].

1. Tri-ratna necklace of Sirima Devata [Cunningham, *Bharhut*, pl. XXIII,]; 2. Yaks.in.i wears a short and a long necklace; the latter has a prominent spoked-wheel in the center, below which are cylindrical bead and egg-shaped bead flanked by two tri-ratna symbols [Cunningham, *Bharhut*, pl. LII, Joshi, LAU, Fig. 653] [After Figs. 23 and 233 in: Dr.Mohini Verma, 989, *Dress and Ornaments in Ancient India: The Maurya and S'un:ga Periods*, Varanasi, Indological Book House, p. 24.]

Chanda Yaks.i (c. 200 BCE, Indian Museum, Calcutta) wearing a seven-string necklace; the drawing shows lower three pearl strings consisting of flat stones or cylindrical beads; the upper row has symbols including: papal leaf, elephant goad, s'rivatsa (which is the middle)[Cunningham, *Bharhut*, pl. L.7]] [After Figs. 232 and Pl. XI in: Dr.Mohini Verma, 989, *Dress and Ornaments in Ancient India: The Maurya and S'un:ga Periods*, Varanasi, Indological Book House, p. 24.] A figure on a mithuna plaque from Ahicchatra is interpreted: 'There are three additional symbols woven in her long necklace, namely a dagger on the left, a puppet (s'rivatsa in the center) and on the right, a vajra with a pointed angle prongs.' These symbols also occur on a terracotta of Mathura. [VS Agrawa,a Terracotta figurines ofAhichchatra, Dist. Bareilly, UP, *Ancient India*, No. 4, pl. XXXII,

2; VS Agrawala, Mathura Terracottas, *JUPHS*, Vol. IX, fig.6,0,2,3).

Vajra in the R.gveda is called **vazra** in the Avesta. S'atapatha Bra_hman.a (3.4.4.14) refers to the deva-s preparing a weapon called **vajra**; it is said to possess parts equal to an arrow, **ani_ka**, **s'alya** and **kulmala** (Eggelng, 1885: 108, n.2 explains these parts as: point, barb of the arrowpoint and connecting piece or shaft, tejana). Thus, a vajra has barb, a point and a shaft. S'Br. (8.5.1.13) refers to daks.in.aaudya_mo hi vajro which is translated as: 'the thunderbolt has a sling on the right side'. Udya_ma as 'extension;' may also mean a protruding part, serving as a handle (Eggeling 1897: 86, n.2). Udya_ma indicates that the weapon was raised to be swung and thrown spinning (pra-vr.t). A vajra is **ks.urapavi** (with a sharp rim)(JBr.). It has four edges (**caturas'ri**: RV). RV 2.16.6: vr.s.a_ te vajra uta te vr.s.a_ ratho. All the qualities described in the texts are fully application in the depiction of vajra in the sculptural tradition of Bha_rata.

Note the tiger, elephant, Ba_lakr.s.n.a and S'rivatsa symbol depicted on a pair of royal earrings. Ca. 1st cent. BCE. India (Probably Andhra Pradesh). Gold. 1 ½ X 3 X 1 9/16 in. Metropolitan Museum of Art, New York.

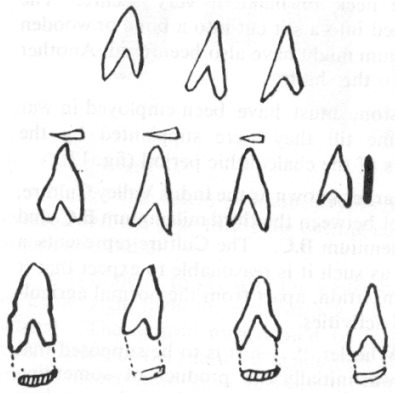
Vajra, dorge, tokko. "The first name is Sanskrit, the second Tibetan and the third Japanese. The Buddhist symbol of the thunderbolt. It may have a single prong at each end, or three or five. In Japanese the names are tokko (single-pronged), **sanko** (three-pronged) and goko (five-pronged). The single pronged form makes a spoke of the wheel of the law. The vajra, usually one of three prongs, is used as a hilt on temple swords; and is frequently carved on Japanese blades." [Collection of Mr. RH Rucker. GC Stone, Figs. 830, 831, p. 652].

Given this remarkable cultural tradition, it is reasonable to formulate a hypothesis that the seals and sealings of the civilization are lists of weapons and devices/equipment used by smelters and metalsmiths. The man:gala-ha_ra may connote a marriage ta_li (man:gala su_tra) tied by the bridegroom indicating the list of property items he brings to the bride-to-be. However, it is noticed that Viru_pa_ks.a on the sa_n~ci sculptures is also shown bearing a javelin, wearing bracelets and a necklace with pendants. It is possible that this tradition later evolved into the form of amulets, as a form of protection from evil. As will be noted below, a seal with Bra_hman.i bull pictorial motif and a typical inscription has been found as a sealing for packaging goods; in this case, the inscription serves the function of a bill of lading. Since hundreds of signs and pictorial motifs are read using the rebus method as items of weapons, arms and armour, the keys to the decipherment are presented as the products of an armourer, kut.ha_ru represented by the homonym, the Bra_hman.i bull, kut.ha_ru. As a logical extension of this methodological key, the one-horned bull may be seen as a ligature composed of: a curved horn, neck highlighted by rings, one side of a pannier and the young heifer bull -- these four images may connote A SET of four distinct battle weapons: san:ga (horn, battle or sa~_ga one fork of a forked stick; sa~_gi = spear(S.); gad.a (neck, mace), san:kara (sack, ?s'an:ku, javelin, spike) and vahr. (heifer, val. -- sword).

This hypothesis will be elaborated and tested further using the entire corpus of inscriptions, objects in the round, including the pictorial motifs, their ligatures and the so-called signs most of which are pictographs and ligatures.

The tradition of valour and use of weapons in ancient Bharat

Early weapons were the bow and arrow celebrated as Dhanurvidya, a term which gets used, during historical periods, to denote warfare training, in general.



Thin, flat pieces of arrowheads made of copper having long barbs and without tangs. Wooden shafts over-lapped these arrow-heads, thus making a medial rib. Mackay notes that the tie-holes were to facilitate the insertion of wooden shafts. These arrowheads are identical to those from Zafer Papoura, Crete. Av. length: 1.19 inches, breadth 0.64 inches and thicknes 0.07 inches. Harappa. After EJH Mackay.

A chronological analysis of the evolution of weapons, and accoutrements with reference to archaeo-metallurgy and with reference both to the a_gamas and the archaeological finds, is yet to be undertaken.

Archer and bow in Vedic texts

The su_kta RV 6.75 is addressed to parts of battle by r.s.i pa_yu bha_radva_ja; (devata_: parts of battle):: 1. varma; 2. dhanu; 3.jya_; 4. a_rtni_; 5. is.udhi; 6. pu_rva_, sa_rathi_, utta, rays; 7. many horses; 8. ratha; 9. ratha gopa; 10. bra_hman.a, pitr., soma, dya_va_ pr.thivi_, pu_s.a_; 11-12, 15-16. is.u samu_ha; 13. pratoda; 14. hastaghna; 17. yuddhabhu_mi, Brahman.aspati, and aditi; 18. varma-soma-varun.a; 19. devabrahma

The bow is adored in the R.gveda as a mighty weapon in battle.

इन्द्राग्नी आ हि तन्वते नरो धन्वानि बाह्वोः ।
मा नो अस्मिन् महाधने परा वर्ग् गविष्टिषु ॥

(bharadva_ja ba_rhaspatya) 6.059.07 Indra and Agni, men verily stretch their bows with their arms, but do not you desert us contending for cattle in the great combat.

Dhanvana_ ga_ dhanvana_jim jayema dhanvana_ ti_vra_h samado jayema
Dhanah s'atrorapaka_mam kr.n.oti dhanvana_ sarva_h pradis'o jayema

RV 6.075.02 May we conquer the cattle (of the enemies) with the bow; with the bow may we be victorious in battle may we overcome our fierce-exulting (enemies) with the bow; may the bow disappoint the hope of the foe; may we subdue with the bow all (hostile) countries. [Exulting: samadah: sa, with; amda, exhilaration; or, sam, entirely; ad, who devours (*Nirukt*a 9.17, 9.18)].

The bow ensures the defeat of the enemy.

bahvona_m pita_ bahurasya putras'cis'ca_ kr.n.oti samana_vagatya
is.udhih san:ka_ pr.tana_s'va sarva_h pr.s.t.e ninaddho jayati ;pr.su_tah

6.075.05 The quiver, the parent of many, of whom many are the sons, clangs as it enters into the battle; slung at the back (of the warrior), prolific (of its shafts), it overcomes all shouting hosts. [Shouting hosts: san:ka_h pr.tana_h: san:ka_ = sounding together, sam ka_yanti; Ya_ska, Nirukta 9.14: san:ka_: from sac, to be assembled or sam, with; kr., to be renowned, armies in which there are assembled, or celebrated warriors]. This r.ca notes that **is.udhi** (lit. arrow-holder or quiver) is slung on the back. Other words for quiver are **tuna** or **tunira** (MBh.) and **kanda (***Ja_taka-s***).**. Persian names are: **tarkash, jaibah**.

The battle is fierce. Warriors assemble with uplifted banners (see the imagery depicted on SSVC inscribed tablet].

यत्रा नरः समयन्ते कृतध्वजो यस्मिन्न् आजा भवति किं चन प्रियम् ।
यत्रा भयन्ते भुवना स्वर्द्वइ१२९षईशस् तत्रा न इन्द्रावरुणाधि वोचतम्॥

7.083.02 Where men assemble with uplifted banners, in whatever conflict, there is something unfavourable; where living beings, looking to heaven, are in fear, there, Indra and Varun.a, speak to us (encouragement). [There is something unfavourable: 'everything is evil'; yatra ca yuddhe bhuvana_, bhuvana_ni, bhu_taja_ta_ni svardr.s'ah, s'ari_rapatad u_rdhvam svargasya dras.t.a_ro vitas' ca bhayante, bibhyati, tatra, tadris'e san:gra_me he indra_varun.au no'sman adhivocatam, asmatpaks.apa_tavacanau bhavata_m = in whatever (battle) living beings and those seeing heaven (i.e. gone to heaven, departed) are in fear, there, Indra and Varun.a, plead our cause].

yatra ba_n.a_h sampatanti kuma_ra vis'ikha_ iva
tamra_ no brahman.aspatiri_datih s'arma yacchatu vis'ca_ha_ s'armam yacchatu

6.075.17 Where arrows alight like shaven-headed boys may brahman.aspati, may Aditi, grant us happiness every day. [Like shaven-headed boys: kuma_ra_ vis'ikha_ iva, like boys without the lock of hair left at shaving; mun.d.ita_ mun.d.ah, shorn-headed; the arrows fall where they like, as boys before they are left with the lock of hair, before the religious tonsure, play about where they like].

The bow-string is stretched upto the ear and embraces the ear like a damsel embracing her lover; the string whispers softly and darts on to her target.

vaks.yantoveda_ ganoganti karn.am priyam sakha_yam parivasvaja_na_
yos.evam s'in:kte vitata_dhi dhanvan jya_ iyam samane parayanti_

6.075.03 This bowstring, drawn tight upon the bow, and making way in battle, repeatedly approaches the ear (of the warrior), as if embracing its friend (the arrow), and proposing to say something agreeable, as a woman whispers (to her husband).

The ends of the bow are like two mothers who take the arrow on their lap like two mothers taking their children on their laps.

ye a_caranto samaneya yos.a_ ma_teva putram vibhuta_mapisvaye
apa s'atru_nbidhyata_m sambida_ne a_tni_m ime bis.phuranti_ abhinna_na

6.075.04 May the two extremities of the bow, acting in concert, like a wife sympathizing (with her husband), uphold (the warrior), as a mother nurses her child upon her lap; and may they, moving

concurrently, and harassing the foe, scatter his enemies. [Like a wife: bibhr.ta_m = ra_ja_nam dha_rayeta_m; or, dha_rayata_m samam, support the arrow; samaneva yos.a_ (a singular used for the dual), the two extremities drawing close to the archer, like two women to their lover, stiyau yatha_ ka_ntam a_gacchatah].

The warrior is well-protected with armour of black leather plates; is well-armed with bow, quiver and arrows; rides a chariot and roars.

marma_n.i te varman.a_ cha_daya_mi somastva_ raja_mutena_tu vasta_ma
urorvari_ya_ varun.aste kr.n.out jayantam tya_nu deva_ madantu
yo nah svo aran.o yas'ca nis.t.yo jigha_msati
deva_ste sarve ghu_rvantu br.mha varma mama_ntaram

6.075.18 I cover your vital parts with armour; may the royal Soma invest you with ambrosia; may Varun.a amplify your ample felicity; may the gods rejoice (at beholding you) triumphant. [May Varun.a amplify: uror vari_yo varun.as te kr.n.otu, may Varun.a make the increase of the large; that is, sukham, happiness].

6.075.19 Whoever, whether an unfriendly relative or a stranger, desires to kill us, may all the gods destroy him; prayer is my best armour. [Sa_maveda: brahma varma mama_ntaram, s'arma varma mama_ntaram, my best happiness my armour].

The king was to be a wielder of a terrible bow and a good commander. [E. Hopkins, Position of the Ruling caste in Ancient India, *Journal of American Oriental Society*, XIII, p. 57; PC Chakravarti, 1942, *Art of War in Ancient India*, Delhi, pp. 150-180; VRR Dikshitar, *War in Ancient India*; Ram Gopal, *India of Vedic Kalpasutras*, p. 184 ff.; Apte, *Social and Religious life in Grhyasutras*, Bombay, 1954, p. 50 ff.; S.A. Dange, Aspects of war from the R.gveda, *Journal of Indian History*, Vol. XLIV, Part I (April 1966), Sl. No. 133, pp. 125-139].

Rudra is the preceptor of the science of archery. He is eulogized as a warrior.

अस्माकेभिः सत्वभिः शूर शूरैर् वीर्या कृधि यानि ते कर्त्वानि ।
ज्योग् अभूवन्न् अनुधूपितासो हत्वी तेषाम् आ भरा नो वसूनि ॥

[gr.tsamad (a_n:girasa s'aunahotra pas'ca_d) bha_rgava s'aunaka] 2.030.10 Achieve, hero, along with our valiant heroes, the exploits that are to be achieved by you; long have (our enemies) been inflated (with pride); slay them, and bring to us their treasures.

ऋतज्येन क्षिप्रेण ब्रह्मणस् पतिर् यत्र वष्टि प्र तद् अश्नोति धन्वना ।
तस्य साध्वीर् इषवो याभिर् अस्यति नृचक्षसो दृशये कर्णयोनयः ॥

The r.s.i who adores Rudra in RV 2.30.10 exhorts in RV 2.24.8 that the country should abound in brave warriors well-versed in the science of archery to maintain peace and order. Yajurveda (16.29: namah kapardine ca vyuprakes'a_ya ca namah sahasra_ks.a_ya ca s'atadhanvane ca namo giris'aya_ya s'ipivis.t.a_ya ca namo modus.t.ama_ya ces.ukate ca; the verse is clear that the science of archery is an essential qualification of a king who is referred to as s'atdhanva (i.e. the holder of hundred kinds of bows). Terms such as is.u-dhanva (Bow and arrow), is.u-dhanvina (holder of bow

and arrow), adhijya-dhanva (bow fitted with string) occur in Vedic texts (Taittiri_ya Sam.hita_ 5.2; Aitareya Bra_hman.a 7.19; 1.25; S.Br. 9.1; 1.6).

AV1.2.1:
vidya_ s'arasya pitaram parjanyam bhu_ridha_yasam
Vidmos.vasya ma_taram pr.thivi_m bhu_rivarpasam

AV 1.1.3
Ihaiva_bhi vi tanu_me a_rtni_ iva jyaya_
Va_caspatirni yacchata mat.ayeva_sta mayi s'r.tam

AV 1.19.2:
Vis.vavan~co asmaccharavah patanta ye asta_ ye ca_sya_h
Daivi_rmanus.yes.ava_ mama_mitra_na vi vidyata

AV 6.66.2:
A_tanva_na_ a_yacchantosyanta_ ye ca dha_vatha
Nirhasta_h s'atravah sthanendro vodya paras'ari_ta

AV 11.9.1:
Ye ba_havo ya_ is.avo dhavana_m vi_rya_n.i ca
Asi_n paras'u_na_yudham vitta_ku_tam ca yaddhr.di
Sarva tadarbude tvamamitrebhyo dr.s'e kuruda_ra_m.s'ca pradars'aya

Rudra as an archer is praised in AV 1.2.1: he protects all with his bow. In AV1.19.2, the arrows are implored: 'dispersing from us let the shafts fly, those that are hurled and that are to be hurled. Ye divine arrows of men pierce my enemies.' AV 11.9.1 provides a list of weapons to be used: bows and arrows, swords (asi), axes (kut.ha_ra), battle-axe (paras'u), spears. [**Goddara.** A Perso-Turkish sabre (Wallace Orient; GC Stone, p. 248; **Guddara.** An Indian sabre with straight quillons, a pistol hilt and a back-edged blade that widens towards the point (GC Stone, p. 254).].

2.024.08 Whatever Brahman.aspati aims at with the truth-strung quick-darting bow, that (mark) he surely attains; holy are its arrows with which he shoots (intended) for the eyes of men, and having their abode in the ear. [For the eyes of men: nr.caks.asah karn.ayonayah: the arrows are oblations and mantras; the first is obvious to the sight; the second is addressed to the ears of men].

भद्रम् मनः कृणुष्व वृत्रतूर्ये येना समत्सु सासहः ।
अव स्थिरा तनुहि भूरि शर्धतां वनेमा ते अभिष्टिभिः ॥

(sobhari ka_n.va) 8.019.20 Give us that resolute mind in conflict by which you conquer in combats; humble the many firm (resolves) of our foes; may we propitiate you by our sacrifices. [In conflict: vr.tratu_rye, in conflict, san:gra_me; or, pa_pana_s'a_ya (*Yajus.* 15,39), for the exptirpation of sin; ava sthira_ tanuhi = make the strong bows without bowstrings, sthira_n.i dhanum.s.i jya_rahita_ni kuru].

जाम्यू अतीतपे धनुर् वयोधा अरुहद् वनम् ।
दृषदं जिह्वयावधीत् ॥

haryata pra_ga_tha 8.072.04 (Agni), the giver of food, scorches the vast bow (Of the sky); he mounts the water; he smites the cloud with his tongue. [With his tongue: ja_mi = pravr.ddham, sarvam atiricya vartama_nam; his own; may be a reference to a forest conflagration; he mounts the forest, he smites the rock (dr.s.adam) with his tongue].

इषुर् न धन्वन् प्रति धीयते मतिर् वत्सो न मातुर् उप सज्यूर् ऊधनि।
उरुधारेव दुहे अग्र आयत्यू अस्य व्रतेष्व् अपि सोमं इष्यते ॥

(hiran.yastu_pa a_n:girasa)9.069.01 (Our) praise is attached (to Indra) as an arrow to the bow; (the Soma-juice) is let loose to (Indra) the fosterer as a calf to the udder to its mother; (Indra sheds blessings) as a cow having a copious stream of milk yields it when coming into the presence (of the calf); in Indra's sacrifices the Soma is stimulated. [The fosterer: u_dhani = Indra, because he is the nourisher of everything].

During cremation, an arrow was first placed in the right hand of the dead warrior and then removed as the final act of the funeral ceremony; the arrow is burnt together with the body. (RV 10.18.9).

धनुर् हस्तादं आददानो मृतस्यास्मे क्षत्राय वर्चसे बलाय ।
अत्रैव त्वम् इह वयं सुवीरा विश्वा स्पृधो अभिमातीर् जयेम ॥

(sam.kusuka ya_ma_yana; devata_ pitr.medha) 10.018.09 Taking his bow from the hand of the dead man, for the sake of our vigour, energy and strength, (I say) you are there; may we (who are) here, blessed with male offspring, overcome all the enemies who assail us.

अहं रुद्राय धनुर् आ तनोमि ब्रह्मद्विषे शरवे हन्तवा उ ।
अहं जनाय समदं कृणोम्यू अहं द्यावापृथिवी आ विवेश ॥

(va_ga_mbhr.n.i) 10.125.06 I bend the bow of Rudra, to slay the destructive enemy of the Bra_hman.as, I wage war with (hostile) men. I pervade heaven and earth.

Yajurveda (16.10) is also emphatic about the bow in the hands of Sena_pati: ‘So long as thy bow is fitted with the string, you will never be defeated and your country will always be prosperous:

vijyandhanuh mapardino vis’alyo ba_n.arva_ uta
Anes’annasya ya_ is.ava amusya nis.an:gadhih).

YV 19.39 praises the bow as the weapon which ensures victory:

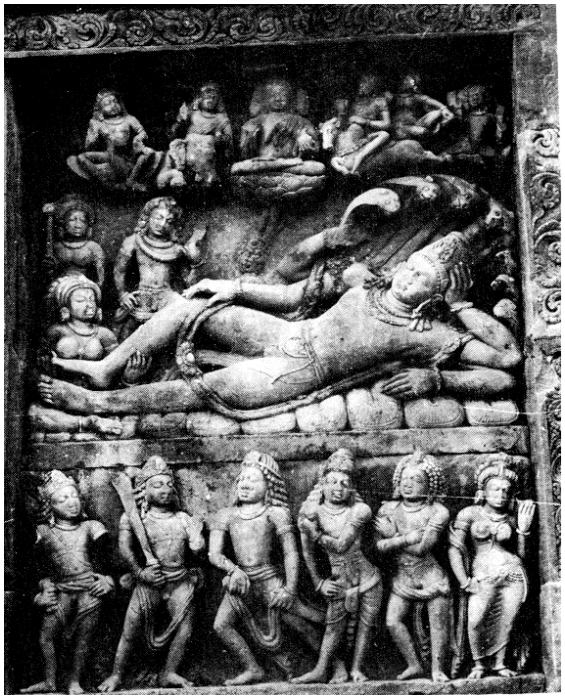
dhanvana_ ga_ dhanvana_ji jayema dhanvana_ ti_vra_h samado jayema
dhanuh s’atrorapaka_mam kr.n.oti dhanvana_ sarva_h pradis’o jayema

Artani is the nock or notch to which the bowstring is attached. (RV 1.51.8; 1.130.8; 1.156.5; 5.75.4). Bowstring is jya_ (RV 5.15.14), the sound of a bowstring or twang is jyaghos.a (RV 6.75.3); stringing of a bow is alan (RV 10.166.3); knocking the arrow to the string is pratidha (RV 4.27.3; 6.75.3; 10.51.6); to bend a bow is ayam and shooting a shaft is as (RV 4.27.3; 6.75.3; 10.51.6). Hastaghna is lit. protection for the hand or a wrist-guard (RV 6.75.14; Nirukta 9.14). It is called talatra in MBh. (Vanaparva 37.19; Dron.aparva 125.16: kavaci_ satalatra_n.i_ baddha gotha_n:gulivava_nuh) In the medieval period, the leather sleeve worn on the left arm was called godha or godhu (Egerton, p. 114).[RV 6.75.3: 'Close to his ear, as fain to speak, she presses, holding her well loved friend in her embraces. Strained on the bow she whispers like a woman, this bowstring that preserves us in combat'.] godha_ = a leather bracer worn by bowman [After GN Pant, 1997, p. 111].

Procession of animals

Bronze dish found by Layard at Nimrud: circular objects are decorated by consecutive chains of animals following each other round in a circle. A similar theme occurs on the famous silver vase of Entemena. In the innermost circle, a troop of gazelles (similar to the ones depicted on cylinder seals) march along in file; the middle register has a variety of animals, all marching in the same direction as the gazelles. A one-horned bull, a winged griffin, an ibex and a gazelle, are followed by two bulls who are being attacked by lions, and a griffin, a one-horned bull, and a gazelle, who are all respectively being attacked by leopards. In the outermost zone there is a stately procession of realistically conceived one-horned bulls marching in the opposite direction to the animals parading in the two inner circles. The dish has a handle. (Percy S.P.Handcock, 1912, Mesopotamian Archaeology, London, Macmillan and Co., p. 256).

Sealing. Mohenjo-daro. Portable standards in a procession (Marshall, 93, III: pl. 6, no.8).



Deogarh. UP. ca. 500 AD. Anantas'a_yi with a_yudhapurus.a (After Fig. 24 in: V.R. Mani, 985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan)

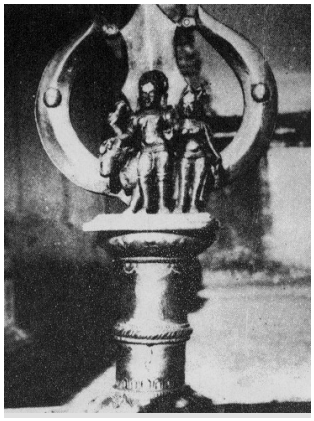
Ma_rkan.d.eya P. refers to the presence near Vis.n.u of five personified forms of weapons: **pa_n~cajanya, sudars'ana, nandaka, kaumodaki_** and **sa_rn:ga** (the **conch, discus, sword, mace** and **bow**). Vaikha_nasa_gama and Vima_na_rcanakalpa refer to yogas'ayana, bhogas'ayana, vi_ras'ayana and A_bhica_rikas'ayana forms of Anantas'a_yi form. Five weapons are stipulated for the first three forms; the fourth form represented in the sculptural complex of Maha_balipuram does not contain any representation of a_yudhapurus.a-s. Anantas'a_yi forms are also associated with other images of Ma_rkan.d.eya, Bhr.gu, Agni, Garud.a, Brahma, Varun.a, Bhu_devi, S'ri_devi, S'iva, Daks.a, Na_rada, Tumbu_ru, the seven r.s.is, the twin As'vin-s, Sanaka_di Yogi-s, Su_rya, Candra, the demons Madhu and Kait.abha. (K.V. Sundararajan, 'The Typology of Anantas'a_yi icon', *Artibus Asiae*, Vol. XXIX, pp. 67-82).

San:gam literature in Tamil refers to the cakra as *ne_mi* or *tikiri*; the divinity is known as ne_miya_n- and tigiriya_n-. (*Kalittokai*, V, 104, 19, 9, 78; *Akam*, V, 178, 11, 14-15; *Padir-r-uppattu*, V, 31, 1,9; *Nar-r-in.ai*, invocation). *Man.imekalai, Paripa_t.al* and *Mullaippa_t.t.u* refer to cakra with shining rays and golden lustre in the right hand and s'an:kha in the left hand. (*Man.ime_kalai*, XIII,1,37; *Paripa_t.al* V, 1: 11,49-54, V,3,1,88 etc.; *Mullaippa_t.t.u* 11,1-2; loc.cit., Mani, p. 7). Paripa_t.al (V,15,1.55) also refers to other weapons: valampuri (s'ankha), ne_mi (cakra), s'ilai-ampu (bow and arrow -- sa_ran:ga), pa_ra_valai, va_l. (sword-- khad.ga), tan.t.u (gada)) and na_n~cil (ploughshare -- hala); the five weapons of Vis.n.u were the motifs used in the ornament called aimpat.aitta_li worn by children in Tamil Nadu in early times. (R. Champakalakshmi, Vais.n.ava Iconography in the Tamil Country, p. 51, fn. 27).

Badami. Karnataka. ca. 575 AD. Anantas'a_yi with a_yudhapurus.a (After Fig. 23 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan)

'Like the weapons of Vis.n.u those of S'iva, and other S'aiva deities like tris'u_la, paras'u, vajra, s'akti, dan.d.a, khad.ga, pa_s'a, an:kus'a, dhvaja etc. are described in the s'ilpa texts as befitting personification. Iconographic details regarding concretised images of these weapons are found in the *Uttaraka_mika_gama*, *Vis.n.udharmottara*, *Pu_rvakarn.a_gama* etc...the **heti**, which according to Gopinatha Rao is a weapon like a hatchet, should be shown as a female. The other a_yudhas to be personified as a male are the **bhindi**, the sling with which stones are thrown and the **ba_n.a** which should have a red body and beautiful eyes...the metaphysical meaning conveyed through the different a_yudhas have been explained in the Ka_mika_gama and a few S'aiva A_gamas. It is said that "the **tris'u_la** indicates the three gun.as of prakr.ti respectively called satva, rajas and tamas. The **paras'u** represents S'iva's divine strength and power (**s'akti**); the **khad.ga** his valour; **va_hni (**fire) his sam.ha_ra s'akti or power of destruction; this last one, namely, the va_hni is further conceived to destroy all **pa_s'a**s or bonds and attachments, and is consequently emblematic of the enlightenment which comes after the bonds of sin and sorrow are broken asunder and destroyed. The **na_ga**s serving as ornaments on his body show the fortitude of S'iva as also the inviolability of vidhi, or his commandments and laws. The pa_s'a which is a three-fold cord or rope, indicates the three-fold bondage of incarnated life consisting of karma_, ma_ya_ and mala, that is, of work, delusion and impurity. The **ghan.t.a_** (bel) is the symbol of sound looked upon as the original cause of creation and is, indicative of the mantra-svaru_pa of S'iva which is his mystic sound-form. The **an:kus'a** stands for the selective faculty in choosing what is enjoyable for the atman as soul." (TA Gopinatha Rao, Elements of Hindu Iconography, Vol. I, Part I, pp. 293-94).' (VR Mani, p.29, pp. 39-40).

Bharates'var (or s'atrughnes'war?) temple. Bhuvanes'war, Orissa. Door guardian, four-armed, depicted on a door jamb. Upper right arm touches the hood of a serpent issuing from the sarpakun.d.ala in his right ear; lower right hand rests on the weapon, tris'u_la personified as a standing dwarf. Over the head of the dwarf are three prongs of the tris'u_la; the lower part of the tris'u_la consisting of a stem pierces his head and throat and is shown in front of him; he holds it by his hands. (After Fig. 26 in: V.R. Mani, 985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan)

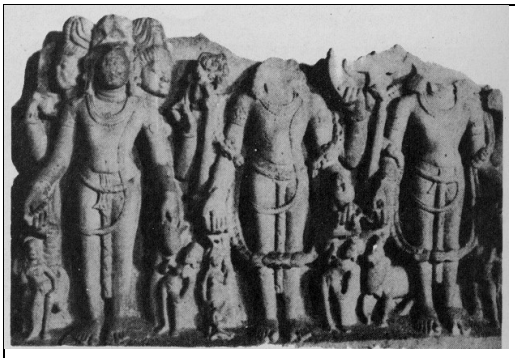


Astradeva.
Tiruman.an~ceri, Mayuram taluk, Tanjore dist. On the tris'u_la, four-armed S'iva is with Uma_devi, both standing with the va_hana, bull. S'iva carries in his upper hands, an **axe** and an **antelope**; his lower right hand is placed on the head of the r.s.abha and lower right arm is stretched to the hip of Pa_rvati (Uma_). A representation of A_lin:gana r.s.abha_n.d.ika. (After Fig. 36 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan) [Antelope as a weapon will be elaborated elsewhere on this website, in a separate section dealing with the pictograph of an antelope].

Subrahman.ya shrine, Br.hadi_s'vara Temple, Tanjore. Late Na_yaka period. Dwa_rapa_la with S'akti on the head and depicting vajra weapon of Subrahman.ya. (After Fig. 33 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan).
(After Fig. 7 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan)

Vis.n.u, Ghat.es'var temple. Baroli. The mu_rti carries in one of his upper right arm a cakra_yudha on top of which a human head is seen, an apparent symbol of personification of the a_yudhapurus.a. [**Cakra** is a vedic weapon.][7]

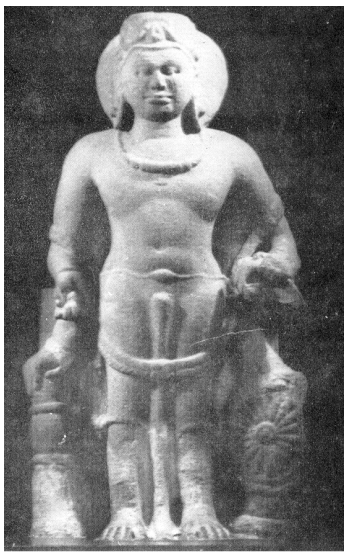
revealing his identity as 'The incidence of Cakrapurus.a in art starts from the fourth century onwards, one of the earliest specimens being a late Gandha_ra metal image of Vis.n.u with a charming Cakrapurus.a gazing at him (*Indologen Tagung*, Gottingen, W. Germany, 1959, pp. 165-178; *Indische Sculpturen,* vol. I, pl. 42-43; C. Sivaramamurthi, *Indian Bronzes*, p. 14, fig.2)...The image of Vis.n.u in the temple of Rajgir places its lower right arm on the shoulders of a male dwarf who has a 'wheel-halo' behind him Cakrapurus.a (A. Ghosh, *A Guide to Rajgir*, 1944, pl. V fig. C; C. Sivaramamurti, 'The Weapons of Vis.n.u', *Artibus Asiae*, XVIII (2), 1955, p. 128, fig.1).' (VR Mani, p. 11). (After Fig. 2 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan)



Gada_devi and Cakrapurus.a flank Vis.n.u in the Trimu_rti panel. Lucknow Museum. (After Fig. 3 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan)

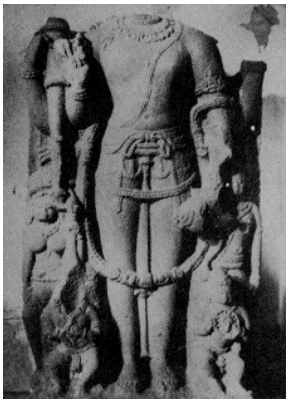
Udayagiri. Cave No. 6. Rock-cut Vis.n.u with Gada_devi and Cakrapurus.a. The latter is a dwarf to whose head (now broken) is attached the cakra with many spokes. Gada_devi is carved in the body of the gada_ held by a right hand of Vis.n.u (After Fig. 4 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan)

Harihara with a_yudhapurus.a 5th or 6th cent. AD. Cakrapurus.a is on Vis.n.u's side and Tris'u_lapurus.a is on S'iva's side. Kutari. Allahabad dist. (Allahabad Museum). (After Fig. 5 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan)

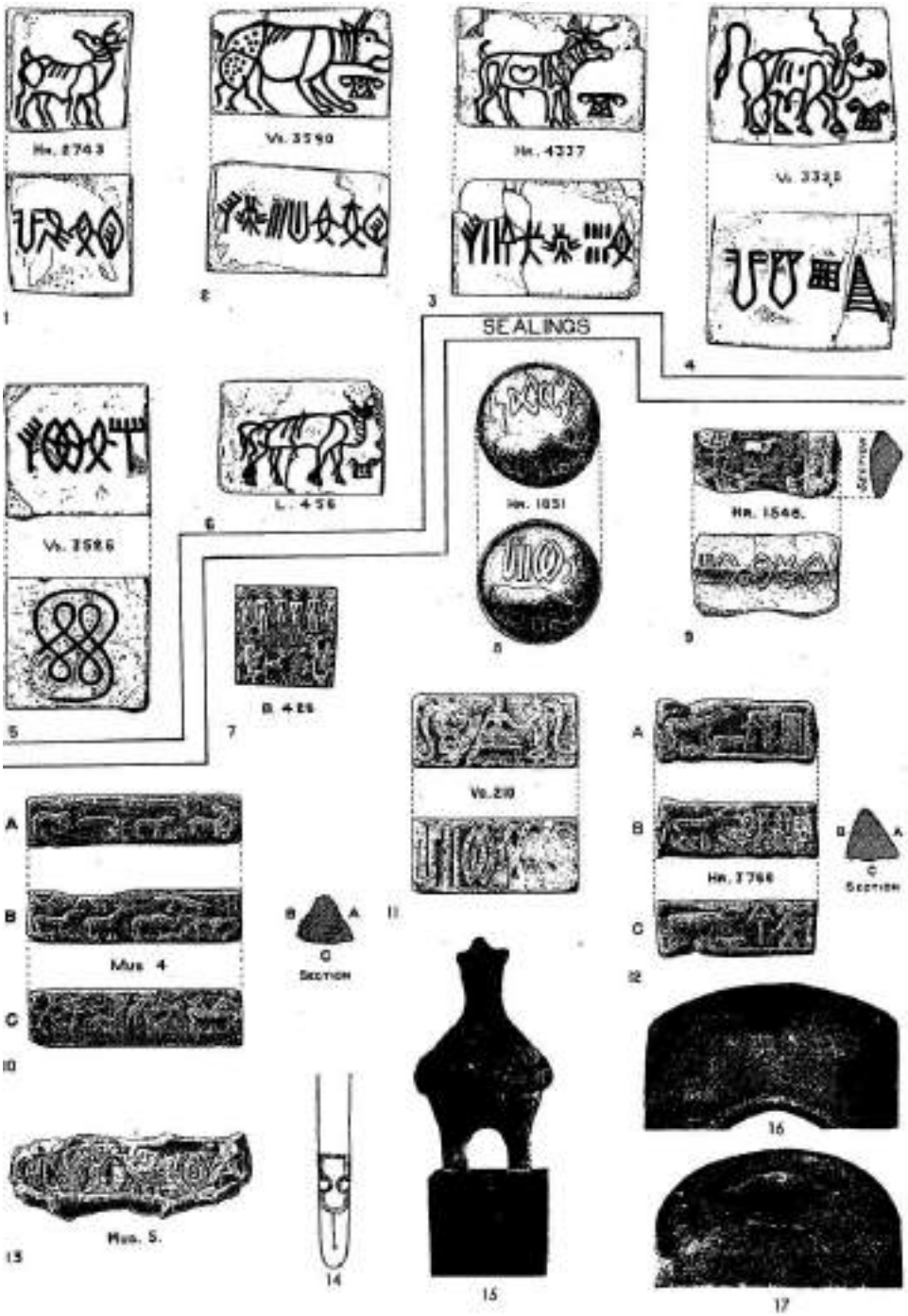


Vis.n.u with Cakra and Gada_. Lower pair of arms carries a gada_ and an 18-spoked cakra placed on a pedestal. Jhusi. Allahabad dist. (Allahabad Museum).

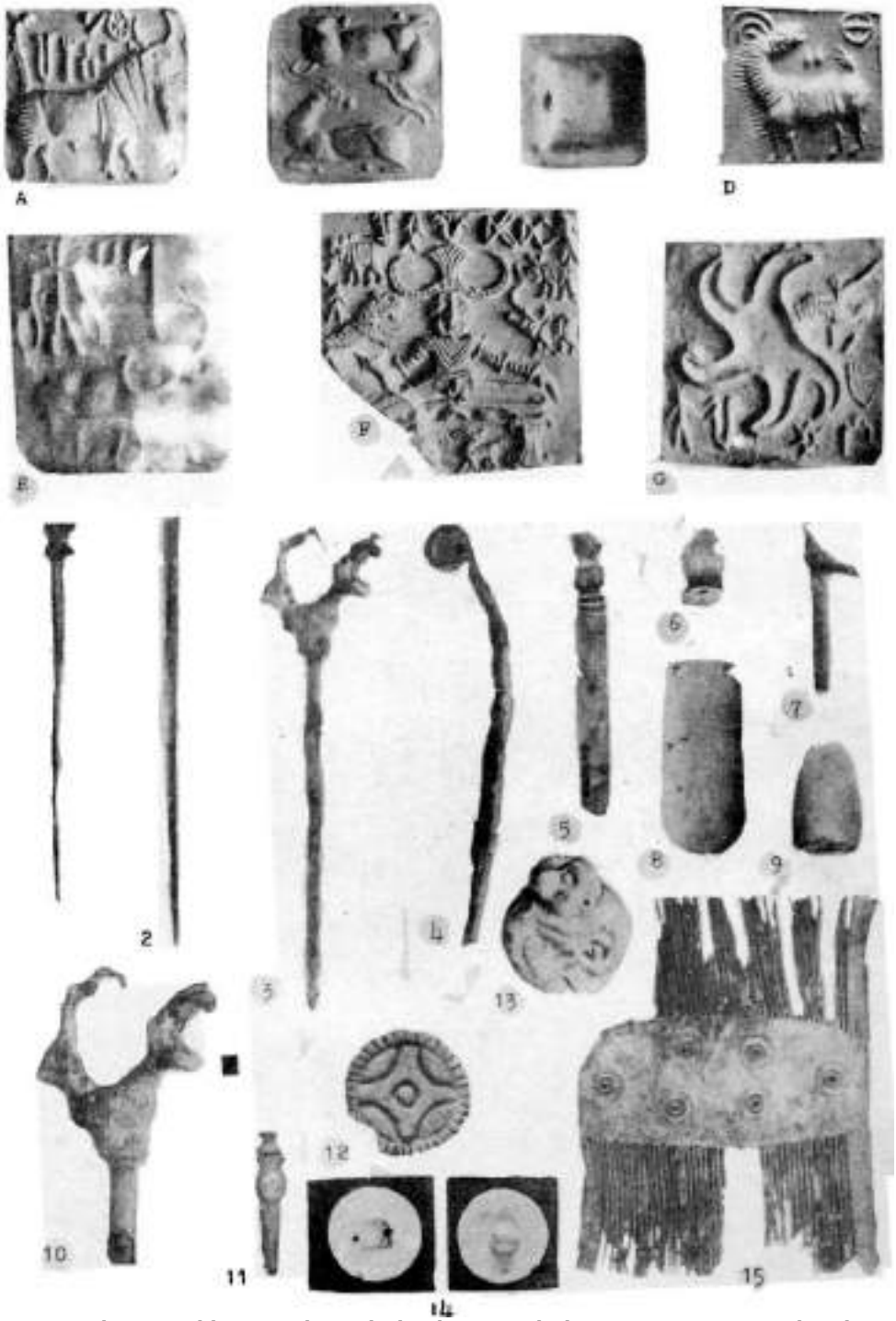
Terracotta plaque



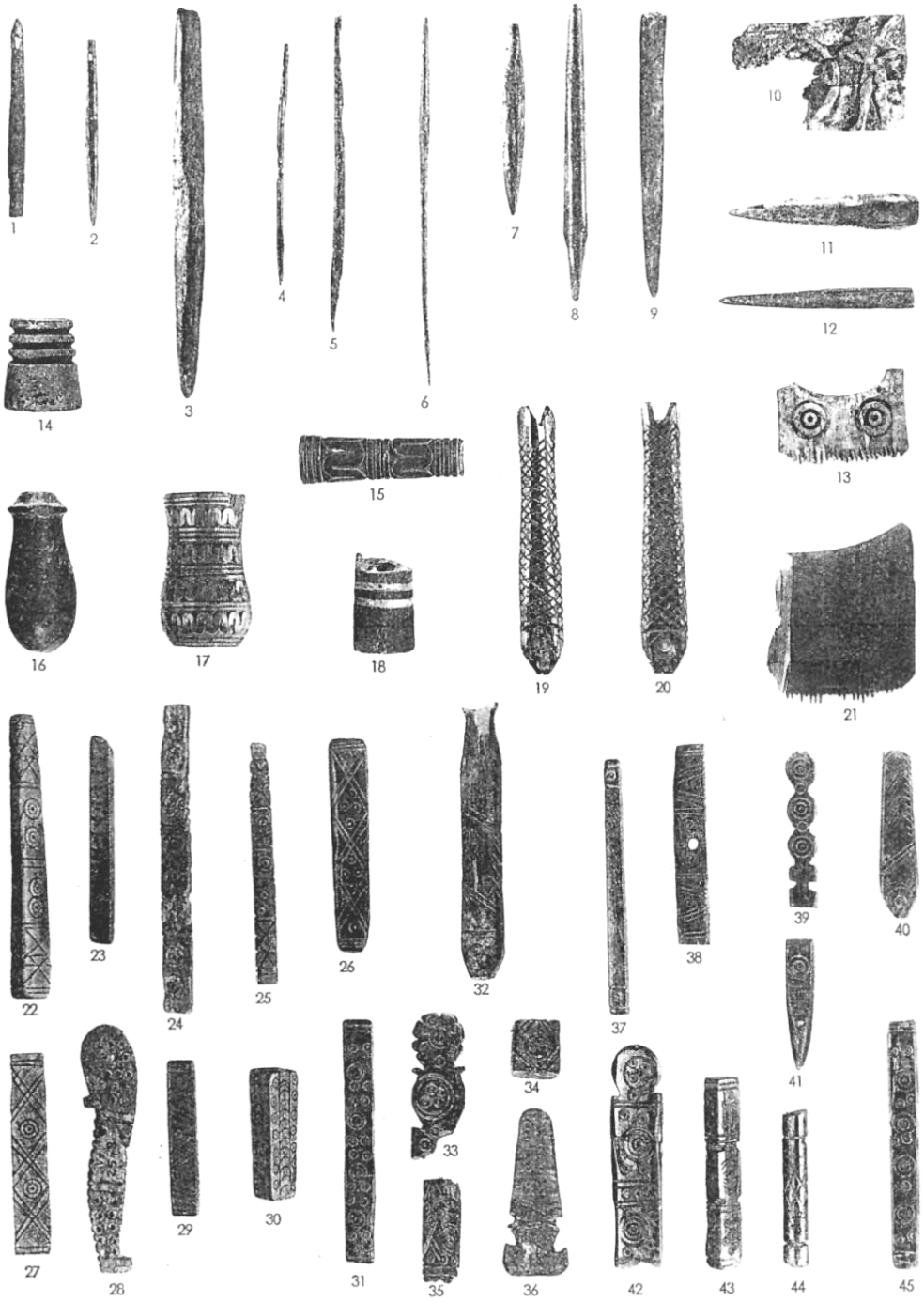
from Ranmahal (Bikaner Museum). '...the dwarfish Cakrapurus.a appears independently as a brahmaca_ri, putting on a dhoti reaching the knees; left hand placed on the thigh and right hand raised up as usual; a wheel halo has also been shown behind his head. This plaque must have been originally studded on the exterior of some early Gupta and brahmanical brick temple in the Bikaner region of ancient Sarasvati and Dr.s.advati_ rivers' (R.C. Agrawala, 'Chakra Purus.a in Early Indian Art', *Bharatiya Vidya*, Vol. XXIV, Nos. 1-4, 1964, p. 43. (After Fig. 6 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan) **Junagarh (Junagarh Museum).** Two young dwarfs hold the weapons, one the conch and the other the discus. At the bck of the dwarf holding the conch is a female figure holding a padma with a long stalk, in her hand. Beside her forehead is suspended the gada_ of Vis.n.u from his right arm; she is perhaps the personififed Padma. (After Fig. 8 in: V.R. Mani, 1985, *The cult of weapons -- the iconography of A_yudha Purus.as*, Delhi, Agam Kala Prakashan).



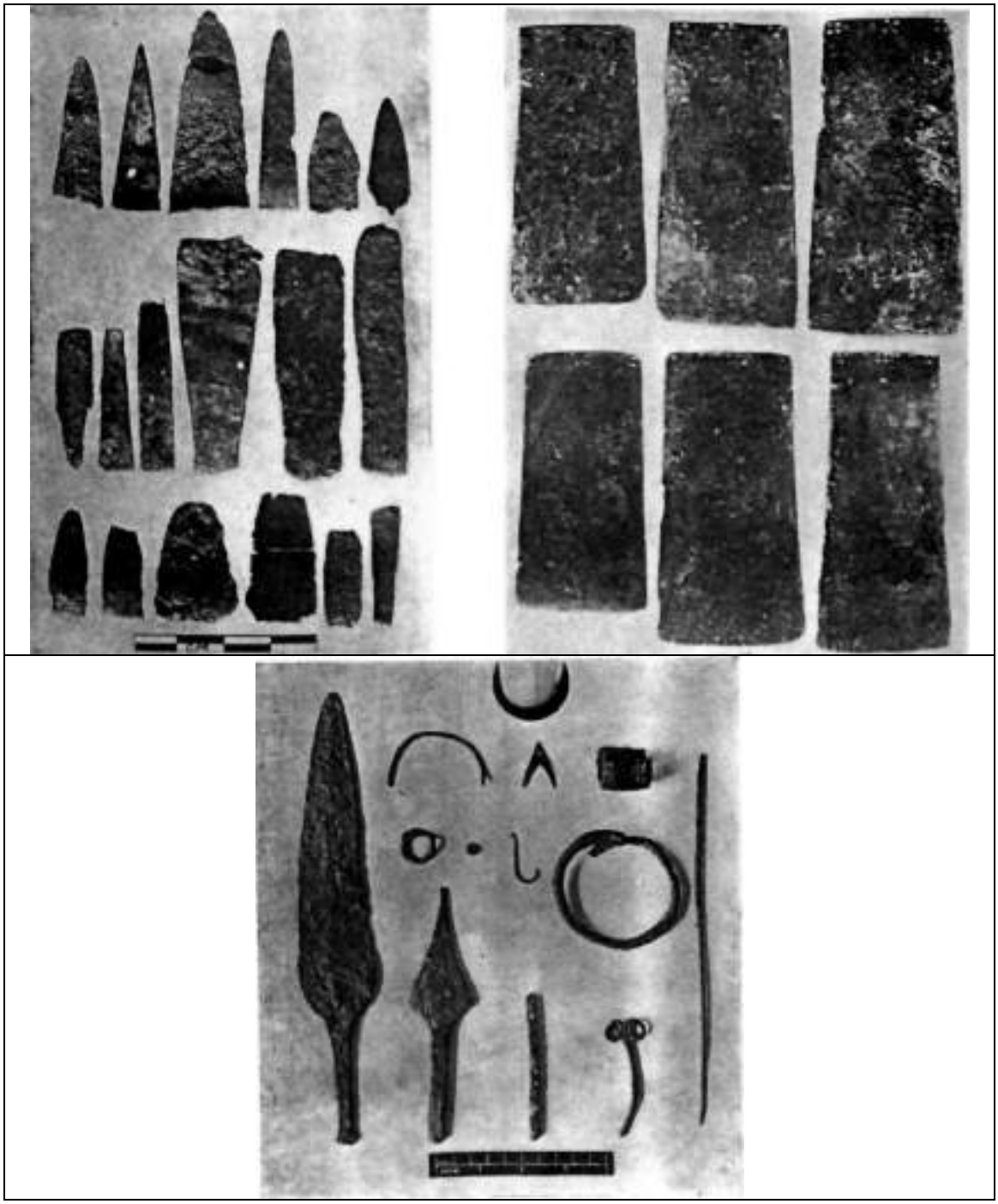
MIC, Pl. CXVIII. Copper tablets, sealings and miscellaneous objects. Item 14 is a gold fillet with an outline of the 'standard device'.



FEM. Pl. C. Seal impressions, hair-pins, comb, buttons, etc. Lower levels.



MIC, Pl. CXXXII. Needles, awls, handles and objects of ivory bone. Dotted circles on ivory (Items 13, 39, 42, 45). Item 10 has a warrior pictograph which becomes a sign.

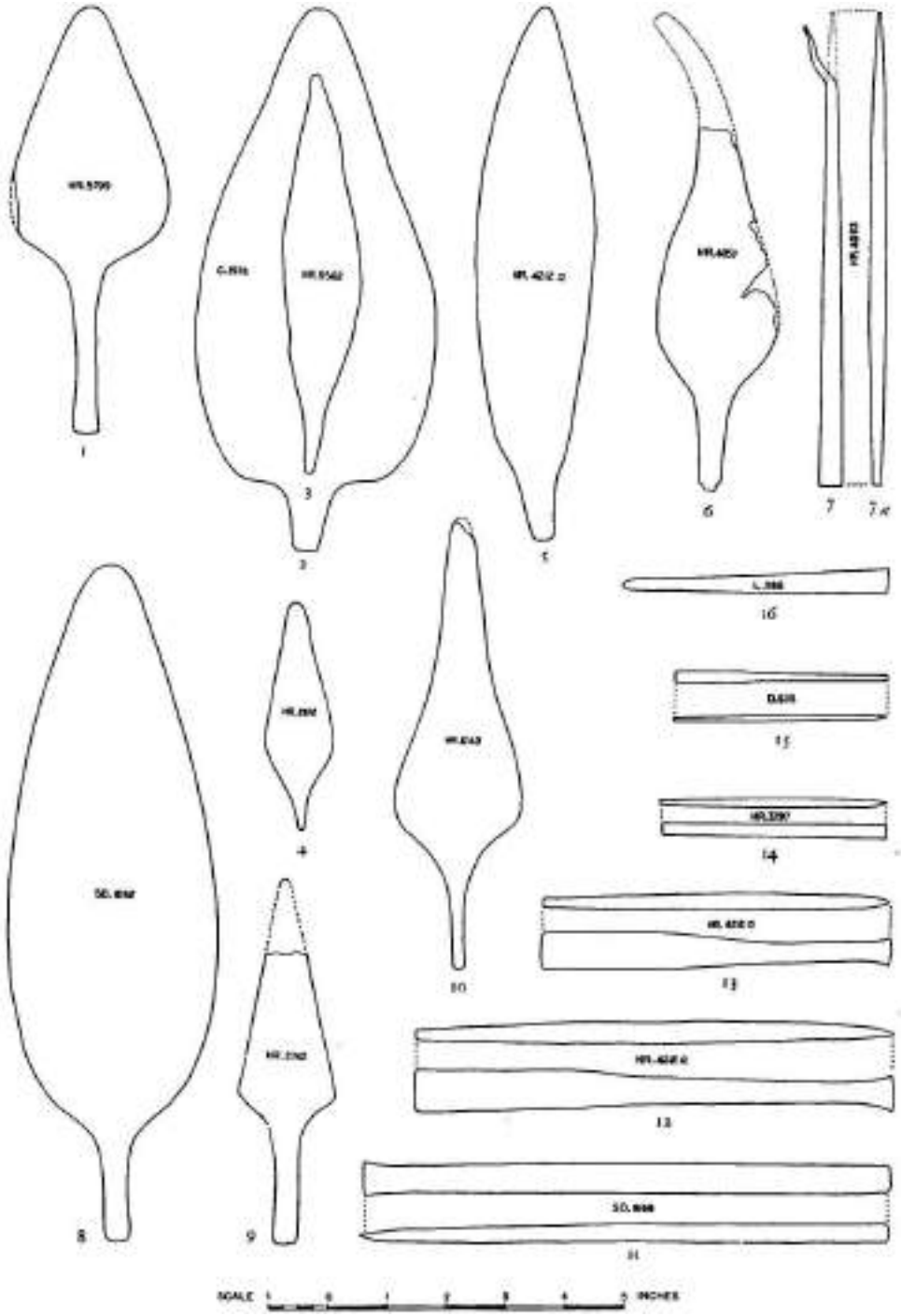


Banawali: Copper objects of the Harappan period. [After Pl. 59 in: BB Lal and SP Gupta, eds., *Frontiers of the Indus Civilization*].

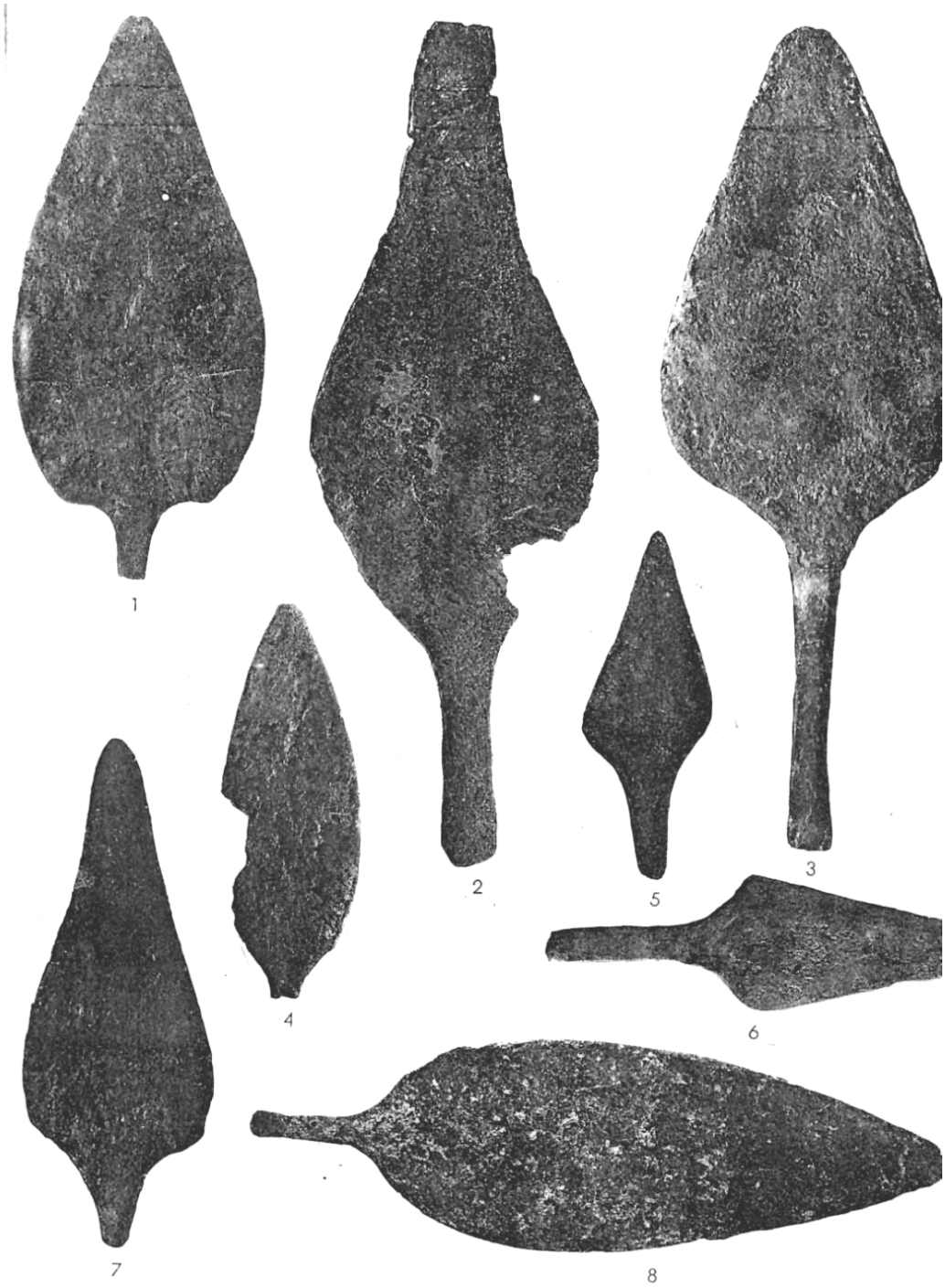
Ahar: copper choppers and a celt; Kurada (or Khurdi): copper celts, choppers and rings.

[After Pl. 69 and 70 in: BB Lal and SP Gupta, eds., *Frontiers of the Indus Civilization*].

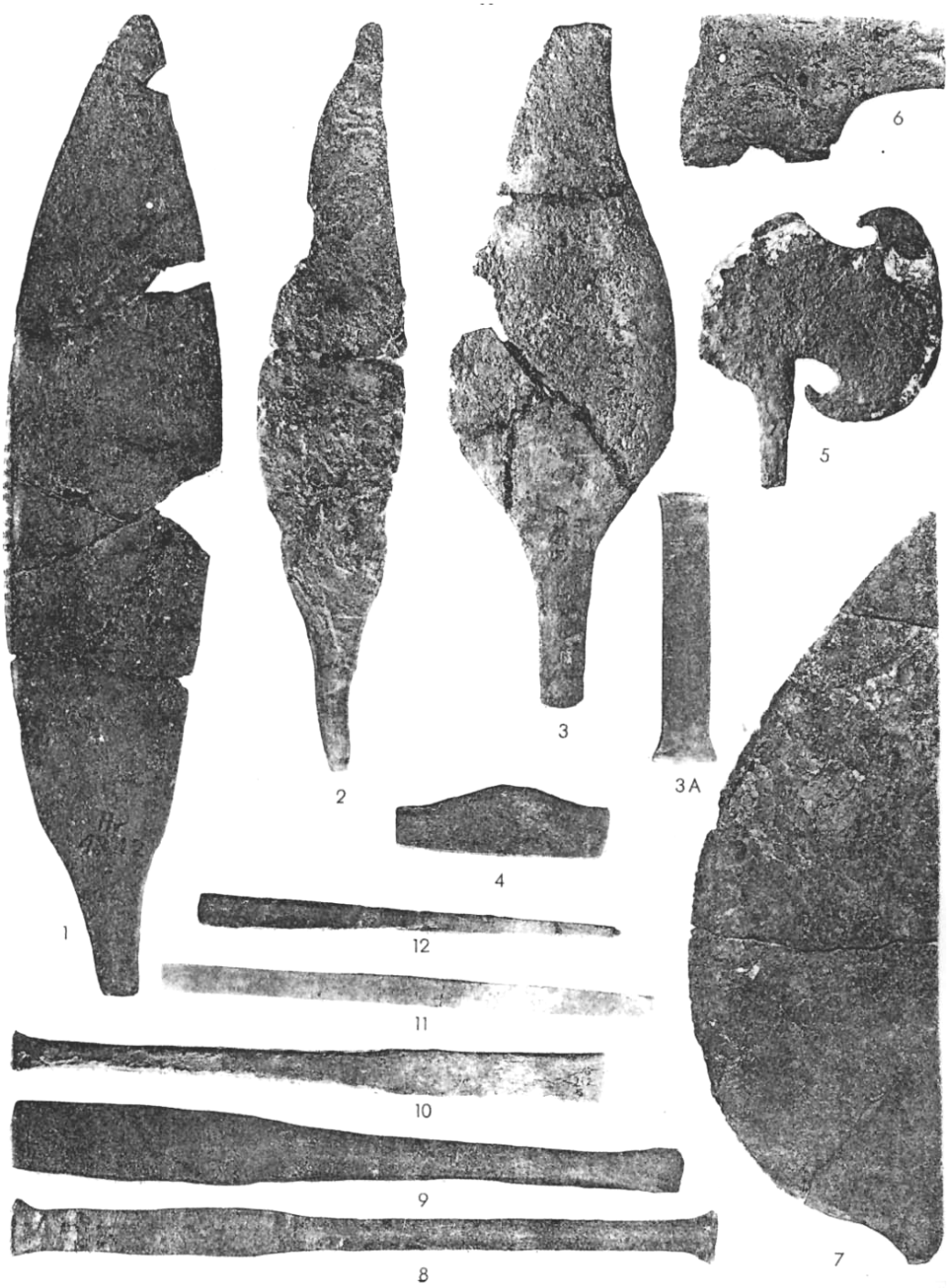
Ganeshwar: coper arrowheads; copper implements; copper celts with indentations. [After Pl. 73, 74 and 76 in: BB Lal and SP Gupta, eds., *Frontiers of the Indus Civilization*].



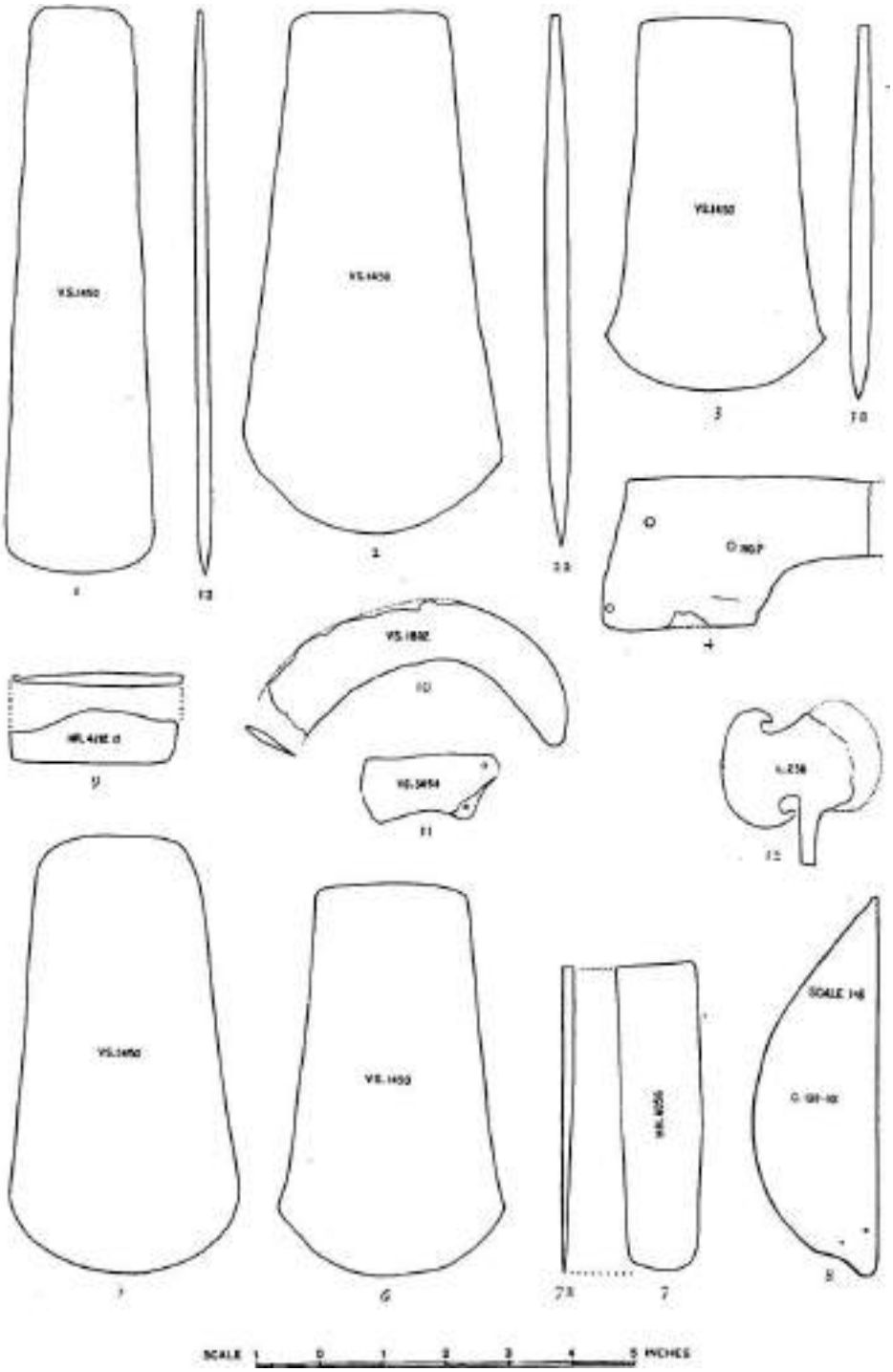
MIC, Pl. CXXXV. Copper and bronze tools and weapons.



MIC, Pl. CXXXVI. Copper lance-heads or daggers



MIC, Pl. CXXXVII. Bronze and copper tools, etc.



MIC, Pl. CXXXVIII. Copper and bronze tools and implements.