International Journal in Management and Social Science
Volume 6 Issue 12, December 2018 ISSN: 2321-1784 Impact Factor: 6.178
Journal Homepage: http://ijmr.net.in, Email: irjmss@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal

Investigating Archeological Science Studies in the Structure of Container Elements from the 4th and 5th Millennium BC in Sar-TaliTerritory, Ramhormoz

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Abstract:
As an ancient site with coordinates of 3664716Y/240 and 659/5519664 X, Sar-Taliis located at a height of 152 m from the freewaters in the east of Khuzestan Province, 3 km southwest of Ramhormoz city and about 1.5 km from the Ala River in Ramhormoz Plain. During the archaeological excavations in this ancient site in 2014, the skeletal remains, which were covered with mud, were found over an adobe space. Some of the items found in this grave had ideological basis, and some other items, which were located on top of the head and the face of the corpse, were gifts of plain and painted ceramic plates of colored and white clay. One of the most remarkable items found in the grave was the appearance of a very elegant white pile of pearls that differed with other pottery in this area in terms of structural elements. The present study was conducted to investigate the elements used in this pottery by various methods such as optical microscopy, petrography and X-ray diffraction. Based on these tests, the results showed that the material used to make this pottery is made of kaolin, and parts of its inner layer are covered with red clay. Also, X-ray diffraction results showed that there are still quartz alpha phases in parts of this pottery, indicating that the heat inside the furnace was not uniform or the potters of that era were not able to control and keep the heat in the furnace. Due to the presence of clay and kaolin resources in the area, it seems that the source of raw materials was located in this same area; thus, it can be claimed that this delicate white dish has been made in this cultural area.

Keywords: Sar-Tali Territory, Ramhormoz,Archeological Science,Container Elements.

- **Introduction**

With important geographic and strategic position,Ramhormoz plain has been one of the most important hinterland areas of prehistoric era in this geographic location. It seems that SarTali is a habitat of the second half of the 5th millennium BC which can be considered, in the light of the cultural findings discovered during the exploration, as one of the most important communication centers between the region on the Persian Gulf and Central Zagros valley (1). Archaeological excavations in 2014 caused the discovery of a grave in this specific archaeological site. Cultural items found include plain and engraved pottery along with rocky tools and skeletal remains, which were significant prehistoric burial indicatorsemphasizing the significance of this dormant grave in the society of that time; given the fact that the items found in this grave were highly regarded by archaeologists with constituent elements specific to the second half of the 5^{th} millennium BC,the present study has been conducted in order to provide full analysis of a specific white dish placed above the top of the grave.

Geographic and geological location of Ramhormoz Plain

Due to its climatic, geographic and geomorphological characteristics,Ramhormoz Plain has always been in the center of attention for individuals interested in prehistoric history. This plain is about 160 km far from Shoush in Khuzestan province between 31 ° 16 'north longitude and 49 ° 37' east longitude compared to the Greenwich meridian and 160 meters above sea level. This plain is a large anode that is filled with river sediments and deposits filled with periodic floods of the Triassic, and it still remains flooded. The most ancient geological layers are belong to Miocene and Pliocene periods, which include the Gachsaran, Mishan and Vahjajari formations; in terms of morphology, this plain is a part of the moray hill units. The largest river

of this plain is called *Ala* or *Ramooz*, which originates from the mountainous cliffs and cold faunas, passing through the city of Ramhormoz and forming the eastern border of the plain. This river passes through a village called Sandali,joinsMaroun River, continues southwest mostly under the tile of Jarahi river and finally sinks to the Persian Gulf. The other main rivers of this plain include Shour and Kobal, which form the northern and southern boundaries of the plain. On the other hand, there are smaller rivers such as Shoura, Malah, AbLashgar, all of which pass through the west of the river, and Samuna enters the Adha River from the east Ramhormoz, which plain can be considered as one of the most direct connecting ways of the land of Khuzestan and the highland of central Fars. It is important to note that Ala River, among all other rivers that surround the plain, is highly suitable for irrigation, and the most ancient enclosures are located on the east coast of the river (Fig.1 and 2)(2,3).

Ancient site of SarTali

As an ancient site with coordinates of 3664716Y/240 and 659/5519664 X, Sar-Taliis located at a height of 152 m from the freewaters in the east of Khuzestan Province, 3 km southwest of Ramhormoz city and about 1.5 km from the Ala River in Ramhormoz Plain.

Research background

This ancient site was added to the survey map of Khuzestan in 1969 by Henry Right Study registered under the code of 018 (4). By the end of 2011, this site was first identified for preventing further damage caused by the leveling of the hill in the process of house-building and agricultural activities, vegetable work, and serious damage to the process of turbulence in its cultural layers. Determination of the boundaries of this area and privacy proposal from Cultural Heritage, Handicrafts, and Tourism Organization of Khuzestan province was issued

and licenseby the Archeological Institute in 2012. Currently, there is only a small hill left from this huge area where people use to throw their garbage in. Therefore, in 2013, due to the studies conducted in the first chapter of the exploration of the lay-outs, the main goals of this exploration were to obtain more details about the history and status of the residents of Sar-Teli and their relationship with their homeland in order toprovide a better understanding of the process by which this establishment was founded during the fourth and fifth millennium BC. On the other hand, obtaining documents in regard with cultural and economic relations within and outside the region was another objective of this exploration.

- **Materials and Methods**

Excavations in the workshops on laminating in Sar-Tali territory and analyzing the observations of the lay-out of all workshops made it possible to identify the three periods of establishment which have continued up to now in the under study area. The first phase was related to the medieval Islamic era with the remains of the architecture and pottery of Ilkhaniperiod. The second stage was related to the settlements of the historical beginning and the pottery of the Elamite era, and the third stage was related to the remnants of architecture and humans buried, such as the skeleton of a man who was covered with a solution of the broom in the middle of an adobe space. Some of the items found in this grave had ideological basis, and some other items, which were located on top of the head and the face of the corpse, were gifts of plain and painted ceramic plates of colored and white clay; the bones and feathers of some bird and animals, which were supposed to provide food for the deceased in the afterlife, were left in the dish; these works and signs indicate their attitude to the world after death and the ritual traditions of

their time and their respect for the dignity of the individual. The grave itself is a symbol of the funerals of this era in this cultural field. One of the most remarkable findings of this exploration was the appearance of a very elegant white pile of pearls that differed in terms of structural elements with other pottery in this area. This structure was identified by various methods such as optical microscopy, petrography and X-ray diffraction. The geological survey of this geographic area and the study of the structure of this container showed that the source of raw materials was in the same very spot and the dish was prepared in the same area (Fig. 3).

Investigating archeological studies

The price of white pottery was investigated as the sample according to archaeological studies related to the 5^{th} millennium BC. This sample is white in appearance and very delicate. It is very homogeneous in cross-section and has a fine crystalline silicate. The sample thickness is very low and about 2 mm. Close analysis of the sample with an optical microscope showed that there is a small microcrystal layer of micron thickness on a part of a sample side. It is not clear why the inner layer of the pottery is covered with this red layer.

Geological and climatic attributes of Ramhormoz Plain

This area is composed of Bakhtiari, Gachsaran, Mishan, Aghajari Formation, and Lembariformation and sediments that have lasted up to the present day; they have formed, and have been in turn formed by, rivers in the region for several consecutive years. In terms of age, the existing formations are all related to the Cenozoic or the third period of geology until the present. There is an alternate collection of limestone gemstones with stone blocks, siltstones, marl and gypsum layers, white to red marls, various types of limestone, gypsum and anhydride, marl or clay, silt red, and green to gray elements in this arrangement. Due to the abundant

variety of Marl in the studied and neighboring areas and various geological processes that occurred in their formation,this element was used as a source for clay for a variety of uses. In this area, mines of marl, clay and kaolin were identified and exploited as identifying indices.

The method for analyzing buried dish in archeological studies

The microscopic study of the sample was done using *thin section* method.

- **Results**

The studied sample is composed of clay and constructive minerals which are floating in the context of the clay. The microcrystal sample texture and the size of the component parts do not exceed 10 microns. The main mineral is quartz. It is bright in PPL light and bright gray to pale yellow in XPL light (5). This mineral has an angled, half-rounded border; it forms about 10.5% of the total volume of the sample. Iron oxide with reddish to dark color in size and forms about 2.3% of the volume is another mineral component of the sample. No other element was found in this sample. These two minerals are in a texture of clay. The surface of the clay is very fine and homogeneous. Empty space is low and small in size; a reddish layer was seen inside the sample which, in addition to quartz and iron oxide, are the main components of the sample. The sample contains no calcite (Fig. 4).

X-ray diffraction test

Part of the sample was powder and deposited on a slurry. This sample was tested with the X-ray diffraction pattern SEIFERT model. The results showed that the sample contains quartz belonging to kaolinite phase. A small amount of alpha quartz was detected in part of the sample. The sample is calcite-free.

- **Discussion**

No calcite phase was identified in petrography and X-ray diffraction results. Since the raw materials of the sample are obtained from a region that contains calcareous stones, and considering the fact that calcite decomposes at above 750 °C, it can be claimed that the sample has experienced a temperature of more than 750 °C. On the other hand, a small amount of alpha quartz is detected in parts of the sample. Alpha quartz changes to beta-5 quartz at 570 °C and causes the item to crumble due to crystalline formation. Since this pottery is related to the 5th millennium BC and no furnaces of this period have been found in the area, it is possible that the potters of this period did not have the ability to fully control the furnace, thus making the heat highly non-uniform. Of course, this is only a premise, and additional tests must be made to determine the exact temperature of the pottery. White pottery specimen is unique in its kind, since Kaolin-made pottery has not been retrieved from this period until now. Kaolin is a clay mineral obtained from weathering and decomposition of granite stones and since it is rarely displaced after its formation, it has the least impurities and, also, accounts for the white color of the sample.

- **Conclusion**

X-ray diffraction results showed that there are still quartz alpha phases in parts of this pottery, indicating that the heat inside the furnace was not uniform or the potters of that era were not able to control and keep the heat in the furnace. Due to the presence of clay and kaolin resources in the area, it seems that the source of raw materials was located in this same area; thus, it can be claimed that this delicate white dish has been made in this cultural area.

- **Acknowledgments**

Hereby, Ms. Frank Bahr al-'Alumi and Beheshti of the Institute for the Conservation and Restoration of Historical and Cultural Works are wholeheartedly appreciated for their cooperation's on the experiments carried out on the cultural items under study.

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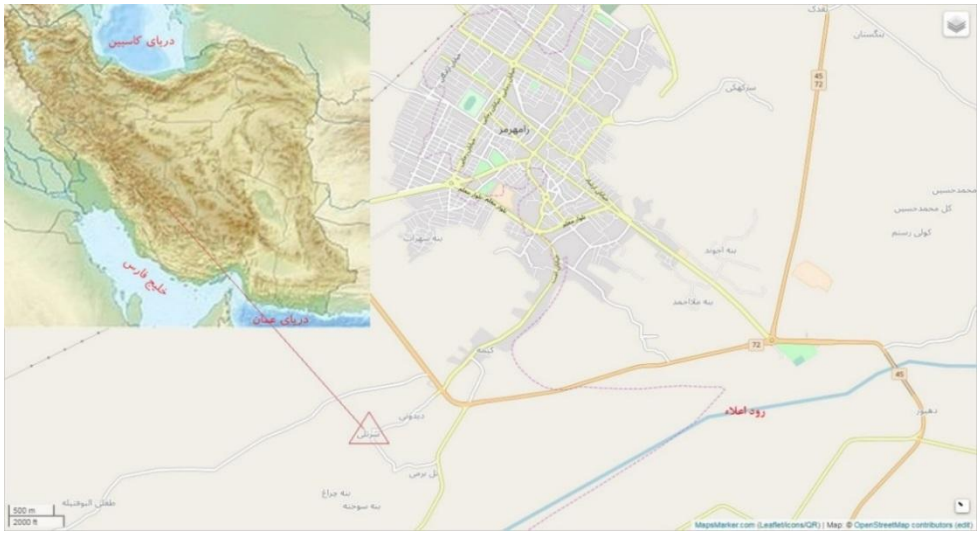

Figure 1. Geographical location of the Sar-Tali territory in Ramhormoz Plain.

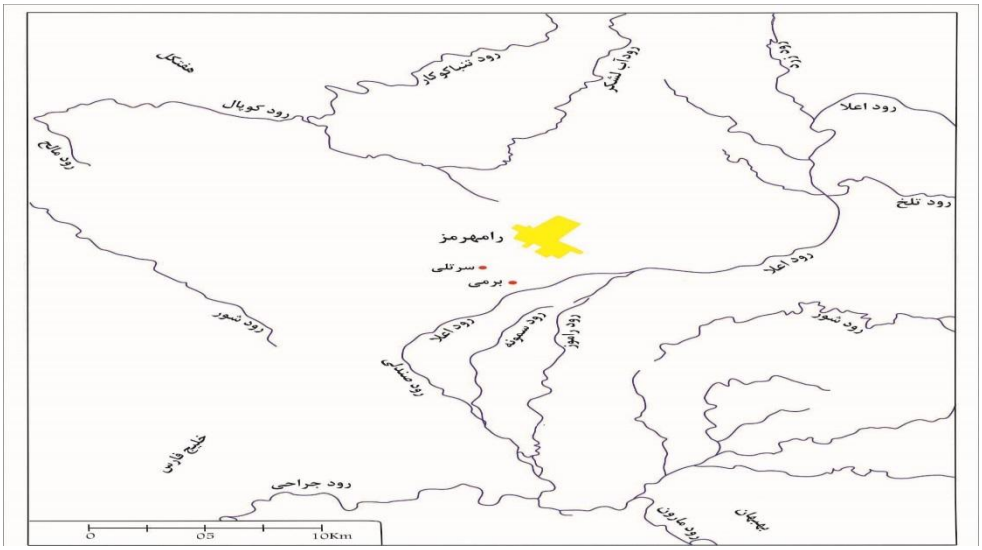

Figure 2. The geographic location of the rivers of Ramhormoz Plain and the location of the Sar-Tali territory towards the Ala River.

Figure 3. View of the Layout Workshop and cultural finds.

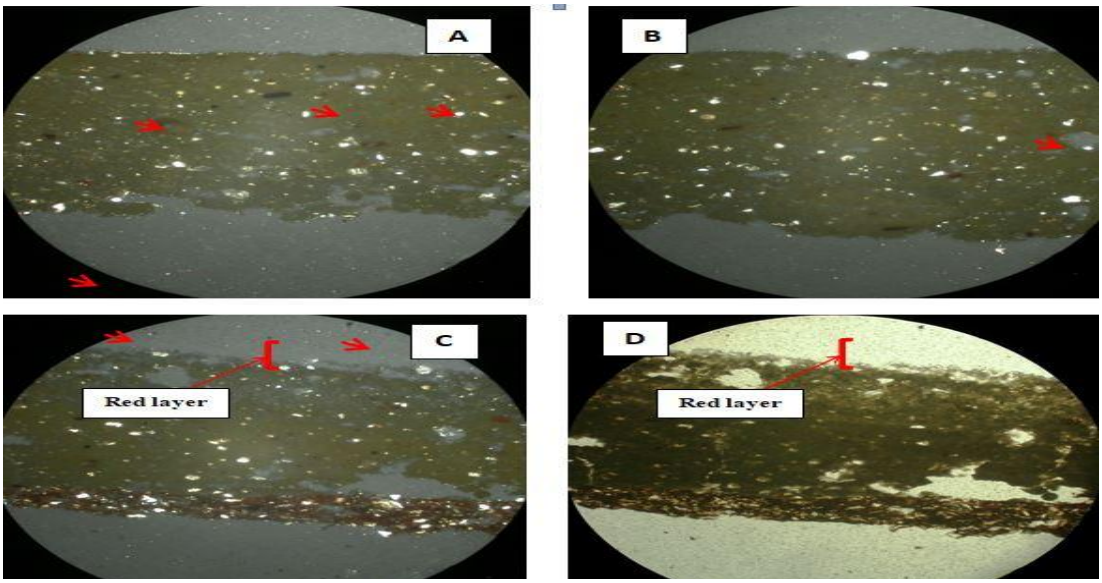

Figure 4. A and B are two overviews of the specimen transmitted in XPL light and 2.3mm field of view, a fine crystalline texture, brightly colored components, quartz crystals, which is sporadic and abundant in the sample. This is the most abundant mineral in the sample. Mineral oxide is characterized by dark color. C - Another part of the sample is red. The layer consists of quartz and iron oxide minerals. D is the same as C in the PPL light; in this image there is an empty space in bright color.