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New Evidence of the Ancient Metallographical Activities in the Margin of the Iranian Central Plateau

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Abstract

The Urmia-Dokhtar volcanic belt is the most important copper belt in Iran, where the archaeological materials discussed in this article also derive from. The discovery of metallurgy findings in several areas of eastern Zanjan province, such as Khurasanlou, Hipi, and Tapeh Kulyeri (Karavansara) which is located within the Urmia-Dokhtar belt on the western margin of the Iranian Central Plateau, indicates the high potential of this region for studies associated with ancient metallurgy. Recent excavation of the site Tapeh Kulyeri in the Zanjan province on the northwestern margin of the Iranian Central Plateau has yielded some copper ores, multiple anvils, a mold as well as several copper bars. These finds have been dated to approximately 4326 to 4240 BCE. based on two absolute dating samples, thereby providing some of the earliest evidence of ancient metallurgy on the Iranian Plateau, preceding remains from the Tapeh Ghabristan, dating to about 3700-3800 BCE., which has previously been considered the oldest.

Keywords: Iranian Central Plateau, Tapeh Kulyeri, Early Chalcolithic, Ancient Metallurgy, Copper Ores.

Article Type: Research Article

Introduction

Despite Iran's importance in studies on ancient metallurgy as one of the first origins of copper smelting in the world (See: Pigott 1999a; 1999b; 2004: 28), there is still limited information on the initiation of this complex process, particularly when it comes to the Iranian Central Plateau. Although traces of the use of natural copper date back to the sixth millennium BCE. from the Tapeh Silk north and then from the Zagheh and Ismaeil Abad sites, the earliest evidence of metal melting in the region is considered to be the findings of the Tapeh Ghabristan of the Qazvin plain, which revealed an important industrial center for copper smelting in the fourth millennium around 3800-3700 BCE. (Madjidzadeh 2008). However, recent archaeological excavations in the Iranian Central Plateau and east of the Central Zagros have yielded exciting results, which indicates that copper melting already took place in the last centuries of the fifth millennium BCE. The new findings from Tapeh Kulyeri can provide important clues in this regard and consolidate previous scattered knowledge of this area. Previously in the Mārāl Tape of Ozbaki in the north of the Central Plateau and from the layers of the plum ware tradition (Madjidzadeh 2010, Figure. 171 and Tablet 12: 4) also from the layers of the Godin VII period of the Tapeh Seh Gabi in the east of the Central Zagros some molds have been obtained (Levine and Hamlin 1974), indicating that copper melting was already conducted in some Chalcolithic settlements on the Iranian Central Plateau in the late fifth millennium BCE.

The archaeological findings suggest that not only did pioneering work on the use of copper happen in this region, but the Iranian Central Plateau also provides the earliest signs of silver production by solvent extraction (Nezafati and Pernicka 2012). Nevertheless, it should be considered that the advanced and astounding evidence of copper

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smelting in areas such as Arisman and the Tapeh Ghabristan, which peaked in the mid-4th millennium BCE., must have older roots. The Iranian Central Plateau regions, especially along the Urmia-Dokhtar volcanic belt, in southern central Iran (Anarak region), northern central Iran, and the southern Alborz foothills (Abbasabad-Tahroud region) and eastern Iran contain major copper deposits dating back to the Tertiary Period (Momenzadeh 2004; 2005). The Urmia-Dokhtar volcanic belt is the most important copper belt in Iran, where the archaeological materials discussed in this article also derives from. The discovery of metallurgy findings in several areas of eastern Zanjan province, which is located within the Urmia-Dokhtar belt on the western margin of the Iranian Central Plateau, indicates the high potential of this region for studies associated with ancient metallurgy. Excavations in the Tapeh Kulyeri dating back to the last quarter of the fifth millennium BCE. have already provided strong evidence of ancient metallurgical activities, and appears to be one of oldest site specialized site of this kind on the Iranian Plateau (Figure 1).

Natural and Geographical Location

The Abharroud basin is one of the inlets of the Salt Lake and also a main sub basin in the center of the Iranian plateau, which is composed of two large tributaries one of which is permanent and the other, seasonal. The Abharroud basin, including plains and valleys of the townships of Abhar and Khorramdarreh is extended from eastern longitude of 48˚ 48′ to 49˚ 30′ and from the northern latitude of 35˚ 57′ to 36˚ 36′, in eastern Zanjan. This basin borders the Qezel Ozan basin on the north, the Kharroud river on the south and the Zanjanroud river on the east (Alibaigi *et al*. 2012).

The basin includes a highland region which is on western part of the Alborz mountain range and on its southern mountainside, between two high mountain ranges with an east-west direction. The basin is about 2300 km2 vast, 900km2 of its area belongs to the plains and the rest goes to highlands. The mountains in the Abharroud basin are formed in two parallel mountain ranges which are stretched northwest-southeast direction, as a continuation of Zanjan mountains, from the Qaflankouh mount to the plain of Qazvin (Takestan). These mountains are connected to the Alborz mountain ranges on the north and to the Zagros mountain ranges on the south and southwest. The rain and snow which fall on these mountains form he various tributaries of the Abharroud, which leave a great deal of deposits in the valley and creates fertile lands for farming. The vegetation on highlands and mountainsides makes pastoral activities possible, this in turn has led to

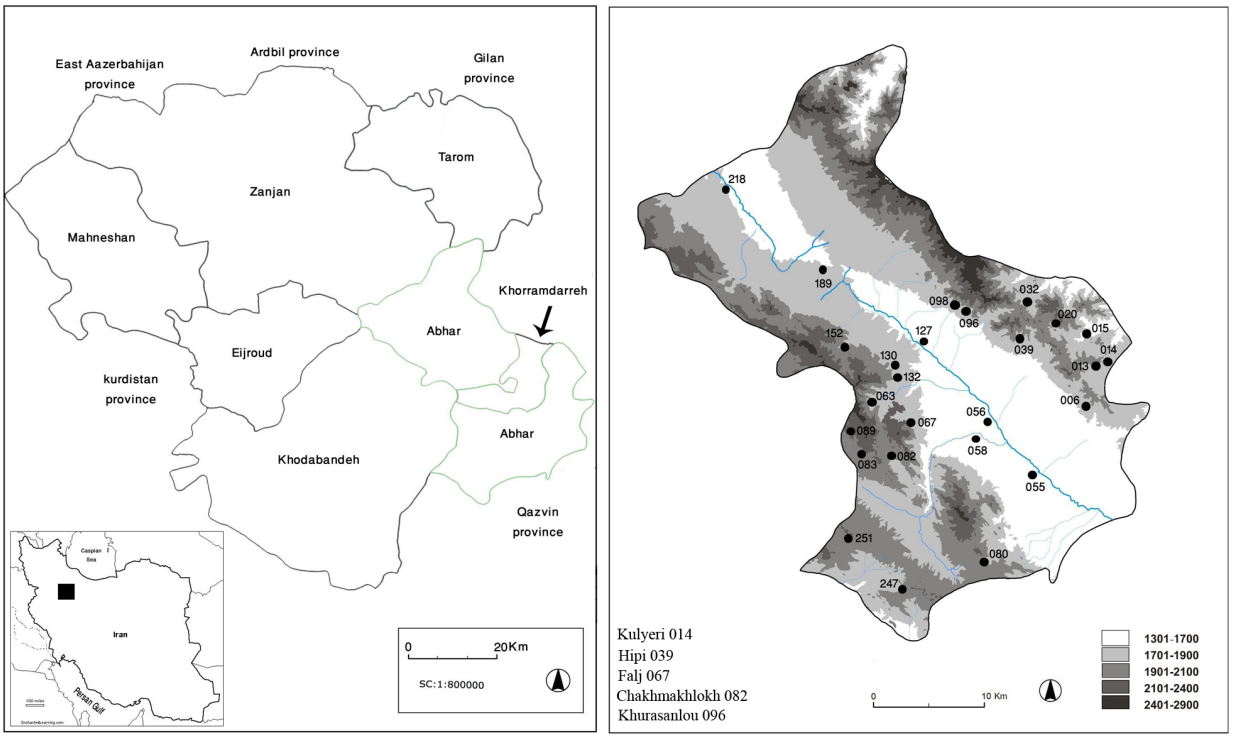


Figure. 1: *The Location of Chalcolithic period sites in Abharrud River Basin*

development of human societies and economic centers such as Sultanieh, Saeen Qaleh, Heidaj, Khorramdarre, Abhar, and numerous villages (Sazman-e Amozesh va Parvaresh Ostan-e Zanjan 1996: 16).

The highest place in the basin is the Sendandagh peak which is 2975m above sea level and lowest place is the confluence of the Abharroud and the Kharrud with a height of 1250m above sea level. The width of the plain between the two mountain ranges is 17km where it is the widest and it is covered with quaternary deposits.

Rivers of this basin mostly emanate from western and central mountains of the Alborz. The Abharroud has two tributaries one of which is seasonal and the other is permanent. One of these tributaries emanate from Chaman-e Sultanieh and the other from the mountains south of Kinehvars. The Abharroud is 60 km long and the length of its branches altogether is about 400 km.

The region has a semiarid climate with very cold winters. The area we studied does not enjoy good vegetation due to environmental features. The region contains steppe vegetation represented in bushes. Low areas of the region almost lack any vegetation and the vegetation in higher areas includes bushes and grass. The average yearly temperature in the region is 11.5˚c and the average yearly rainfall in the region is 412.7 mm (Baghche Kurd Mahale 1999).

Tapeh Kulyeri is located between the northern heights of Abhar county (N: 36º 15' 38.5'', E: 49º 24' 35.8'' and elevated 1704 m above sea level) at the border of the two provinces of Zanjan and Qazvin. The site lies in a narrow valley on the northeastern margin of the Yengejeh-Amirabad intermountain plain on a small natural promontory overlooking the Yengejeh-Chai River (Figure 2).



Figure. 2: A, B: *The situation of Tapeh Kulyeri,* ***C:*** *a view from the Excavation*

Background

Unfortunately, we know little about the past cultures of Zanjan province. Despite the frequent archeological surveys concentrated on western and especially southwestern Iran, adequate attention has not been paid to cultural and historical remains of Zanjan province. Hence, here is so little information about prehistoric cultures of the region. Considering the capabilities of the region for attracting various human groups in different times, beside the unique location of the region among the three cultural zones of the central plateau, western, and northwestern Iran, studying the its ancient sites and evaluating their features seemed necessary (Alibaigi *et al*. 2012). Thus, an archaeological project was carried out through two survey seasons in 2003 and 2005 in order to study and identify the archeological sites of the Abharroud basin (Aali 2004a; 2004b; 2006a & 2006b). The project which was conducted by Dr. Abolfazl Aali, provided us valuable information about the region, from very old times up to the present.

The two seasons of survey led to the identification of 257 ancient sites which are variant and remarkable in terms of type, appearance and their temporal and special distributions. During the two seasons in an area of 3400 km2, 34 prehistoric sites were discovered. These include 25 Chalcolithic sites. Chalcolithic potsherds of the region are composed of potsherds with red, orange, grey and smoked paste. The exteriors surfaces are covered with dark red (Early Chalcolithic Period), red or grey (Middle Chalcolithic Period), and reddish orange or light grey (Late Chalcolithic Period) slips. These sherds are all hand-made and fired in low temperature, therefore their cores are smoked. Some of these potsherds are decorated with rather plain geometric patterns and in few cases with motifs of animals in dark colors. The vessels are rather plain in form and include small and large bowls, vessels with vertical bodies and plain rims, crocks and storage jars. Furthermore, during the survey of other sites such as Kharabeh I, Guy Sadeh (Sareh), Falj, Chakhmaghlukh, Qieh, Kulyeri (Karvansara), Shahrbanoo, and many others, potsherds of middle and late Chalcolithic periods were discovered which are contemporary with settlements in the Central Zagros, and Northwestern and the Iranian Central Plateau.

The number of the sites relating to this period indicates a remarkable growth in population and settlements compared to previous times. Sites of this period are scattered both in plains and highlands. Southern heights and mountainsides of the basin host 10 sites, 8 sites are in northern heights and mountainsides and 7 sites are located in the plain and close to the Abhar River. The highest site is located 2150 m above sea level and the lowest one 1490m above sea level. Locations the Chalcolithic settlements showed that most of them are formed near water sources, usually less than 200 m (see: Alibaigi *et al*. 2012).

This paper presents the result of the sounding at Tapeh Kulyeri one of the chacolithic sites in highland of Abharroud basin.

The Site: Tapeh Kulyeri

Tapeh Kulyeri or Tapeh Karavansara is a relatively small Tell measuring 40×55 m with steep slopes, and its maximum height, including its natural bedrock, is approximately 10.5 m above the relatively flat western lands. The archaeological deposit is two and a half meters deep and covers the entire mound. The natural landscape surrounding the site is mountainous, steep and rocky and lacks facilities for livestock and agriculture due to its geological and topographical position. In 2013, the stratigraphical excavations in this site were conducted under the supervision of Sajjad Alibaigi. Archaeological findings have demonstrated that this site dates back to the late fifth millennium BCE. and belongs to the same horizon as the Ghabristan I/ Silk III1-3 period (Figure 3) (Alibaigi *et al*. 2015), which has been dated to 4326-4240 BCE. based on absolute chronology, also referred to as the early Chalcolithic in the Iranian Central Plateau (See: Pollard *et al*. 2012; 2013; Fazeli *et al*. 2013). Although no melting kiln was excavated, a series of cultural materials, including molds, copper rods, copper ores and anvils provided important evidence that metallurgical activities took place at this site.

Finds

During the surface survey of the site some copper ores and copper fragments were obtained, among several looting pits and excavated sections. Giving the difficulties in carrying greater portions of copper ores that are relatively large in size and collectively high in weight, one must assume that the site is located near the original copper ore deposit, which has also been confirmed by geological maps.

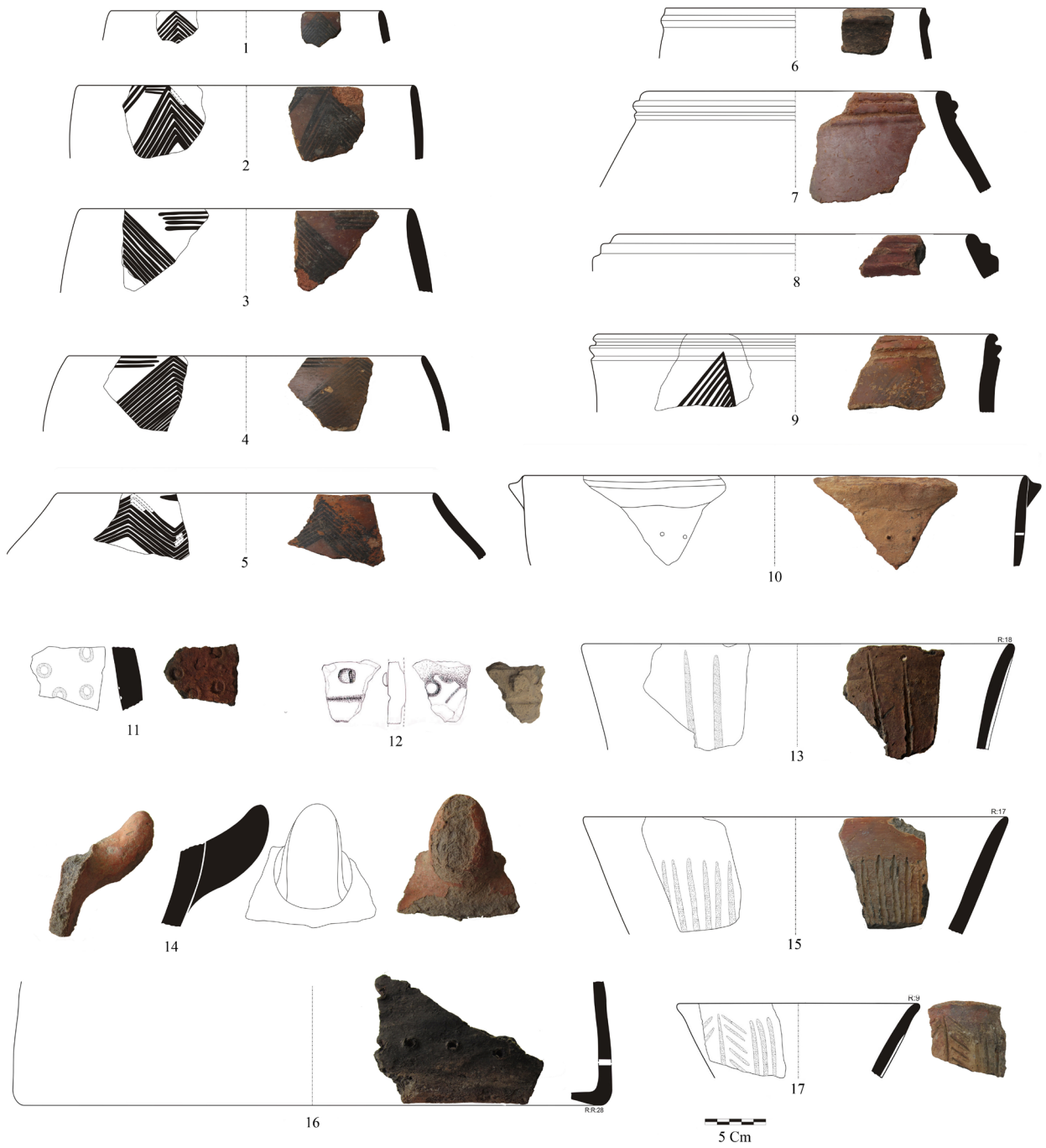


Figure. 3: *Selected potsherds of Ghabristan I/ Silk III1-3/ Godin VII period from Tapeh Kulyeri*

However, the exact mine from which the copper ores were extracted has not yet been identified. Alongside these findings are a number of other stone objects excavated from this area that are comparable to anvils found at the Arisman industrial site (Helwing 2011) and the metallurgical areas on the northern margin of Dasht-e Kavir plain in Semnan province (Roustaei 2012), which were used during the extraction process of the copper metal (Figure 4).

The most important finding regarding metallurgical activities in the site is part of a metallurgical mud mold. This can be characterized as a handmade rough object that is baked at insufficient heat, being 22 cm long and 7 cm wide for the remainder. The bottom of the mold has 6 rows of relatively parallel longitudinal grooves covering almost the entire surface and was probably used for molding narrow rods (Figure 5). It therefore appears

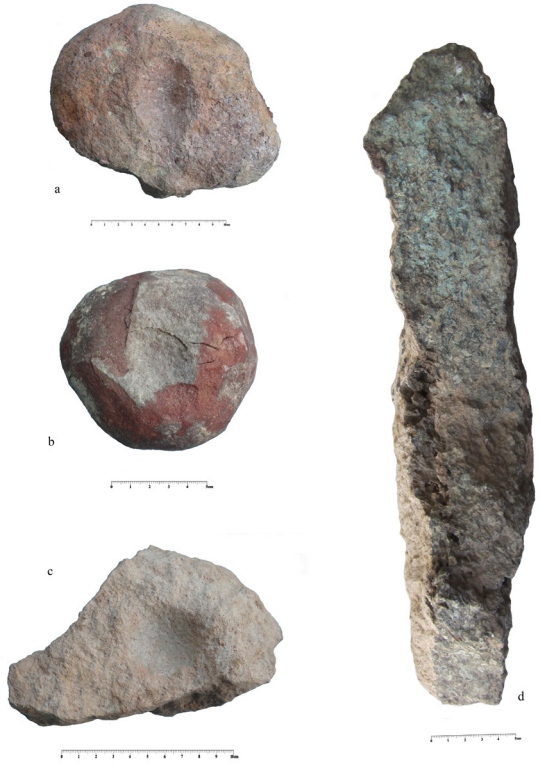


Figure. 4: *Some anvils and a large copper ore from Tapeh Kulyeri*

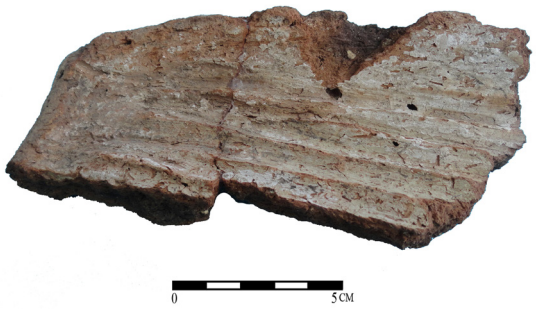


Figure. 5: *A fragment of Early Chalcolithic Mold from Tapeh Kulyeri*

that several small copper bars found at this site may have been produced locally in more or less similar formats during the period of 4326 to 4240 BCE. Similar evidence has been discovered from sites such as Tepe Hissar (Schmidt 1937: Figure. 44, h1727), Tepe Ghabristan (Madjidzadeh 2008: 127, Figure. 65 & 177: PL.19c), and Arisman (Helwing 2011: 268, Figure 42-43) in the Central Plateau. Further evidence includes a high density of ash deposits and several heated structures. The amount of ash in the area was so significant that the locals referred to this site as "Kulyeri" meaning "Ash Land".

Discussion

These results, along with the very low geographic features of the Tapeh Kulyeri, indicate that factors beyond the environmental capability were the reason for the site selection. The findings of the survey and excavation of the site also revealed that the Tapeh Kulyeri was not a typical rural settlement. Kulyeri is located in a region with poor environmental and landscaping capabilities; the existence of rocky, steep and rough terrain around the site has caused farming and breeding to be possible, but difficult even with modern advanced facilities. Therefore, there must be another reason for the formation of this settlement, pointing to this trans- subsistence aspect, as reflected in the excavated materials of the site. Anvils, copper ores, ash debris, molds, and prepared copper bars are clear indications of past metallurgical activities in this region.

Another valid point is the discovery of a seal, seal impression, sealing, and tokens among the archaeological remains of the site, which should most likely be associated with administrative measures (Figure 6). It is therefore possible that these finds from Tapeh Kulyeri should be related to the management of metallurgy activities on the site. In general, it seems that the Tapeh Kulyeri is an industrial site that also managed the affairs involved with the production activities. As research in the central and western margins of the Iranian Central Plateau shows, these areas had high potential for ancient mines and metallurgical processes (See: Nezafati 2004; Nezafati & Pernicka 2005; Pernicka *et al.* 2011; Matthews & Fazeli 2004; Chegini *et al*. 2000). It therefore appears unlikely that the administrative evidence in these sites was completely unrelated to such activities.

The unusual location of the site from the outset also indicated that factors other than environmental capabilities (cultivation) were likely to have formed

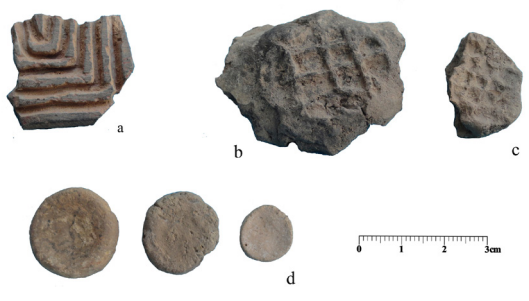


Figure. 6: *Chalcolithic seal, Sealing and Tokens from Tapeh Kulyeri*

the site. Given the current evidence of settlements related to the plum ware traditions such as Godin VII, Mārāl Tapeh, Seh Gabi, Tapeh Khurasanlou, and Tapeh Koyleri, this may indicate that these people specialized in metallurgy. At most of these sites metal casting molds have been found, which undeniably confirms the existence of metal production taking place in this area. This indicates the existence in the late fifth millennium BCE., of a group of static or mobile communities scattered in the west of the Central Plateau to the east of Zanjan province, which had access to rich copper mines, and thereby specialized in the production and processing of copper objects.

Koyleri is not the only site in this region that has provided important evidence for these activities, such as molds, seals and seal impressions. In addition to Koyleri, during the archaeological survey of the Abharroud River basin under the supervision of A. Aali from Khurasanlou and Hipi sites near the present-day Khalifelou Copper Mine in the northern heights of the Abhar-Zanjan Valley, fragments of a mold (Khosravi 2009) and from two sites of the Tapeh Qale Falj and Chakhmakhlokh respectively, a stone seal and a clay piece with seal impression from the chalcolithic period (Alibaigi *et al.* 2011; 2012) and also from the archaeological excavation of SohaChai Tapeh Ijrud, a stamp stone seal and a seal impression has been obtained (Aali, 2007) (Figure 7). All of these very small sites are

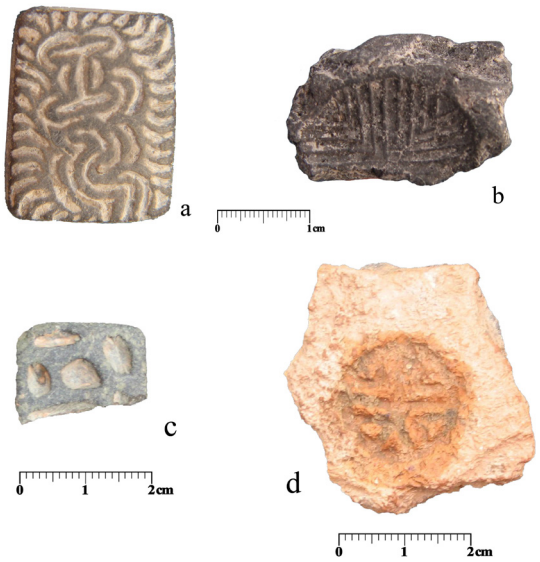


Figure. 7: *Chalcolithic seal, Sealing from Soha Chai Tapeh (a & b), Chalcolithic seal from Tapeh Falj (c), and late Chalcolithic seal imperssion from Tapeh Chakhmakhlokh (d)*

either in the same horizon or slightly later than excavated materials from Tapeh Kulyeri. Therefore, it seems likely that metallurgy-related activities were taking place during the Chalcolithic period due to the rich landscape of the region in terms of copper mines, which would have required some level of administration. This explains the existence of a seal and a seal impression as well as tokens in the aforementioned settlements.

Conclusion

The excavation of the Tapeh Kulyeri showed that, at least in terms of site selection, something beyond its livelihoods had formed it. Hence, single-period and unfrequented sites such as Khurasanlou, Hipi, Falj and Chakhmakh-Lokh, located in the highlands of eastern Zanjan province, which have either a seal and a seal impression or a mold, indicate a similar nature like the industrial settlement at Tapeh Kulyeri. If our interpretation is correct, it should be noted that the sites listed are not small and ordinary villages, but possibly industrial sites related to the production and extraction of copper in the heights around the Abhar River Valley. Furthermore, the earliest evidence of metal melting in the margins of the Iranian Central Plateau, which developed later in the mid-4th millennium BCE., has also been obtained from these sites.

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