An Introduction to Harappan Mirrors: Studies in the National Museum, Karachi, Pakistan

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Abstract

The objective of this paper is to highlight four masterpieces of Harappan mirrors in the collection of the National Museum of Pakistan in Karachi. The origin of those mirrors from Harappa and Mohenjo-Daro and side by side an attempt is made to locate the present location of other mirrors elsewhere.

Keywords: Mirrors, Harappa, Indus Valley Civilization, National Museum of Pakistan.

1. Introduction

Mirror or *Darpan* or *Mukura* or *Ayna* is the essential material objects of everyday life. It helps us in our daily mundane lives, though we rarely ever really appreciate its usefulness. From the dawn of civilization this object is continuing without any substitute even in the 22nd century.

Harappan Civilization is contemporaneous with other early state level societies but it has some unique and challenging issues. In the Old World the major state level societies include Harappan or Indus-Saraswati, Mesopotamian, Chinese and Egyptian. Excavations revealed the different Harappan sites in this subcontinent. Regarding periodisation the use of mirrors began in mature *Harappan Phase,* 2600-1900 BCE. A few mirrors had been discovered from the burials of Harappan sites of Pakistan and India.

The National Museum of Pakistan was established in Karachi in 1950. The objective of this paper is to discuss the Harappan Mirrors of their collections. The emergence of mirror in southeast Asia throws even a clearer pattern of intercultural links and trading exchanges over a very wide area in the late third and early second millennia BCE (During Caspers 1996)[1].

[1] During Caspers, E.C.I. (1996). The reliability of archaeological evidence for mercantile/ intercultural contacts between Central and South Asia, the Arabian Gulf, and the Near East in the late third and early second millennium B.C. in *Explorations in Art and*

This vast area includes the Indus Valley Civilization, comprising India and Pakistan and its neighbourhoods in North West Afghanistan (ancient Bactria), Baluchistan - Central, Southern Pakistan and Iranian; Uzbekistan, Arabian Gulf areas and Mesopotamia. Archaeological excavations and exploration have long established that the mirrors were extensively used in Ancient India though scanty of specimens is available now.

We shall discuss in this paper, a few masterpieces of mirrors of this museum's collection with a brief discussion on their origin; with a bird's eye view of their archaeological context. The discussed mirrors of this Museum were recovered prior to 1947, before the partition in this subcontinent. In New Delhi, National Museum of India was established in 15th August 1949. Both these museums were initiated with the collection of few other museums of this subcontinent.

2. Elements of Material and Methodology

Throughout the world there is a believe that human learnt the use of native copper in Neolithic Period. The human of the then period made small artifacts using the small pieces of native copper by hammering those pieces with the use of heating in small furnace using wood as fuel. But this is not considered as the beginning of metallurgy; that only to be considered when human learnt to extract metal from the ore- minerals. The discovery of copper slag of 7500 BCE at Catalhoyuk, at Anatolia region in Konya province of Turkey is considered as the beginning of metallurgy.

The transition from lithic to metal is noted in Mehrgarh Baluchistan (29.3873ºN, 67.6096ºE), Pakistan where early beginning of metallurgy in this sub content was noted. The bulk of the worlds' supply to have been from ores based on chalcopyrite, a mixed iron and copper sulphide ($CuFeS_2$). That ores exploited at the beginning of Copper Age appear to have been located some distance below the surface of a weathered and oxidized primary outcrop. The iron-oxide regions above the rich copper deposits are known as gossans (Agrawal 2009: 184)[2]. Agrawal

Archaeology of South Asia, (Ed) Debala Mitra), Calcutta: Directorate of Archaeology and Museums, Government of West Bengal, pp. 123-156.

[2] Agrawal, D.P. (2009). *Harappan Technology and its legacy,* New Delhi: Rupa & Co.

also shared much information from Darling (1990)[3], who shared different aspects of origin of non-ferrous metals. From Sumer of southern Mesopotamia - located in south central Iraq was one of the contemporaneous civilizations of Indus valley, one of the earliest pieces of evidence of copper casting was noted in 2700 BCE. *Cire perdue* (or Lost wax) casting techniques were mastered by Egyptian before 2200 BCE.

The term mirror is a material object which possesses a very smooth surface where regular reflections occur, following the laws of reflections of light. In present days normally the glass sheets with coating of metal like silver, mercury or other materials on one side is used. In ancient period, the mirrors were basically made of copper or copper-tin alloy better known as bronzes. Throughout the old world, bronze - an alloy of copper (Cu) and tin (Sn) were known from very beginning.

Perhaps the formation of first alloying was due to the natural presence of copper and tin minerals together. Pure copper is difficult to melt for its very high melting point 1084.87 ^{o}c. The smelters discovered that adding Sn to copper decreased the melting temperature. With repeated experimentation in hundreds of years they identified those three types of alloys with Cu-Sn system. The earliest copper–bronze technology began in Harappan civilization. Those include adzes, axes, chisels, fishhook, knives, pans and ornaments. The copper bronze objects of that civilization were mostly made by using pure copper. 30% of the specimens analysed in Harappa and Mohenjo-Daro were identified as low tin bronze, bearing less than 10% Sn. The ornaments and tools of Harappan civilization were manufactured by casting technique. The famous dancing girl, and a few other statues, models of cart and small vessels were made through precision casting technology, known as *cire perdue* or lost wax techniques. Thus, a well-developed casting technology was flourished in Harappan culture. Those bronze specimens were lesser than a kg in weight.

There is some evidence for smelting copper ores at the site of Harappa in crucibles as well as in larger furnaces. (Hoffman, B. C. 2019:54). Excavation at Binjore in the modern state of Rajasthan, were conducted by the Institute of Archaeology and Excavation branch of the Archaeological Survey of India. They have revealed hundreds of copper

[3] Darling A.S. (1990), Non-ferrous metals, in An *Encyclopaedia of the H*istory of Technology (Ed.) I. McNeil, London: Routledge, p. 47-144.

smelting furnaces (Manjul et al 2017)[4]. That indicates import of copper in ingot form, to the Harappan copper smelters. The evidence of bun shaped ingots with an uneven puckered top surface from Mohenjodaro, Chanhudaro, Harappa and Lothal indicate that those were the raw materials for further forging. Cold as well as hot forging were known to the artisans. But those were limited in quantities where the specimens were initially made by casting and subsequently finished by forging. The techniques of forging become too tough. Saws and razors discovered in Harappan sites were made from sheet metal that subsequently forged, to obtain cutting edge. Some of the objects revealed 'twins'- through metallography – indicating annealing, after forging.

Casting technology depends first on the development of furnace for melting the metal and secondly for making proper mould to obtain the desired product. Ancient mould types like open moulds, etc. were discovered in Harappan sites. Casting of low tin bronze objects was easier to pure copper objects. Forging to thin cross section was also possible for pure copper. Casting was easier for low-tin bronze than pure copper. The increase of Sn content above 10% is difficult for forging due to very short forging zone of 50 to 100 ^{o}C. That low tin bronze alloy can be termed as α-bronze, which is only a single-phase solid solution of tin in copper. Low tin bronzes are harder and stronger than pure copper.

Harappan metal workers were very good at making alloys and if they had wanted to make high tin alloys, they would have been able to do this. They clearly did not want to do this and the tin ratio that they used is because that is what they found suitable for the mirrors and other objects that they made. (Hoffman B.C, 2018-19: 175).[5]

The copper-bronze smelters of Harappan culture processed bronze above 10% Sn alloy. This is the major reason for the composition of artifacts of this period and improvement was noted in subsequent Gandhara period in this region.

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[4] Manjul, S.K., Arvin Manjul, P.K. Chattopadhyay, D.C. Pal and A.S. Baidya (2017). Metal Craft of Harappan Culture: A case study at Binjor, paper presented at BUMA-9. Busan, Korea

[5] . Total 324 copper and bronze samples were analyzed for their compositional character by HARP (Harappa Archaeological Research Project during excavation from 1986-to present, including one mirror.

2.Technology of Mirror Making

Two techniques might be employed by the Harappans to make mirrors – forging the mirror blank straight from copper-bronze ingots, then grinding and polishing the mirror surface; the second technique is casting the mirror blank then subsequent finishing techniques. The second technique is easier and experimentally reproduced by Jonathan Mark Kenoyer, leading excavator of Harappa in Pakistan (Personal communication, 20 May 2015). He reproduced a mirror by using sand bivalve mould and finished those with grinding and polishing. Thus, the manufacturing technique has been established. Gandhara mirrors were made with technological improvements over the Harappans.

A mirror is physically combination of three units — polished mirror face, back side and handle/ or a small tang. The mirrors of the Harappan period are round to oval in shape like most of the ancient mirrors. It is very closely associated with an individual and had both aesthetic value and religious significances. Most of the former mirrors were made of cast or forged blanks. Artisans inspect both the surfaces of the blank carefully – then select the best one, which is almost free from surface defects. If surface defects were more, they rejected that piece without any further steps, and scrap that piece and recommends for re-melting in a crucible over a melting furnace.

3. Brief Archaeological Information

The archaeological information related to the source of the mirrors of the collection of National Museum of Karachi, Pakistan; those may be explained as follows. The sources are from Harappa and Mohenjo-Daro. Those were excavated prior to the partition in this part of the subcontinent. If anyone is able to study those categories of mirrors - the entire Harappan mirrors, and then knowledge for the entire Southeast Asian mirrors would be achieved.

Harappa

The site, Harappa (30.6110° N, 72.8929° E) is one of the largest and most important cities of the Indus Valley Civilization, consists of a series of low archaeological mounds and cemeteries to the south of a dry bed of the Ravi River. The site was initially excavated by M.S. Vats of

Archaeological Survey of India between 1920-21 and 1933-34 (Vats 1940). One of the excavated specimens from Harappa is preserved now in the National Museum of New Delhi (Acc. No. 2602) Pl-I, (Fig. No. 1). Excavations have revealed a number of mirrors from Harappan burials by the archaeologists. We shall discuss afterwards.

Wheeler had discovered a circular handled copper mirror in 1946 from burial 2. Two faces of the mirror are shown in same figure, Pl-I, (Fig. No. 2). The burial revealed an elongated skeleton of a woman aged 30 years. The length of the skeleton was 162.6 cm. Several potteries, round water pot and a few other objects were also revealed. The mirror was in highly corroded state. Wheeler (p. 125) had further referred the composition of it which includes Sn (0.35%) and Pb (2.39%); Ni and as are absent. He had mentioned that it was originated from the (ores of) Aravalli.

Mohenjo-Daro

Mohenjo-Daro is the next important Harappan site. Discovered and excavated first time by R.D. Banerjee. Excavation continued afterwards by E.J.H. Mackay (1938:478)[6]. The site (27.3243^{o} N, 68.1357^{o} E) is situated in the Larkana district of Sindh province, Pakistan and it was one of the largest and most important cities of the Indus Valley Civilization. Till 1928 there was no evidence of mirror in the excavation at Mohenjo-Daro. Mackay (1938: 483-486) was the first excavator who discovered five mirrors from the DK area of Mohenjo-Daro. The first two mirrors of this site were recovered from upper level and three mirrors from lower level. The sketch / photographs are shown in Pl.2, Figure-2, was the first mirror (Fig. 1) which has been included by Mackay in his volume as plate CXIV, 1.[7] At present this mirror is preserved in National Museum Karachi Pl.2 (Figs. 1-2).

The back side of this mirror Pl.2, (Fig. 2) which is quite plane and somewhat irregular. The polish has completely disappeared from the recessed face of that mirror. The handle is rectangular in cross section at the end and it looks as if there had been another hole close to the mirror itself, but if it was so, then it has been filled up by corrosion afterwards.

The second mirror one of Mohenjo-Daro, shown by Mackay as (Pl. CXVIII, 10), is made of bronze; slightly with the edge of the face raised

[6] Mackay, E.J.H. (1938). *Further Excavations at Mohenjodaro*, 2 vols. Delhi: Archaeological Survey of India.

[7] D.P. Agrawal 2009: 219.

4.3 mm. The length of that mirror was 266.7 mm, its width is 151 mm and thickness of blade is 10.2 mm Pl.2, (Fig. 2). It is interesting to identify, that mirror now accessioned, with (No.13303 A2601) in the National Museum, New Delhi Pl-2, (Fig. 3). The tang was, however broken now and subsequently under conservation.

From lower level the third mirror, (Pl. CXXX, 24) was 229.4 mm, its width is 165 mm and thickness of blade is 4.32 mm was recovered, Pl-2 (Fig. 4). Another specimen fourth mirror is shown in (Pl. CXXX, 25), Pl-2 (Fig. 5). This mirror is also located now in the National Museum, Karachi.

4. Description of the Mirrors in National Museum, Karachi's Collection:

In this Museum we have four Harappan mirrors – two from Harappa and two from Mohenjo-Daro. All those were revealed in excavation by the erstwhile Archaeological Survey of India. After partition they have handed over these four such specimens to this museum and two such to the National Museum, New Delhi. Out of the four Harappan mirror specimens in Karachi let us describe those in serial:

Specimen Pl.3, Sl. No. 1

The first mirror specimen in this paper (Accession No 54931) is shown in Pl.3, Fig. No. 1 for its' face side. Its' back side is shown in Pl.3, Fig. No. 2. This specimen was recovered from upper level in the DK area of Mohenjo-Daro (Mackay 1938: 483-486). We are aware that Mackay was the first excavator who recorded five mirrors from this site. This was the first one, which was mentioned in Pl. CXIV, 1 of that excavation report.

The height of the mirror, i.e., mirror face and handle – (better we should call it as tang), is 290 mm. The width of the mirror face is 165 mm. with the edge of the face is slightly raised to 4.3 mm. The mirror face is oval in shape, with height 183x164 mm in breadth. The thickness of the mirror blade is varying from 10 to 5 mm. The back side of the mirror face is somewhat irregular. The polish has completely disappeared from the mirror face. Slightly above the handle there is groove. The handle is about 92 mm in length and 11 mm in breadth, and rectangular in cross section with average thickness of 5 mm. At the end of the handle, it appears that

there was another hole close to the mirror itself. Because of the corrosion and subsequent conservation, it was perhaps filled it.

The engineering drawing is shown in Pl.3, Fig. 3. In this drawing one can see that there is a difference of an arc of 15 mm depth exists between the oval mirror face and handle. The edge of the face is clearly exposed there.

Pl.3, Specimen Sl. No. 2

The second mirror specimen of this discussion (Accession No. H-810) were obtained from Harappa. The Pl.3, Figs. No. 4 and 5 respectively represents the mirror face and the back side of the specimen. The total height of the mirror including mirror face and handle is 140 mm. The face is slightly oval. The handle has some similarities with 'dove tail' shape. The handle has the minimum breadth at the centre. The mirror smith has designed as such it would be gripped at easy. Arc of this handle tip is 9.01 mm. Handle length is 26.74 mm. Thickness of the mirror is 2 mm. The engineering drawing of this specimen is shown in Pl.3, Fig. No. 6.

Pl.3, Specimen Sl. No. 3

The third specimen Sl. No. 3: was obtained from the DK area of Mohenjo-Daro. Its accession no (54.930, DK200). It was excavated by Mackay and is shown in Pl. CXXX, 26). The front face of the mirror is shown in Pl.3, Fig. 7 and back side of the mirror is shown in Pl.3, Fig. 8. Size is 95 mm height and the width of the mirror is 53 mm). The length of that mirror was 95 mm, its width is 53 mm and thickness of blade is 5.6 mm. It is important that this mirror now under the National Museum of Karachi with and its present accession number i.e. 54.930.

This mirror is oval shaped with an inbuilt handle. The handle was damaged and subsequently well-conserved. The height of the mirror is 53 mm. The handle is 38 mm height and its breadth at the middle is 9 mm and at the bottom is well curved about 12 mm.

This specimen we are confirming Mackay's claim that it was made for a child for its smaller in size in shape. The engineering drawing of this specimen is shown in Pl.3, Fig. No. 9.

Pl.3, Specimen Sl. No. 4

The fourth specimen (bears Accession No 543278), were recovered from Harappa. Pl.3, (Fig. No. 7) indicates the front face and the Pl.3, Fig. No. 8 indicates the back side of this mirror. The main feature of this mirror is its oval shaped and that one is connected with a handle, - both processed simultaneously during manufacturing. The height of the mirror including the handle is 190 mm. The breadth of the oval face is 110 mm. The mirror face is about 1 mm. The handle is flat in cross section, with thickness range of 3 mm. The edge at bottom of the handle was chiselled out.
The uniqueness of this specimen is for its back side of the mirror face – having a rim all along and that is varying in thickness with average value of 4.9 mm. The mirror face is flat. The handle is rectangular in cross section 64.9 mm in height and maximum breadth is 19.6 mm at tip of the handle it is 14.7 mm. We observe the presence of this type of rim first time on Harappan mirrors. The engineering drawing of this specimen is shown in Pl.3, Fig. No. 12. In brief, the dimension of the mirrors are shown in Table-1.

The recessing of the faces of all these mirrors was perhaps intended to protect them and to preserve their polish. It is almost certain that the handles at one time encased with wood and therefore than they now are, for these mirrors are very heavy and difficult to hold in their present condition (Mackay 1938: 478).

The mirrors discussed in this paper represent the reference collection of Harappan mirrors of this part of the subcontinent. Because of some technical problems we are unable to separate them from their fragile and conserved states in this museum.

5. Conclusions

The copper metallurgical tradition practiced at Harappa shows that different alloying techniques were in practice at the same time in order to produce metal objects for different application has come out as a strong explanatory model in other regions. It indicates that Indus copper/bronze workers would have been expert in a variety of allying techniques and production. The evidence of an alloying practice tradition at Harappa based on object appearance allows for incorporating the possibility that some of the ethnographic (Lahiri 1993;1995) and textual (Chakrabarti and Lahiri 1996:137-150) evidence for the use of specific alloys to make

special objects categories or for particular purposes, such as religious ceremony, could have it roots in Harappan copper/bronze metallurgy.

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1. Mirrors of Harappa

Fig. 1 - Mirror Harappa (Access. No. 2602, National Museum, New Delhi).

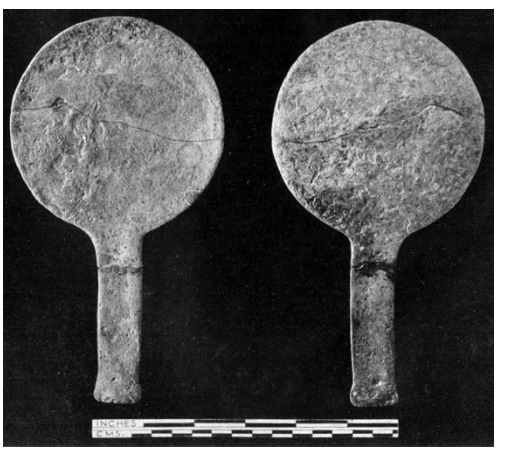

Fig. 2 - Two faces of mirror Harappa, cemetery R 37. (After Wheeler 1946).

Fig. 3 - In-situ mirror from Harappa
(Photograph by J. M. Kenoyer)

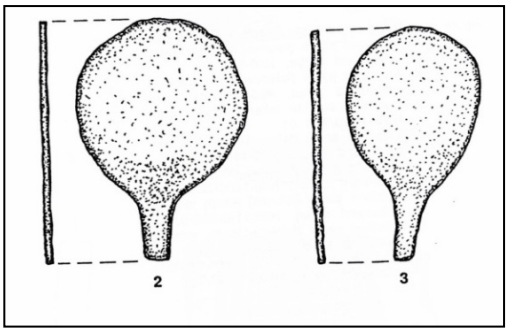

Fig. 4 - Circular mirrors from burials.

Fig. 5 - Mirror from Harappa
(Photograph: Harappa Archaeological Research Project).

Fig. 6 - Mirror from Harappa.

2. Mirrors from Mohenjodaro (after Mackay)

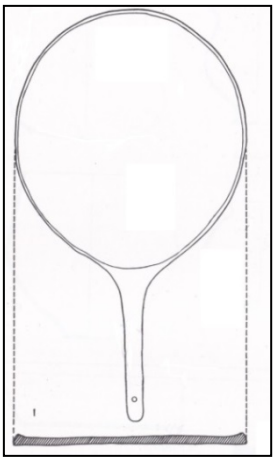

Fig.1 - Mohenjodaro
(Pl. CXIV, 1, after Mackay)
National Museum Karachi

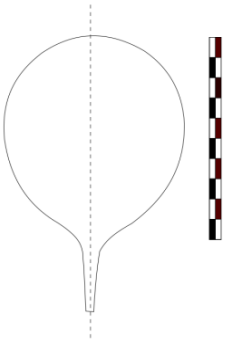

Fig. 2 - Mohenjodaro
(Pl. CXVIII, 10, after Mackay)

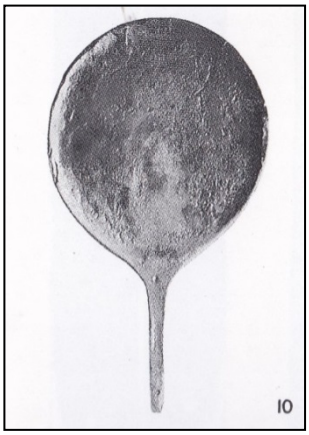

Fig.3 - Mohenjodaro
(Acc.No. 13303 A2601)
National Museum New Delhi.

Fig. 4 - Mohenjodaro
(Pl. CXXX, 24)

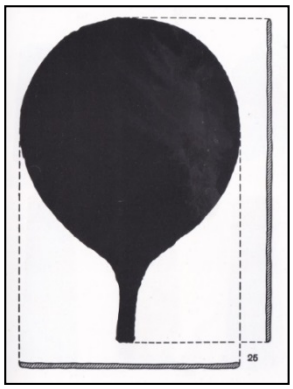

Fig. 5: Mohenjodaro
(Pl. CXXX, 25)

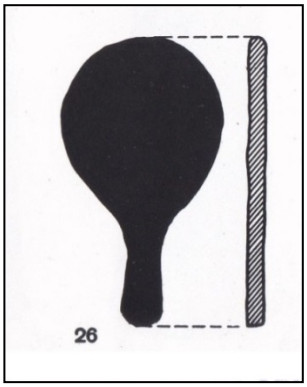

Fig. 6: Mohenjodaro
(Pl. CXXX, 26)

Mirrors of the National Museum in Karachi
Sl. No. 1: Figs. 1 -2= size. 290x 165 mm (Acc.No. 54931)
Mohenjodaro

Fig. 1 - Front face of Mirror Sl. No. 1. Fig. 2 - The back side of this mirror.

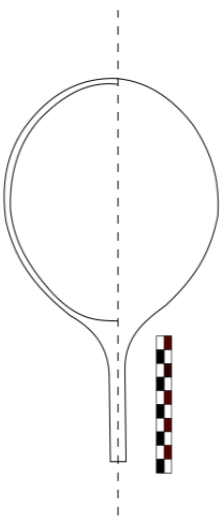

Fig. 3 - Engineering Drawing of Sl. No. 1.

Sl. No. 2: Figs. 3-4=size. 140 mm x 85 mm (Accession No. H-810) Harappa

Fig. 4 - Front face of mirror Sl. No. 2. Fig. 5 - The back side of this mirror.

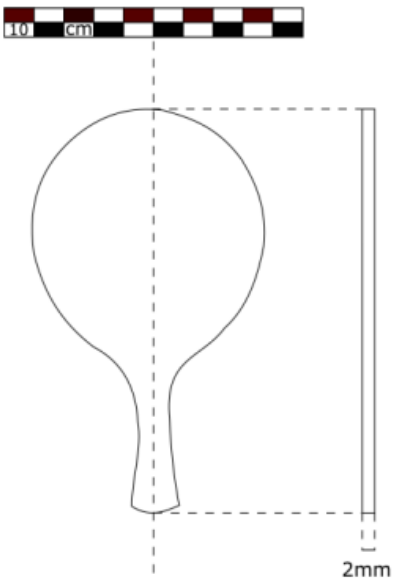

Fig. 6 - Engineering Drawing of Sl. No. 2.

Sl. No. 3: 5-6= Size 95 mmx53mm = (54.930, DK200) Mohenjodaro

Fig. 7 - Front face of mirror Sl. No. 3.

Fig. 8 - The back side of this mirror.

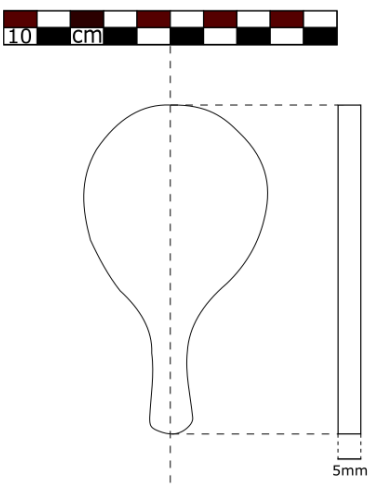

Fig. 9 - Engineering. Drawing Serial. No. 4.

Sl. No. 4: Size 190 x110 mm (Acc No. 543278) Harappa

Fig. 10 - Front face of mirror Sl. No 4.

Fig. 11 - The back side.

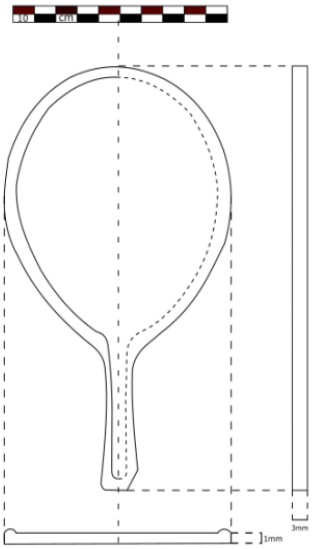

Fig. 12 - Engineering Drawing of Serial. No. 4.