

Usage of Mortar in Some of the Major Harappan Sites

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Abstract

The term 'Mortar' means bonding materials, mainly used for joining the stones or bricks of an architectural monument or structure. It is mainly the mixture or amalgamation of lime, sand, and water as needed. Although experts believe that the Harappan Civilization period was the beginning of using mortar for bonding purposes and plastering in the Indian subcontinent. From that period onwards, the use of mortar has been used very widely. Archaeological excavations and remains give us several examples of this material. Apart from archaeological evidence, ancient Indian literature also helps us to reveal more about mortar. Vedic and Later Vedic texts and a large number of Sanskrit texts of the ancient and early medieval period, Shilpashastras, and some Buddhist texts also mentioned the mortar. In textual evidence, the terms Sudha and Vajralepa have also been used as mortar. This article's main focus will be on the mortar used in some archaeological sites of the Indus Valley civilization only.

Key Words : Mortar, Lime, Gypsum, Mud, Harappan Civilization

Introduction

The term 'Mortar' means bonding materials mainly used for joining or plastering stones or bricks of monuments, buildings, walls, and architectural decorations. It is mainly the mixture or amalgamation of lime, sand, and water as required, but in some cases, other materials are also used to make mortar-like mud, gypsum, etc. So, we must be aware of the typology of the mortar used from ancient times. Mortar mainly affects the hardening process. The main ingredient of mortar is generally lime and significantly mortar is made with the inclusion of fat lime. Many experts briefed their own way about the fat lime mortars. Vitruvius, a Roman architect of the first century BCE, has been vividly described as fat lime mortar.

Different Types of Mortar

Different types of mortar were used from ancient times in different parts of the World. As we know from archaeological evidence, the earliest rather oldest use of mortar was noticed in ancient Egypt and the oldest type of mortar was used, which was **Mud Mortar**. Mud Mortar is basically made of sand and clay and some water is also mixed with this composition, because if they are mixed with water then mud and sand should not be fissured or cracked after drying. Egyptians mainly used mud mortar with bricks, which were sun-dried. Other ancient civilizations like the Babylonian civilization and Mesopotamian civilization also used mud mortar as building materials.

Another type of mortar is **Gypsum Mortar**. This is one of the most important typologies of mortar in the context of the history of the Indian subcontinent because this kind of mortar is used for several purposes in the earliest civilization of India, the Harappan Civilization. From many Harappan sites like Mahenjodaro, Harappa, Kalibangan, and Banawali, archaeologists found references to gypsum mortar. Gypsum is mainly the compound of Plaster of Paris and sand (in some cases marble dust is also used instead of sand). Gypsum mortar is generally used for plastering the walls. A genuine problem with this kind of mortar is in the case of damp conditions this is not durable like other types. Apart from Harappan Civilization, an important use of gypsum mortar was noticed in the 3rd century

BCE. The Indian subcontinent, especially among Buddhist architecture. They generally use these elements along with lime and mud for the same purpose like plastering the walls.

The third type of mortar is **Lime Mortar**, which is the most historical and durable mortar compared to other types. Lime mortar is a compound of lime, sand, and water as needed. Lime, which is the most important material to prepare the mortar mainly produced from different kinds of substances like shells, conch, limestones, etc, which contain calcium carbonate. After the derivation lime is burnt under controlled heating in a kiln, calcium carbonate becomes calcium oxide, which is also called quick lime. Quick lime is the main ingredient to prepare the lime mortar along with sand and water which were used as building materials, plastering the walls etc purposes.

Beginning of the use of Mortar in the Indian subcontinent

In search of Indian contribution regarding the use of mortar, one can consider the earliest use of mortar in the Harappan Civilization period (from 3200 BCE to 1200 BCE). Mostly there we can find Gypsum Mortar but the reference of Mud Mortar has come known from the excavations also. Although these materials were used for architectural purposes mostly. The most notable and impeccable on this subject is the pioneering work of K. M. Varma where he discussed the nature of the gypsum compound which was found in two prominent sites, i. e. Harappa and Mahenjo-daro. According to K. M. Varma, "Gypsum compound alone was used as mortar, i. e. to cement the bricks, it was, however not used in extensive areas, its use was confined to limited and selected places, where a strong binding medium was thought necessary".¹ It clearly indicates that in some sites of the Harappan civilization where binding of any bricks or stones was necessary, in that place gypsum mortar was used. As we know Harappan Civilization had three important phases. (1) Pre Harappa or Early Harappa (c. 3200 BCE – c. 2600 BCE); (2) Mature Harappa phase (c.2600/2500 BCE - 1800/1700 BCE); and (3) Late Harappa phase (c.1800/1700 BCE - 1200 BCE). From all three phases, archaeologists found evidence of mortar that was used for different purposes. In the mature phase when the urban culture was developed all over the Harappan sites, the cities were mainly divided into two parts upper town (also called Citadel) and Lower Town. Now we focus on some major Harappan sites where the example of mortar was noticed after archaeological excavations.

Mahenjo-Dāro

Mahenjo-Dāro was one of the largest and most important sites of the Harappan Civilization. Many architectural remains were built during the mature phase found here. One of the major features of Mahenjo-Dāro was its urban planning. Most of the parts of this site were built with kiln-burnt bricks. Here gypsum mortar played a vital role as building materials or plastering of walls. The most significant remaining of Mahenjo-Dāro was the 'Great Bath'. The Great Bath of Mahenjo-dāro was probably the oldest rather earliest public water tank of not only India but also the ancient world. The Great Bath of Mahenjo-dāro was constructed by a brick structure, which measures 12m x 7m and near about 3m deep from the surrounding pavement. In the side walls of this water tank, Gypsum mortar was used to avert the leakage of water from the tank. Gypsum mortar worked as waterproof in this scenario. On the other hand, sawn bricks were used to build or construct the floor of the great bath. A layer of bitumen was found along with Gypsum mortar which was used on both sides (inner and outer) of the bricklayer. So, the floor of the Great Bath of Mahenjo-dāro also witnessed the use of gypsum mortar. Generally, the Gypsum compound was used not only in the Great Bath but also in several parts of the site for plastering of walls, construction of the floor, etc., where archaeologists noticed the quantity of Gypsum was 40% to 75% and sand was almost 20% to 40%. Interestingly a brick-lined pit

was found in the remains of a house of Mahenjo-dāro where the brick-lined pit was suffused or filled with Gypsum mortar compound. And we know that the Gypsum compound always hardens more hastily than other compounds. The Gypsum compound has been used in the houses of Mahenjo-dāro where the surface of the walls was covered with this material. Gypsum was also used as mortar for flooring in several places of Mahenjo-Daro.

Harappa

Another major site of the Indus Valley Civilization was Harappa, located in the Sahiwal district, Punjab, modern Pakistan, on the bank of the river Ravi. One of the main features of Harappan city in the mature phase was its only focus on functional expression and practicality. Instead of magnificent buildings, the Harappans concentrated on public buildings only, commodious houses, granaries, etc. In Mahenjo-dāro, Gypsum mortar was used as a building material but in Harappa, Mud Mortar was most evident. Archaeologist Sane Ullah (1965) scientifically analysed Mud mortars and Gypsum mortars which were found from Harappa and Mahenjo-dāro respectively. According to him, Gypsum mortar which was found in Mahenjo-dāro contains 72.3% of Gypsum, but no lime was evident here. He also studied Mud Mortar from Harappa where he found almost 60-61% used clay and sand. Another interesting point was notable here. In some cases, the reference to combined mortar was also evident in Harappa and Mahenjo-dāro. Now the question, what is combined mortar? Combined mortar was used when the Gypsum compound was mixed with Mud mortar to make much stronger and well-built building houses.

Bānāwālī

Bānāwālī is one of the major Harappan sites located on the right bank of the river Sarawati in Hisar district of Haryana. Here archaeological evidence witnessed one of the earliest uses of mortar. The pre-Harappan phase in Bānāwālī witnessed Mud mortar as an important building material. Archaeologists generally divided the pre-Harappan period of Bānāwālī into three phases, among them the earliest phase evident a settlement which was fortified, and here the purpose of bonding the bricks rather mud bricks, Mud mortar was used. The next phase of Bānāwālī also recorded the use of Mud mortar, which was applied on moulded bricks.

Kālibangan

Kālibangan was another major site of the Harappan Civilization, which was excavated by Amalananda Ghosh in 1953. Kālibangan is located on the left bank of the Ghaggar-Hakra river basin in Rajasthan. The mature phase of Kālibangan started c. 2500-2300 BCE. From this period archaeologists found some 'Cylindrical Pits' which may be used as drinking water storage. Here we found the evidence of lime plaster, with lime plaster these cylindrical pits were lined. Lime plaster which was used in it that is none other than Lime Mortar.

Conclusion

This article highlighted some observations on the use of mortar as building materials found in some major archaeological sites of the Harappan Civilization. It can be said that in some contemporary or slightly later periods of the Harappan Civilization, Chalcolithic settlements in the Indian subcontinent witnessed the use of mortar also, e. g. Gilund. The use of Mud mortar which was laid on bricks recorded in a major chalcolithic site Gilund. This site is located on the bank of the river Banas in the Rajsamand district of Rajasthan. Gilund is a part of Ahar-Banas culture, which was the earliest settlement in western India, where people's life mainly depends on the agricultural economy. So it can

be mentioned that not only Harappan sites but also some major regions of the Indian subcontinent record evidence of the use of different types of mortar. Of course, there is a scope for more research on this topic.

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