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Steatite and Faience Manufacturing at Harappa: New Evidence from Mound E Excavations 2000-2001

by Jonathan Mark Kenoyer

Introduction

Seals of the Indus civilization were generally made from two different materials, steatite and faience. Steatite was also used to make a variety of beads, inlay, gaming pieces and figurines, the most famous being the so called "Priest-King" from Mohenjo-daro. Faience was also used to produce similar objects, including seals, tablets, figurines, beads, miniature vessels for holding ungents and perfumes, and various types of bangles. Steatite, a form of talc, is a very soft stone and was easily shaped and carved. But in order to make the finished objects more durable, it was hardened by firing at a high temperature. Sometimes the surface was also glazed with a blue green silica glaze, or with a clear glaze created through a process that is still not well understood. Faience is made from ground quartz that is melted and then reground to make a frit or glassy paste. This material can be colored with copper to make a blue-green or turquoise color, and then fired at high temperatures to create a shiny glazed object. The valuable ornaments and decorations created from steatite and faience were used by the Indus peoples as indictors of status and wealth. The seals and tablets were even more important because they were used by elites to legitimize and reinforce their political, economic and ritual power (Kenoyer 2000). Because of their value to the Indus people it is important to understand who was controlling the manufacture of these objects and precisely how they were being produced.

Ever since the early excavations in the 1920s and 1930s, scholars have been interested in the production processes of these materials (Marshall 1931; Mackay 1938; Mackay 1943). Studies of steatite have been undertaken at Mehrgarh (Vidale 1995) and the larger Indus cities such as Mohenjo-daro (Vidale 1989) and Harappa (ongoing by the author), as well as at the smaller site of Chanhudaro (Vidale 1987) and sites in Gujarat (Hegde, et al. 1982). These studies have focused on the production processes for beads, which can be quite accurately reconstructed due to the discovery of numerous unfinished beads. Studies of faience production have also begun to slowly reveal the complexities of this industry and the major technological achievements made by Indus faience makers (McCarthy and Vandiver 1990; Kenoyer 1994).

One major piece of evidence that is lacking from these earlier studies relates to the firing of both steatite and faience. We know that steatite beads and ornaments were first carved while the rock was soft. The finished object was then heated in a kiln to over 900° C to harden the steatite and actually transform it into different minerals, enstatite and cristobalite (Hegde, et al. 1982). Faience was also fired in a kiln that reached temperatures over 900° C to partially vitrify the powdered quartz and to create a vitreous glaze on the surface of the bangle or ornament (Kenoyer 1994). The actual kilns in which steatite or faience were heated or fired were never identified by the earlier scholars and for many years scholars have tried to determine the nature of these early high temperature kilns. Recent excavations at Harappa in 2000 and 2001 uncovered an actual faience and steatite tablet workshop that was devoted to the production of both steatite and faience tablets as well as beads (Meadow and Kenoyer 2003). This workshop has provided new evidence for understanding the processes of manufacture as well as the firing of these important objects.

Faience and Steatite Workshop

During the 2000 and 2001 field season at Harappa, excavations were conducted along the southwestern edge of Mound E to uncover remains of the occupations dating to the Kot Diji Phase (Period 2, circa 2800-2600 BC) and Harappa Phase (Period 3A, circa 2600-2450 BC). On the basis of surface surveys it was also evident that important craft activities were also present in the area and these appeared to belong to Period 3B (circa 2450-2200 BC) and Period 3C (2200-1900 BC) of the Harappa Phase occupation (Meadow, et al. 2001).

The excavation area called Trench 54 (Figure 1) was laid out over an area where two erosion gullies cut deeply into the mound and along the southern edge of one gully a large concentration of faience slag and vitrified firing canisters was discovered. Many inscribed objects including steatite and faience tablets were discovered in the course of the surface survey and some tablets were found in the area with the high concentrations of faience slag and kiln debris.

A small test excavation done in this area at the end of the 2000 field season revealed several distinct layers of "faience slag" with canisters and large quantities of complete and broken faience beads. “Faience slag” is a general term given to a light green to yellow colored vitreous material that is usually quite frothy looking and is often associated with calcined bone. Many times there are drips of green glaze on the bone or mixed in with the frothy material. Many of the vitrified canisters were also coated on the inside with a green to greenish black glazed surface. Some of the canisters also had fragments of white calcined bone or possibly crushed steatite on the inside as well. Faience and steatite tablets and vitrified faience wasters were also found in the initial excavations and suggest that this area was a faience and steatite workshop that produced both tablets and beads.

The numerous faience tablets found on the surface to the north and south of this area were probably being manufactured in the same workshop. One of the most important molded faience tablets found in 2000 (Figure 4.3) may have been discarded during the manufacturing process and was recovered from the surface just to the south of, and down slope from, this area of the site.

Although the bottom portion was broken off, the tablet appears to have been made in the shape of a spreading tree. One side of the tablet is decorated with a thorny tree under which two short horned bulls are fighting. The other side has a rectangle filled with three rows of eight dots each beneath which is an inscription.

Excavation of the faience and steatite workshop continued in 2001 (Figure2) during which the entire area was excavated horizontally. The area had been robbed of bricks at some time in the past and large wall voids indicated that the manufacturing material was actually part of the fill inside a small courtyard surrounded by four walls. The faience and steatite manufacturing debris was carefully documented by mapping all significant artifacts using triangulation, leveling, and digital photography. All sediment recovered from these excavations was sifted and then wet sieved to recover microdebitage from bead and tablet manufacture.

The manufacturing dump included some brick fragments, and scattered pottery fragments of vessels that appear to belong to Period 3B. No pointed base goblets were found in these deposits, so it is clearly before Period 3C. Most of the pottery fragments were actually parts of large vegetable tempered canisters that were partially vitrified on the inside (Table 1). Approximately 1009 fragments of canisters were recovered from around the workshop area totaling 37.391 kg in weight. In addition there was 13.293 kg of bone with slag, 16.664 kg of bone fragments without any slag, and 7.4428 kg of faience slag without bone. This is the largest amount of faience firing debris ever found at Harappa. Other objects that appear to be related to the firing process are conical terracotta objects with splayed ends. These appear to have been used to hold up something in the firing process as they were partly vitrified on the splayed portion and the midshaft area away

from the point. Two examples of thick disc-shaped lumps were found that also may have played a role in the firing process, but these were not vitrified. Experimental studies carried out during the summer of 2001 (discussed below) may shed some light on their actual function.

In addition to pottery and canisters, many other types of artifacts were found in the workshop area that may have been used as tools, for example, 13 chert blades and flakes, a chert hammer stone fragment, and two grindstone fragments. Various types of ornaments that may have been worn by the workmen or women included 109 terracotta bangle fragments, 2 shell bangle fragments, 4 terracotta beads, one copper bead, 2 stone beads and a truncated conical amulet. Other finds that may have been used by people in the workshop or by children in nearby rooms; include 7 terracotta toys (carts, wheels, tops, etc) and 2 animal figurines, a bone point, and terracotta cakes.

Objects that may have been the result of manufacturing in the workshop includes over 732 faience bead fragments, many of which were blackened or distorted in firing were recovered from the workshop area along with two faience pendants. Thirty-seven finished steatite beads and one unfinished steatite bead were found along with 23 sawn and unsawn fragments of steatite that include two tablet blanks. Various colors of raw steatite were being processed in the workshop, including tan, gray, black-black, and whitish steatite.

Perhaps the most significant finds were five steatite tablets and 8 molded faience tablets (Figure 3). To make the tablets, the steatite was first cut into thin slabs and then shaped into rectangular tablet blanks. Two fragments of uninscribed tablet blanks (Figure 3.6 and 7) and four partly inscribed tablets all having the same inscription were found within the workshop (Figure 3.1, 2, 4, and 5). A broken fan shaped steatite tablet (Figure 3.3) appears to have been a mold to make a molded faience tablet with the identical inscription (Figure 3.15). Before the discovery of this mold it was thought that faience objects were being make with wood molds that have not been preserved archaeologically. While wood molds may have been used for some objects, it appears that many of the deeply incised and unfired steatite seals may in fact have been used for molding faience tablets (for example compare the steatite seal H670 and the tablet H775 in Shah and Parpola 1991).

In addition to the actual tablets, the numerous fragments of sawn and unsawn steatite have as well as the large masses of vitrified faience slag with whitened bone indicate that this was the actual workshop in which these objects were being made. It was however surprising to find no evidence for a kiln-like structure in the room. In fact, no actual kiln structures have been identified at Harappa that could have been used to reach the high temperatures required for the glazing of faience and the firing of steatite.

After careful consideration of the evidence, it appeared that the layers of debris were spreading out from the southern edge of the room, which had a high concentration of vitrified canisters and layers of ash and charcoal. A careful analysis of the canisters and vitrified setters suggests that they may have been used as a makeshift mini-kiln that could have reached sufficiently high temperatures (c. 940°C) to glaze faience. The Harappans may not have needed any large high temperature kilns, since they were only firing very small faience objects, such as tablets, figurines, miniature vessels, beads and bangles.

Experimental Study

During the summer of 2001 in Madison, Wisconsin, it was possible to undertake an experimental firing using canisters and setters that were made with approximately the same materials as those found at Harappa. A brief summary of this experiment is outlined below.

First of all, vegetable tempered clay canisters were made and allowed to dry completely to avoid spalling in a rapidly heated fire. A mixture of faience paste was prepared using a commercial self-glazing frit and two small steatite tablets were carved to use as a mould. On one side was a small short horned bull and the other side had some arbitrary script

signs. Several faience tablets were molded using the steatite moulds, and additional beads, cones and pyramidal gaming pieces were also made to include in the firing. The experimental faience and steatite tablets were placed inside one canister, while a second canister was overturned and placed on top as a lid. A narrow space was created between the two canisters by using three splayed conical setters to raise the top canister slightly above the lip of the first canister. This created a small, enclosed space that would be insulated from the direct flame and ash. The canisters were placed on top of a layer of wood fuel (pine and oak) and covered by additional fuel. After gradual heating, the entire pile of fuel was ignited creating an extremely large bonfire. The tablets could be seen through the space left open between the two firing canisters, and after approximately three hours they reached a deep red orange color typical of relatively high temperatures. Using a thermocouple (chrome-alumel) and digital pyrometer, the temperature of the interior of the canister was documented at 935°C. By continuously adding fuel on top of the canisters it was possible to maintain this temperature for about one hour, after which the fire was allowed to die down. Around two hours later, the canisters had cooled enough to be removed from the firing area to allow them to cool down more rapidly. Eventually, when the canisters were cool enough to handle with bare hands, they were opened to reveal greenish blue to black glazed faience and hardened white steatite tablets. Some of the faience tablets had a purple-red tinge and the steatite tablet also had some reddish stain from uneven firing. This discoloring appears to have been due to irregular heating and the introduction of smoke into the firing canister. Similar discoloring has also been found on Harappan faience and steatite tablets. The interior of the terracotta canisters did not become glazed, but this may be due to the fact that only a few faience objects were being fired and also because the canister was only used one. It is possible that the ancient canisters were used repeatedly and that they contained many more pieces of faience. Repeated use would probably result in a gradual buildup of ash and other minerals that would cause the interior and the setters to become glazed.

Even though the quality of the first experimental tablets did not produce objects identical to those produced by Harappan craftsmen, this relatively simple firing process may have been what Harappan craftsmen used to create their faience and steatite objects. Further experiments are planned to try and reach a higher quality of firing using faience paste that is prepared in the same manner as Harappan faience.

Other Finds and Discussion

It is important to note that both faience and steatite production were being done in the same workshop and that the craftsmen who were manufacturing inscribed tablets were also producing a variety of faience and steatite beads. This suggests that faience and steatite beads may have been quite important as symbols of value since they were being made in relatively controlled contexts.

The discovery of a tiny faience bull figurine leg (Figure 4.4) in the erosion gully adjacent to the workshop suggests that the craftsmen may have also been involved in the production of other types of objects for elite use in rituals or for trade. The faience bull leg is made using two different colors of faience, a yellowish-white color for the hoof and a darker black-black faience for the leg itself. Several of the faience tablets found in the workshop were made from the same two colors of faience (Figure 3.13, 4.1, 2) and lend support the idea that the bull figurine leg was made in the same workshop with the tablets, and possibly even by the same craftsmen.

The use of two colors of faience to make tablets is also important for tracing the movement of tablets from this workshop to other areas of the site. Four tablets were made using a combination of a yellowish-white faience with a wide central band of black-black faience. Three of these were made using the same mold, but were produced in two different shapes. One shape was flat rectangular (Figure 4.1), while the other was a flat lozenge shape (Figure 3.13). The fourth tablet was long rectangular with a lenticular section (Figure 4.2). This last example has an inscription that is identical to that found on

three additional two-colored faience tablets recovered during excavations at Harappa in the 1930s (Shah and Parpola 1991:H773 and H774; and Joshi and Parpola 1987:H 194). These other tablets come from Area D, which is only a few hundred meters west-southwest of the workshop, and from Mound F, which is on the other side of the city (Figure 1). These new discoveries confirm the strong links between Mound E and Mound F, but for the first time we now have evidence linking Mound E with Area D. Furthermore, we can now date the period of such interactions to Harappa Period 3B (ca. 2450 BC – ca. 2200 BC).

In this brief discussion it is not possible to present all of the other important studies being carried out that will eventually help us to understand the full implications of this workshop. The various types of materials present in the workshop reveal a complex network of trade and exchange the spread throughout the Indus Valley. Each of these materials was brought to the site by distinct trade networks and redistributed within the site through other exchange processes. The people who controlled this workshop also probably had some role to play in the trade of raw materials needed in the production of these objects. For example, the various colors of steatite may have come from different areas of the Indus Valley and ongoing studies by Randall Law (Law 2002; Law 2003)will hopefully identify the general source areas for the materials being used in this workshop . The chert blades came from the Rohri Hills to the south and the grindstones probably came from the Salt Range to the west. Rock quartz used for making the faience paste may have come from several different sources in the Salt Range or from areas to the north (R. Law personal communication). All of these materials would have come to the site along with masses of stone used for a wide variety of domestic and commercial activities.

However it is evident from the restricted area of the workshop, that faience and steatite tablet production was a highly regulated craft. In addition the production of steatite and faience beads may also have been strongly regulated during certain periods of urban development. This fact should not be surprising since these objects are perhaps the most important symbols of authority and wealth in the cultural life of ancient Harappa. It is possible that faience tablets may have been used as a form of credit or communication, for economic and possibly even for ritual purposes (Kenoyer 1998; Kenoyer 2000). Furthermore, the beads may have been strung on specific lengths of cord and used as a form of standardized exchange in addition to being worn as ornaments. It is possible that the workshop served as a type of mint, producing tokens and beads that were then redistributed throughout the site.

The initial interpretations presented here will undoubtedly be revised and refined through these future excavations of this workshop in the upcoming seasons. However, since no other seal or tablet workshops have been found at Harappa, it will always remain one of our most significant discoveries.

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Illustrations

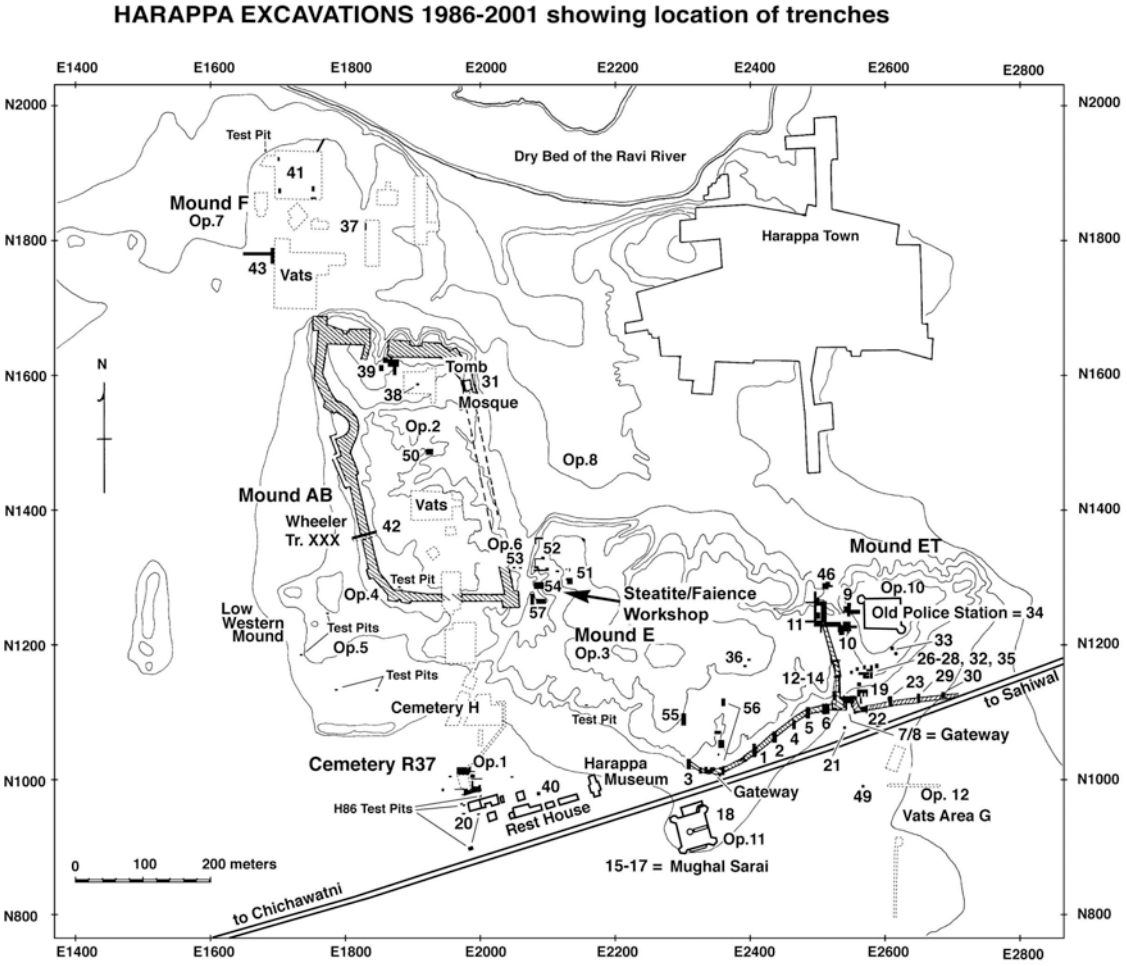

Figure 1. Map of Harappa showing excavation areas and workshop location.

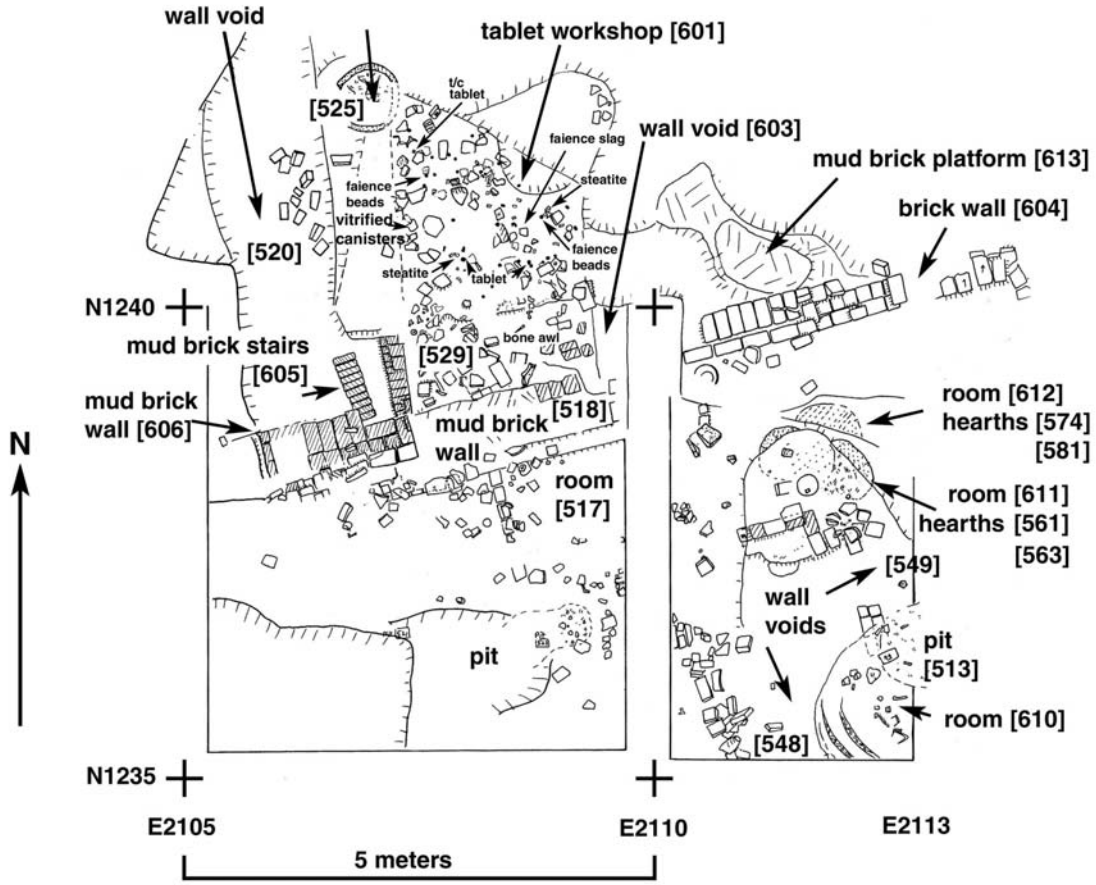

Figure 2. Harappa 2001, Trench 54, South Extension. Workshop Area

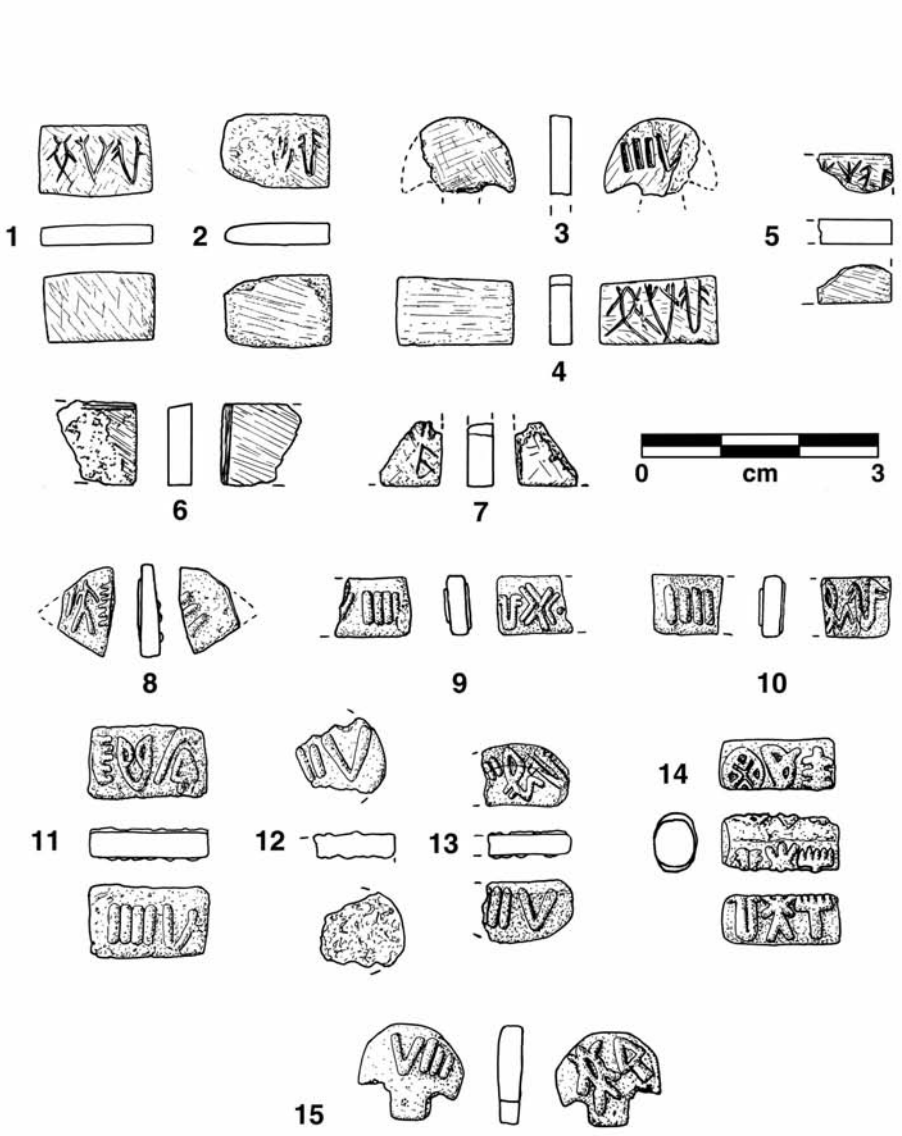

Figure 3. Harappa 2001, Trench 54, Steatite and Faience Tablets from Workshop Area

No.	Accession	Lot	Artifact Type	Material
1	H2001-5084	2913-07	Tablet (incised)	unfired steatite
2	H2001-5087	2934-01	Tablet (incised), broken	fired steatite
3	H2001-5069	2913-02	Tablet (incised), broken	unfired steatite
4	H2001-5068	2913-01	Tablet (incised), broken	unfired steatite
5	H2001-5074	2913-04	Tablet (incised), broken	unfired steatite
6	H2001-5187	2934-270	Tablet (not incised), broken	unfired steatite
7	H2001-5135	2913-210	Tablet (not incised), broken	unfired steatite
8	H2001-5064	2373-01	Tablet (molded)	faience
9	H2001-5065	2373-02	Tablet (molded), broken	faience
10	H2001-5077	2913-05	Tablet (molded), broken	faience (bicolor)

11	H2001-5083	2913-06	Tablet (molded)	faience
12	H2001-5089	2913-08	Tablet (molded)	faience
13	H2001-5090	2913-09	Tablet (molded)	faience (bicolor)
14	H2000-5042	2357-13	Tablet (molded)	faience
15	H2000-5041	2360-01	Tablet (molded)	faience

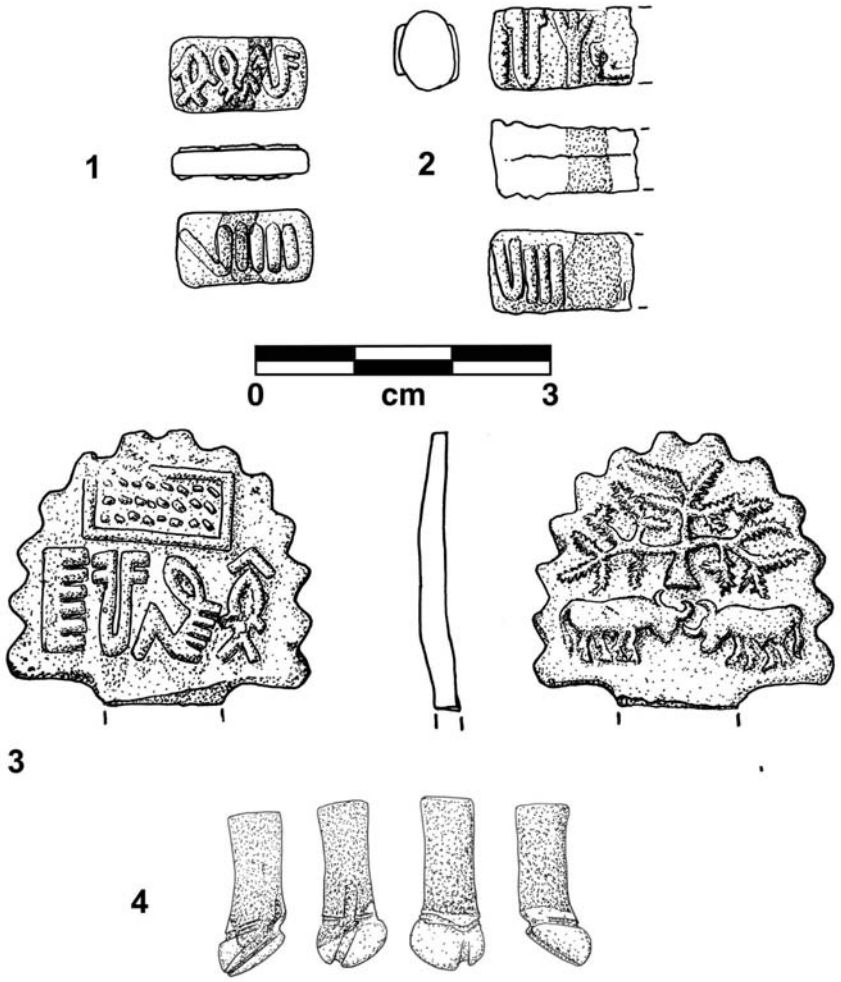

Figure 4. Harappa 2000-2001, Trench 54. Other Faience objects.

No.	Accession	Lot	Artifact Type	Material
1	H2001-5082	2920-02	Tablet (molded)	faience (bicolor)
2	H2000-4385	2087-05	Tablet (molded), broken	faience (bicolor)
3	H2000-4483	2342-01	Tablet (molded), broken	faience
4	H2000-4440	2121-90	Faience figurine leg	faience (bicolor)

Appendix 1:

Table 1. Harappa 2000/2001: Trench 54, Canisters, Faience and Bone Slag

Object Type	**Number**	**Weight - kg**
Canisters	1009	37.391
Bone with slag		13.293
Bone fragments		7.428
Faience Slag		16.664

Table 2: Harappa 2000/2001: Trench 54 (Lots 2357, 2360, 2373, 2913, 2934) Artifacts from the workshop area.

terracotta toys	7
terracotta animal figurines	2
misc. terracotta objects	45
terracotta kiln setters	2
terracotta/ pottery discs	2
terracotta nodules	2
terracotta beads	4
faience beads	736
faience pendants	2
steatite beads	37
unfinished steatite bead	1
stone beads	2
agate blocklet	1
truncated amulet	1
copper bead	1
misc. copper fragment	1
inscribed sherd	1
inscribed steatite tablets	5
molded faience tablets	8
sawn and unshaped steatite	23
unshaped stone	2
chert flakes/blades	13
hammer stone	1
quartz fragments	1
grindstone fragments	2
Total	1013