



Original Article

Analysis and Study of Beveled Rim Bowls (BRB) Based on Their Distribution in Iran

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Abstract

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From a temporal perspective, we observe the presence and distribution of beveled rim bowls in Iran and Mesopotamia from the mid-fourth millennium BC until the beginning of the Bronze Age. The large production and specific shape of this pottery, alongside its extensive distribution, have prompted many archaeologists to study this subject. Beveled rim bowls is categorized into two types: Uruk and proto Elamite, based on their shape and structure. The geographical conditions in Iran have differentiated the distribution of this pottery compared to Mesopotamia. During this period, the Uruk type gradually changed in structure and transformed into the proto Elamite type. The regions of Khuzestan, Central Zagros, and the Central Plateau have the highest density of sites and pottery in Iran, connecting these centers through intermediary areas. According to the studies conducted, this distribution in Iran has been exported to various other regions by local elites or specific groups of people. Perhaps, this group consisted of local merchants who, through migration, spread the proto Elamite culture in Iran, while the Uruk type of beveled rim bowl was produced and distributed for economic or political purposes in significant sites such as Susa, Chogha Mish, Tepe Yahya, Sefalin, and Godin Tepe.

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Introduction

In the fourth millennium BC, we witness the expansion and advancement of social, economic, and political structures in Mesopotamian society, known as the Uruk and Jemdet Nasr cultural periods. Additionally, this period has yielded evidence of the earliest writing, which is why it is also referred to as the beginning of writing. Beveled rim bowls is very rough and coarse in texture, with their chamotte often consisting of sand and, in some cases, straw, making this pottery highly porous. In fact, beveled rim bowls spread across a vast area of the Middle East from the late fourth millennium, from the eastern Mediterranean to the Indus Valley. This type of pottery, alongside other characteristics such as the beginning of writing and urbanization, under the formation of administrative structures and their related features, constitutes some of the most prominent research elements of the late fourth millennium BC in Iran (Potts 2009). Beveled rim bowls is studied in two distinct types: proto Elamite and Uruk (Figures 1 and 2). The taller examples of beveled rim bowl belong to the early use of this pottery type in the Middle

East (Potts, 2012: 63). The proto Elamite beveled rim bowls, often referred to simply as bowls, are actually narrow and tall vessels produced in large quantities, originating from the fourth-millennium Uruk culture in ancient Mesopotamia. Through a process that remains unclear to us, they evolved into taller and narrower proto Elamite examples, spreading across a wide area of the Central Plateau of Iran until the late millennium. Aside from the narrower and taller shape of the proto Elamite examples (Figure 1), all characteristics of the construction and finishing of this pottery type follow the same techniques as the Uruk beveled rim bowl (Yousefi Zeshk, 2021). The proto Elamite period likely spanned from 2800 to 3300 BC, coinciding with the new Uruk, Jemdet Nasr, and the Old Sumerian dynasties in Mesopotamia (Alden, 1982: 613). According to the chronological framework presented by LeBron on the Acropolis, the proto Elamite period coincides with Susa III. Additionally, the Jemdet Nasr periods and the Old I and Gash dynasties are the same as what is referred to as Susa III (Alden, 2002: 318 and 319).



Figure1.

Representative of proto Elamite beveled rim bowl pottery from the site of Mahitabad, source: (Vidale, 2013: 29)

The initial type of this bowl is known as the "beveled rim bowl." It appeared in early Shush 2/Uruk period (around 3800 BC) and transformed into a standard type in the middle of Shush 2. Although this type of pottery continued with a taller and narrower variant until the early Shush 3 period, it is not abundant. Around 2800 BC, at the end of the proto Elamite period, this pottery became taller with a flat and hollow base (Alizadeh, 2021: 4). Beveled rim pottery has a wide distribution as an indicative pottery of this period (McCown, 1942). The distribution of beveled rim bowls, according to recent studies, requires re-evaluation. Therefore, the aim of this research is

to study the factors influencing the distribution of this pottery in Iran. The question posed is: Can the distribution of beveled rim bowl in Iran follow specific patterns? Various applications for beveled rim bowls have been proposed so far, with the most important applications being as follows. The first idea regarding the application of beveled rim bowls was proposed by Campbell Thompson in 1931. He suggested that they were ritual bowls used for offerings (Campbell Thompson and Hutchinson, 1931: 104). Following this, Nissen, based on archaeological and linguistic findings regarding the daily rations of workers or casting molds, proposed that workers received their

wages in the form of daily rations under an administrative system (Nissen, 1970: 137). Among the archaeologists who accepted Nissen's idea was Gregory Johnson. In 1973, based on Nissen's idea, he measured the volumes of beveled rim bowls and considered them as the rations for workers (Johnson, 1973: 129-132). A few years later, Miller, in 1981, reached the same conclusion regarding the significant size variations of these vessels based on his study of the Farakhabad site (Miller, 1981). Daniel Potts suggested in 2009 that beveled rim bowls were molds for baking delicious bread that spread to Shushan and the Iranian plateau due to popular demand (Potts, 2009: 13-14).

Necessity of research

Considering the studies conducted so far on the Chalcolithic period in Iran and the Uruk period in the Iranian plateau from the second half of the fourth millennium BC to the early Bronze Age in Iran and the late Uruk period in Mesopotamia, which spans from 3500 BC to 2900 BC, the distribution of this pottery has not been comprehensively examined or has been addressed implicitly concerning new studies and excavations in Iran.

Research Method

This research has been conducted using a documentary (library) method with a descriptive-analytical approach. Initially, based on archaeological evidence, the distribution of beveled rim pottery will be investigated through site localization using GIS, Bahesab, and Google Earth. Then, based on this process, the final pattern of sites with beveled rim bowl will be mapped in Iran, and the distribution of this pottery will be analyzed.

Background of Research

According to Glatz, the distribution of beveled rim bowls in the fourth millennium BC extends from southern Iraq and the Persian Gulf to the eastern highlands of Turkey and Iran (Glatz, 2022: 48). Talayi mentions in his book "The Bronze Age" that beveled rim bowls first became prevalent in the Uruk period of Mesopotamia with astonishing quantities and spread through various mechanisms, including inter-regional trade in the broader Middle East during specific periods. During this time, the political, social, and economic foundations and structures of the people in Mesopotamia underwent transformation, leading to significant urbanization. The Uruk period in Mesopotamia was a time of great changes, with large urban centers forming and people gathering in new ways to live in cities. Analyzing the beveled rim bowls found in the region elucidates their socio-political significance (Talayi, 2012: 21, Goli et al, 2024). Demorgan, in an article titled *Recherches archéologiques, 1^{re} série. Fouilles à Susa*, discusses Uruk pottery and concludes that these bowls are formed raw and untrimmed, solely by hand. Although beveled rim pottery is recognized as a product from Mesopotamia since the second half of the fourth millennium BC, it was first discovered and reported during the excavations at Susa in 1898 and 1899 by Demorgan (de Morgan, 1900: figs. 91, 118, 121). The first examples of beveled rim bowls in Mesopotamia were found in 1918 at Eridu (Tell Abu Shahrain) (Campbell-Thompson, 1920: figs. 3/4, 4.10). Shahmirzadi mentions in his book *Foundations of Archaeology in Iran, Mesopotamia, and Egypt* that some of the earliest examples of beveled rim bowls were also found in Layer 12 of Warka. It is certain that settlement in Warka during the Ubaid period was very limited and scattered (Shahmirzadi, 1996: 307). A few years later, in 1925 and 1926, several more beveled rim bowls (six bowls) were discovered at Jameh Nasr (Mackay, 1931: pl. 67, 22, 23). In Nineveh, these bowls were first reported from Ashur (Campbell-Thompson & Hamilton, 1932: 88; Campbell-Thompson & Mallowan, 1933: 168; Campbell-Thompson & Hutchinson, 1931: 104).

**Figure2.**

Representative of beveled rim bowl pottery from the site of Meymanat Abad, source: (Yuosefi Zoshk. et al, 2015: 19)

Ghirshman also states in his book *Silk* that this pottery was first found in the Iranian plateau in 1933 during the Silk excavations (Ghirshman, 1938: pl. 2). Daniel Potts, in an article titled *beveled rim Bowls and Bakeries: Evidence and Explanations from Iran and the Indo-Iranian*, notes that the discussion about the use of beveled rim bowls began in the late 19th century with their discovery at the Susa site in Iran (Potts, 2009). Abdi, in his article on beveled rim bowls: usage and distribution, emphasizes that if we accept various applications, evidence may be found elsewhere that could deny them, due to the extensive distribution of these bowls. However, he suggests that

they seem to have been inexpensive vessels used for various purposes (Abdi, 1999: 72). Le Brun published sixteen different sites in Iran where beveled rim bowls were found in 1980 (Le Brun, 1980: 67-68). Abdi notes that by 1999, this number of sites had increased to 45 (Abdi, 1999: 83-84). Daniel Potts, in 2011, considered the distribution of sites with beveled rim pottery to exceed 100, found in 19 different regions in Iran and Pakistan (Potts, 2012: 59). This research aims to study the sites where beveled rim bowls have been discovered, based on the pattern derived from the new point mapping process, and to re-examine and analyze the distribution of this pottery.

**Map1.**

Indicates the point distribution of the sites beveled rim bowls in the provincial divisions of Iran, Source: Author: 2024

Discussion

Based on studies and cultural findings from the Copper and Stone Age, particularly from the second half of the fourth millennium BC to the beginning of the Bronze Age in Iran, a type of connection and transfer of pottery culture can be observed among the settlements of the Late Copper and Stone Age. The discovery and study of beveled rim bowls in many archaeological sites in Iran and the distribution of this pottery in the region have been conducted in various forms for a long time. Almost all archaeologists have addressed the potential uses of beveled rim bowls in their studies. However, factors such as distribution and, consequently, the transfer and cultural influences of groups that played a significant and effective role in the dissemination of cultural materials have received less attention. To study the distribution of beveled rim bowls in Iran, it is essential to consider how this distribution occurred across the Iranian plateau, particularly in Mesopotamia. Generally, the presence

of this pottery in the Iranian plateau encompasses extensive areas of Iran and Mesopotamia, as well as a few regions in Turkey, Syria, Palestine, and Pakistan. The distribution of beveled rim bowls in Mesopotamia is primarily along the Tigris and Euphrates rivers and the trade routes of the region. However, in contrast to Mesopotamia, this distribution in Iran appears to be different, concentrated, and at times scattered (see Map 1). In terms of the extent of distribution, Khuzestan is the main center (Center 1) for this pottery, hosting the highest number of sites with beveled rim bowls. The central plateau and central Zagros (Centers 2 and 3) follow Khuzestan, accounting for the next largest number of sites with this pottery in Iran. The southern and southeastern center (Center 4) also includes significant areas but has a lower density compared to other centers (Tables 1 to 4).

Table1.
Introduction of beveled rim bowls Sites in Center 1 (Khuzestan)

| Sate | Sate | Sate | Sate |
|------------|-------------------------|-------------------------------|--------------------------------|
| Bladiyeh | Marbach | Suse | Gasar |
| Bard Panir | Abu Chizan | Homayun | Farokh Abad |
| KS269 | KS007 (Tape Sanjar) | KS006 (Ishan Iraydeh) | Ishan Masilat |
| KS284 | K016 (Tape Mohaad Agha) | KS015 | KS005 (Chogha Cheshmeh) |
| KS285 | KS032 | KS027 (Tape Hasan Abad) | KS008 |
| KS286 | KS035 | KS034 | KS022 |
| KS288 | KS040 | KS039(Chogha Fatayun) | KS033 (Ishan Rud),(Taie Babad) |
| KS289 | KS049 | KS045 | KS037(Ghaieh Pangoon) |
| KS1508 | KS054 | KS052(Tape Bolahiya) | KS044 |
| RH006 | KS076 | KS064 | KS050(Tape Boneh Alvan) |
| RH016 | KS092 | KS090 (Khazanet Sabeh) | KS061 |
| RH032 | KS098 (Haft Tape) | KS096(Tape Chenaneh),(Keihf) | KS079 (Ishan Ain) |
| RH067 | KS108 (Chogha Kabira) | KS102 (Chogha Pahn) | KS094 |
| RH069 | KS120 (Tape Deh Now) | KS113 (Tape Shangar) | KS099 |
| RH072 | KS165 (Chogha Pahvande) | KS153 | KS112 (Tape Towaim) |
| RH077 | KS190 | KS173 | KS121 (Ishan) |
| RH086 | KS240 (Tape Halvimash) | KS218 | KS171(Tape Jalle Kar) |
| RH117 | KS059 (Abu Fandoveh) | KS024 (Tape Soleyman) | KS197 |

| | | | |
|-------------------|---------------------|-------|-------|
| KS001(choghamish) | KS004(Abu Diyayat) | KS290 | KS266 |
| KS093 | KS036(Sharaf Abad) | | |

Table2.

Introduction of beveled rim bowls Sites in Center 2 (Central Zagros)

| Sate | Sate | Sate |
|--------------|----------------|---------------|
| Godin Tape | Dehsavar | Molla Vasou |
| Shatte Ghile | Nane Marivan | Sar Ghale |
| Babajan | Chogha gavaneh | Molla yousef |
| Kaldir | Reh Sheh | Valilu |
| Gariran | Lavin | Gave Botkhane |
| Masour | Gave Vazme | Giyan |
| Badam Yar | Gouman | Babajan Tape |

Table3.

Introduction of beveled rim bowls Sites in Center 3 (Central Plateau and North of Central Plateau)

| Sate | Sate | Sate |
|---------------|---------------|--------------|
| Ghomroud | Gol dasteh | Vavan |
| Maral Tape | Mohammad Abad | Meymoun Abad |
| Gholi Darvish | Cheshme Ali | Mamourin |
| Zavare Var | Sialk | Ghabrestan |
| Sofalin | Sakz Abad | Ozbaki |
| Arisman | Zagheh | |

Table4.

Introduction of beveled rim bowls Sites in Center 4 (Southeast and East)

| Sate | Sate | Sate |
|-------------|-------------|------------|
| Miri Kalat | Mahtut Abad | Tape Yahya |
| Tape Langar | Talle Eblis | Dasht Kar |
| Tale Zahak | Ali Abad | Rig Anbar |
| Sate | | |
| Kalle Koub | | |

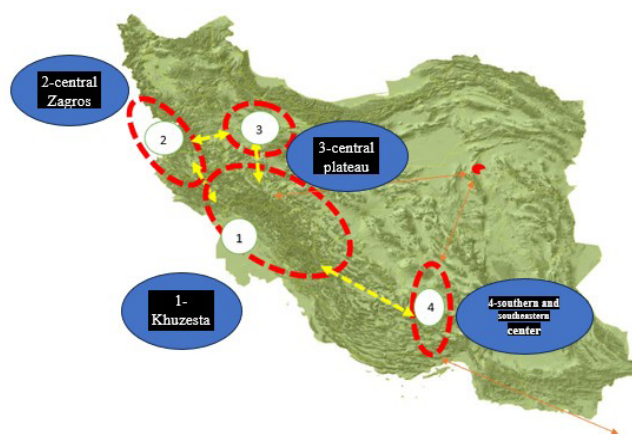
Table5.

Introduction of sites with beveled rim bowls in intermediate areas (Fars, Ilam, Shahrekord)

| Sate | Sate | Sate |
|-------------|---------------|-----------------|
| Gap Kenareh | Talle Koureh | Argan |
| M- Kazemi | Alouni | Zebarjad |
| Talle Spid | Nour Abad | Malian |
| Kougang | Gour Kay | S17 |
| Chiya Gap | Godar Khosh | Jamalou |
| Mousian | Chogha Ahovan | Chiya Fathollah |
| Ghale Tal | Talle Afghan | Ghale Geli |

It should be noted that between these centers, there are numerous intermediary sites that connect them. These sites are scattered in the central Zagros region, extending ultimately to the Lavin site, connecting to the central plateau through Godin, and finally stopping at Erisman. The southern branch also extends from the south to the southeast, reaching Miriklat at the current border of Iran and Pakistan, gradually decreasing in the number of sites with beveled rim bowls. It is important to mention that archaeologists have not discovered any pieces of beveled rim bowls in the layers of the fourth millennium BC at the sites of Tepe Hissar and Shahr-e Sukhteh, which are

considered significant centers from the second half of the fourth millennium BC and the early Bronze Age. Nevertheless, a large number of beveled rim bowls have been found at the Kalleh Koub site in the northeastern region, which is unique and controversial in itself. Considering the study of this distribution, there are pathways that can connect the main centers mentioned. The routes from Godin to the central plateau, Erisman to Khuzestan, Miriklat to Khuzestan, and finally the more probable southern route from Tepe Yahya and Tell Ablis towards Kalleh Koub are among the possible routes (Map 2).



Map2.

Representing the schematic distribution of areas beveled rim bowls in Iran(Source: Author: 2024)

The discovery, study, and examination of sites related to this period can facilitate analyses and better explain the reasons for this distribution in the future. Based on the studies conducted on beveled rim bowls so far, this pottery is categorized into two types: Uruk and proto Elamite. The Uruk type generally encompasses

Mesopotamia and Khuzestan. According to Alghazeh, the distribution of Uruk beveled rim bowls was also carried out by Mesopotamian elites at significant sites in Iran such as Susa, Chogha Mish, Tepe Yahya, Sefalin, and Godin Tepe (see Figure 3), for economic or political purposes.

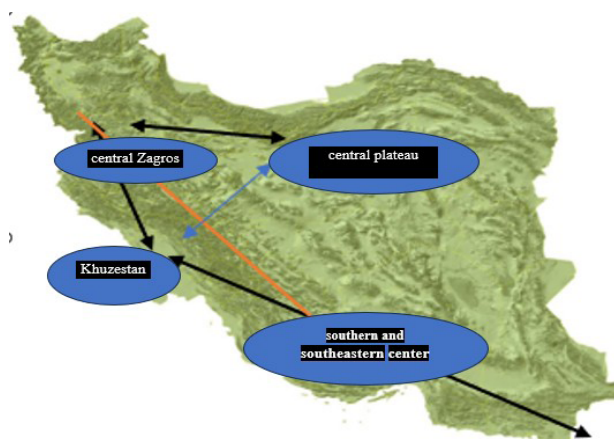


Figure3.

Representative of beveled rim bowl pottery from the site of Godin , source: (Gopnik and Rothman , 2016: 784)

In this study, a total of 147 sites with Uruk and proto Elamite beveled rim bowls have been identified and studied. This includes 46 archaeological sites in Khuzestan (Center 1), 21 in Central Zagros (Center 2), 21 in intermediary regions, 17 in the Central Plateau (Center 3), 9 in the south and southeast (Center 4), and the Kalleh Koube site in the northeast. Based on the existing evidence in Iran, the Uruk type of beveled rim bowls gradually transformed into the proto Elamite type and has been distributed across nprotoy all sites in Iran. It is worth mentioning that in some sites of this period, we observe the presence of both Uruk and proto Elamite beveled rim bowls, indicating the continuity of pottery production and the significance of the sites. Furthermore, considering the number of sites and the quantity of beveled rim bowls, it can be inferred that the main center for proto Elamite beveled rim bowls, based on the number of sites containing this pottery, was Khuzestan, similar to its Uruk counterpart. This culture was gradually disseminated by local elites or specific groups of people as a native cultural phenomenon from Khuzestan to other regions of Iran, including Central Zagros and various other areas (see Figure 4). Various factors can be considered influential in the distribution of this pottery culture, which occurred in two different stages in Iran. In the first stage, the pottery was introduced into Iran by Uruk communities for purposes such as colonization, establishing Uruk bases, and the need for mineral resources like copper and other

economic necessities, such as gemstones. The initial type of this pottery, namely the Uruk beveled rim bowl, belongs to this stage and entered Iran through communication routes from Mesopotamia. In the second stage of this distribution, the culture, which gradually became indigenous in Iran, encompasses the main and intermediary centers in the country. Activities of local merchants or economic elites are among the most significant factors that, through nomadic communities, migration, regional pressures, or climate changes, spread the proto Elamite culture in Iran. The proto Elamite beveled rim bowls belong to this second stage, having spread from Khuzestan towards Central Zagros, the Central Plateau, and the southern and southeastern regions of Iran. The interior regions of Iran, due to the presence of scorching deserts and arid areas, lack sites suitable for permanent habitation, making the distribution of various cultures in these areas difficult, weak, or seemingly impossible. Consequently, the distribution of sites occurs either in the desert fringes or in the semi-mountainous areas of the Zagros and Alborz mountain ranges, creating a circle around the dry and desert regions. The distribution of beveled rim bowls in Iran, according to a study conducted, resembles the letter U, spanning from the west to the east (left to right) of Iran (see Map 3). In the eastern regions, except for the Kalleh Koube site in Isfahan, no other site yielding beveled rim bowls has been reported so far.



Map3.

Representation of U-shaped schematic distribution of western to eastern regions beveled rim bowl in Iran,) Source: Author: 2024)



Figure4.

Representative of beveled rim pottery from the site of Badamyar, source: (Abedi et al, 2019: 174)

Conclusion

Based on the investigations carried out in this study, it appears that the distribution of beveled rim bowls in Iran, unlike the low-lying land of Mesopotamia, is subject to different geographical and climatic conditions. The main center of the Uruk type of this pottery was in Mesopotamia, and its distribution in Iran includes Khuzestan and some Uruk sites such as Tepe Yahya, Chogha Mish, Godin Tepe, and Sefalin. However, the distribution of this pottery gradually occurred with the introduction of a new type called the proto Elamite beveled rim bowl in Iran. In some sites of this period, we observe the presence of both Uruk and proto Elamite beveled rim bowls, indicating the continuity of pottery production and the importance of the sites. The distribution of

the proto Elamite type in Iran has become a native cultural phenomenon, spreading through local elites or specific groups of people. Perhaps these groups were local elites or merchants who, through migration, climate changes, regional pressures, etc., disseminated the proto Elamite culture in Iran. It appears that the distribution of this pottery, in terms of quantity, encompasses four main regions: The Central Plateau, Central Zagros, Khuzestan, and the south and southeast. According to the conducted studies, this distribution has spread from Khuzestan to various other areas, including Fars, Central Zagros, the Central Plateau, and other sites associated with this culture. This culture is known in Iran as proto Elamite.

Table6.
Representative of beveled rim pottery from the Iran

| Sate | KS-59 | Talle Gasar | KS-01 | Suse | Mousian |
|----------|--------------|--------------|--------------|--------------|--------------|
| Latitude | 32°05'36.56" | 31°21'37.90" | 32°13'28.54" | 32°11'30.30" | 32°31'01.61" |
| Longtude | 48°18'59.85" | 53°47'45.34" | 48°33'21.33" | 48°14'55.36" | 47°22'51.26" |
| Sate | Talle Koureh | Zebarjad | Talle Spid | Zavare Var | Ghale Tal |
| Latitude | 27°55'11.25" | 31°49'34.55" | 30°15'18.02" | 35°14'44.68" | 31°37'51.67" |
| Longtude | 53°47'45.34" | 49°52'43.36" | 51°28'53.12" | 51°43'14.88" | 49°53'29.38" |
| Sate | Vavan | Meymoun Abad | Mamourin | Molla Vasou | Tale Afghan |

| | | | | | |
|------------------|---------------|--------------|--------------|---------------|-----------------|
| Latitude | 35°30'32.85" | 35°29'43.87" | 35°25'26.81" | 36°13'30.04" | 36°09'20.45" |
| Longitude | 51°13'01.42" | 51°01'08.70" | 51°09'02.89" | 45°31'05.38" | 54°22'46.55" |
| Sate | Valilu | Ghabrestan | Sakz Abad | Zagheh | Kale Koub |
| Latitude | 36°17'21.36" | 35°48'59.34" | 35°48'58.71" | 35°46'49.96" | 33°52'37.35" |
| Longitude | 45°31'11.86" | 49°56'50.98" | 49°57'07.98" | 49°56'18.85" | 58°17'38.99" |
| Sate | Gave Botkhane | Tape Yahya | Tape Giyan | Talle Malian | Chiya Fathollah |
| Latitude | 33°25'37.36" | 28°19'51.69" | 34°10'53.82" | 30°00'40.87" | 33°34'30.95" |
| Longitude | 47°46'53.77" | 56°52'02.49" | 48°14'37.33" | 52°24'31.52" | 48°42'07.88" |
| Sate | Gol dasteh | Tape Langar | Bladiyeh | Jamalou | Kougang |
| Latitude | 35°35'50.43" | 30°04'31.86" | 32°11'19.18" | 32°39'57.20" | 32°32'08.75" |
| Longitude | 51°15'52.91" | 57°15'42.41" | 48°31'03.36" | 50°32'11.51" | 50°20'36.51" |
| Sate | Dasht Kar | M- Kazemi | Dehsavar | Mohammad Abad | KS-36 |
| Latitude | 29°54'33.35" | 30°13'30.71" | 34°19'04.97" | 35°49'59.82" | 32°06'31.19" |
| Longitude | 56°39'28.47" | 51°26'47.67" | 47°08'58.67" | 50°36'58.64" | 49°08'21.38" |
| Sate | Cheshme Ali | Nane Marivan | Marbache | KS-4 | KS-5 |
| Latitude | 35°36'37.14" | 35°25'12.17" | 31°16'11.60" | 32°09'01. 14" | 32°09'15. 87" |
| Longitude | 51°26'59.21" | 46°18'08.66" | 49°23'15.20" | 48°30'50. 76" | 48°29'26. 89" |
| Sate | Farokh Abad | Arjan | Homayun | Rig Anbar | Mahtut Abad |
| Latitude | 32°35'18.94" | 30°39'58.61" | 30°30'22.40" | 28°23'33.70" | 28°27'23. 80" |
| Longitude | 47°13'35.53" | 50°18'10.97" | 50°28'21.38" | 57°45'25.10" | 57°47'23. 99" |

Table7.
Representative of Uruk beveled rim pottery from the Iran

| | | | | | |
|------------------|----------------|--------------|--------------|---------------|---------------|
| Sate | Sialk | Sofalin | Nour Abad | Kalgir | Arisman |
| Latitude | 33°58'20.47" | 35°18'58.97" | 30°07'16.97" | 33°54'29.60" | 33°39'43. 93" |
| Longitude | 51°24'15.03" | 51°44'08.72" | 51°31'14.47" | 46°08'03.69" | 51°59'44.42" |
| Sate | Tape Masour | Badam Yar | Ozbaki | Maral Tape | Gouman |
| Latitude | 33°26'23.57" | 36°13'26.22" | 35°58'47.80" | 35°58'47.800" | 36°21'31. 77" |
| Longitude | 48°19'18.29" | 45°33'04.99" | 50°35'11.65" | 50°35'11.652" | 45°25'48. 04" |
| Sate | Chogha gavanah | Reh Sheh | Lavin | Gave Vazme | Godin Tape |
| Latitude | 34°06'36.60" | 35°32'05.77" | 36°40'22.65" | 34°03'51.17" | 34°31'06. 55" |
| Longitude | 46°31'43.21" | 46°11'59.53" | 45°12'19.06" | 46°39'19.84" | 48°04'07. 37" |

| | | | | | |
|------------------|----------------------|---------------------|------------------|----------------------|---------------------|
| | | | | | |
| Sate | KS-120 | KS-121 | KS-153 | KS-165 | KS-171 |
| Latitude | 32°04'07.08" | 32°03'12.22" | 32°14'51.91" | 32°11'04.22" | 32°10'42.91" |
| Longitude | 48°34'06.82" | 48°33'32.05" | 48°47'44.20" | 48°41'04.50" | 48°48'50.83" |
| Sate | KS-173 | KS-190 | KS-197 | KS-218 | KS-240 |
| Latitude | 32°14'04.76" | 32°07'05.14" | 32°04'13.47" | 32°00'57.70" | 32°17'35.28" |
| Longitude | 48°51'22.98" | 48°42'30.69" | 48°42'00.88" | 48°43'19.47" | 48°07'14.20" |
| Sate | KS-266 | KS-269 | KS-284 | KS-285 | KS-286 |
| Latitude | 32°11'20.98" | 32°09'39.56" | 32°07'11.65" | 32°07'50.02" | 32°14'50.78" |
| Longitude | 48°29'22.17" | 48°22'40.39" | 48°32'08.70" | 48°22'37.34" | 48°13'49.59" |
| Sate | KS-288 | KS-289 | KS-290 | KS-1508 | Talle Afghan |
| Latitude | 32°24'28.38" | 32°13'34.46" | 32°11'42.10" | 31°59'50.19" | 30°15'29.47" |
| Longitude | 48°24'57.90" | 48°26'04.87" | 48°31'44.53" | 48°50'54.33" | 51°27'55.40" |
| Sate | Miri Kalat | RH-16 | RH-32 | RH-67 | RH-69 |
| Latitude | 26°03'12.13" | 00°00'00.00" | 31°18'34.67" | 31°09'25.09" | 31°09'22.35" |
| Longitude | 63°05'40.47" | 00°00'00.00" | 49°33'33.01" | 48°07'25.32" | 49°36'06.53" |
| Sate | RH-72 | RH-77 | RH-86 | RH-117 | RH-06 |
| Latitude | 31°17'40.30" | 31°08'54.34" | 31°12'54.16" | 31°14'05.60" | 31°16'02.00" |
| Longitude | 49°26'35.80" | 49°34'42.11" | 49°41'40.24" | 49°26'55.87" | 49°25'58.00" |
| Sate | Sar Ghale | Gariran | Chiya Gap | Chogha Ahovan | Gap Kenareh |
| Latitude | 35°17'47.09" | 33°54'11.65" | 33°05'53.73" | 33°07'55.34" | 29°54'41.20" |
| Longitude | 46°22'30.16" | 48°13'50.98" | 46°11'44.24" | 46°12'55.42" | 52°51'27.77" |
| Sate | Ishan Masilat | Molla yousef | | | |
| Latitude | 32°18'39.88" | 45°27'35.89" | | | |
| Longitude | 48°07'28.32" | 36°11'52.24" | | | |

Data Availability

The data underlying the results presented in this paper are not publicly available at this time but may be obtained from the corresponding author upon reasonable request.

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Conflict of Interest

The results obtained in this research do not conflict with any individual or organization.

Authors' Participation

All authors contributed equally to the analytical and numerical calculations and have read and approved the final manuscript.

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