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Structural Analysis of Social Settlement Models within the Ancient Sites of Sarbaz County Based on Geographic Information System (GIS)

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Abstract

During archaeological fieldwork conducted in Sarbaz County, numerous sites have been identified. However, much of the data collected from these sites remains unexamined, and no comprehensive interdisciplinary studies have been undertaken to date. Consequently, the primary research question guiding this study is: What influence does the geographical environment have on the formation and variation of settlement patterns in the ancient settlements of Sarbaz County? Accordingly, the key objectives of this research are twofold: (1) to assess the impact of environmental factors on human activity and settlement formation in the region, and (2) to examine the relationships between these factors and the spatial distribution of settlements. To address these objectives, the study first examines the geographical environment of Sarbaz County. Next, the distribution of settlements is analysed using Geographic Information Systems (GIS). Finally, by applying branch classification, ecology, and economy theories, the ancient settlements are categorised based on their chronological period, elevation, size, and type. This framework allows for an analysis of how the geographical environment influences the spatial distribution patterns of these settlements. The findings of this study reveal distinct patterns in settlement distribution. The northern regions of Sarbaz County are predominantly characterised by single-period sites, featuring temporary and seasonal settlements located in the highland areas, which reflect the semi-mountainous terrain. In contrast, the southern regions, particularly the Jakigur area and its surroundings, exhibit a relatively flat topography. In these areas, evidence of sustained agricultural land use is apparent, with continuous activity traced back to the pre-Islamic period.

Keywords: Sarbaz County, Archaeological Surveys, Settlement Patterns, GIS.

Article Type: Research Article

Introduction

The environment and its conditions are crucial factors in the formation of ancient sites, directly impacting them. As a result, most archaeologists begin their studies by examining the environmental factors of the region to analyse the settlement patterns (Bamedi 2017: 2). Based on archaeological theories, the terrain, conditions, available resources and gifts of the location play a significant role in the livelihood of the people, the type of residences (sedentary or semi-nomadic), the materials used for structures, and the design of houses. Moreover, there is a direct relationship between the quality and quantity of environmental relocation and the socio-economic and demographic status of settlements. Essentially, the environment serves as a platform for habitation that affects all aspects of the residents' lives (Papoli Yazdi 2002: 214 Mortazavi and Mosapour Negari 2010: 7). Hence, the environmental context is one of the first variables to investigate when exploring the relationship between humans and their environment in a specific region. The study of the Sarbaz area raises important questions about how the relationship between humans and the environment influenced the formation of the ancient sites in this area. What factors have

led to differences in the settlement patterns of the study area during various periods? It seems that the correlation between humans and the environment regarding settlement patterns is a mutual relationship that determines whether or not the settlement pattern change. With advancements in technology, humans have gained more control over the environment, which, similarly to earlier periods, has led to variations in settlement pattern over time. Primitive technology has also played a significant role in this evolution.

Location of the Sarbaz County

Sarbaz County is located in the southeastern region of Iran, within the province of Sistan and Baluchestan. It is bordered by Iranshahr County to the north, Pakistan to the east, Saravan County to the southern (adjacent to Chabahar County), and Nikshahr County to the west. This region is characterised by its mountainous terrain, particularly the compacted mountain range of South Makran. The complexity of this mountains makes it challenging to establish large settlements throughout history, and despite the presence of the permanent Sarbaz River, it has had an increasing impact on the environmental and geographical conditions and the way settlements are formed (Moradi *et al*. 2014; Moradi 2016; Sarhaddi-Dadian 2024) ;(Figure.1).

Research Background

Sir Aurel Stein, a British archaeologist, was the first to conduct explorations in the region extending from the Indus River to Fars Province. In Baluchestan, he focused on three significant sites: Chah Hosseini, Daman, and the Khorab Cemetery (Stein 1937). In southeastern Iran, Joseph Caldwell and Sadegh Malek Shahmirzadi initially investigated the site of Tel-Iblis in Kerman, with Caldwell later expanding the research, thereby marking the beginning of systematic archaeological studies in the area. Concurrently, Beatrice De Cardi (De Cardi 1967) conducted excavations at the Tepe-Bampur site in Iranshahr, uncovering evidence of early human occupation (De Cardi 1968; 1970). Noteworthy contributions also come from of Gary Hume of the University of Minnesota. Between 1967 and 1968, Hume surveyed the Ladiz Terrace, Simish, and Mashkid regions, identifying Palaeolithic tools, including bifacial hand axes and chamfered-edge artefacts. These tools exhibit similarities to the Soan tools of

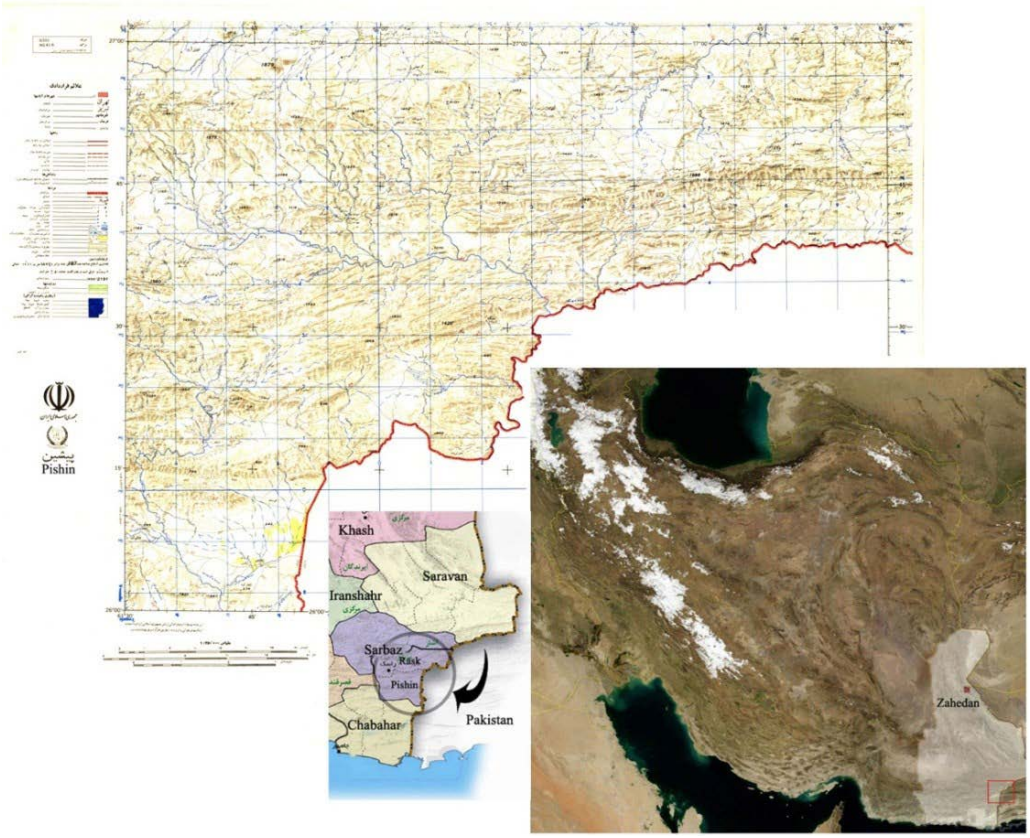


Figure.1: *Location of Sarbaz County in Sistan and Baluchestan province (Photo by Authors 2021).*

Pakistan and the Oldowan tools from Tanzania, dating back approximately 100,000 years (Seyyed Sajjadi 1995). Additionally, Judith Maruchak's work in Khash hypothesised early human activity in the region, leading to the discovery of tools akin to those found at Ladiz, along with stone blades dating back around 70,000 years (Marucheck 1976). Further archaeological surveys, such as those conducted by Sedich, Makran, and Konarak in 1974 and 1975 uncovered artefacts similar to those from Khash, indicating that the Makran Sea coastline was inhabited during the Palaeolithic era before being submerged (Vita Finzi and Copeland 1980). Following the Islamic Revolution in Iran, archaeological activity in the region experienced a significant halt until 1997. That year, excavations at the Shahr-I Sokhta cemetery in Sistan began under the direction of Dr. Seyyed Mansour Sajjadi. These excavations were later extended to include the residential area and the zone referred to as the Monuments (Seyyed Sajjadi and Moradi 2019). The same research team also conducted a season of exploration at Tepe-Bampur and its associated fortifications. A notable achievement of this team was the identification of Parthian-period remains within the Bampur sequence, a phase that had not been documented in earlier reports. Additionally, the Sistan and Baluchestan Cultural Heritage Organisation conducted excavations at the significant cemeteries of Spidej and Chegerdak in Iranshahr (Heydari *et al*. 2019; Heydari *et al*. 2015). The archaeological investigations in the Bampur region, particularly those involving students from Zahedan University, represent a substantial contribution to the field. These studies, supervised by Mehdi Rahbar, were carried out over two distinct seasons and ultimately focused on the exploration of Site No. 14 in the Bampur Valley. This research was conducted in collaboration with the University of Sistan and Baluchestan and the Cultural Heritage Organisation of Iran (Rahbar 2015; Saeidpour *et al.* 2022). Following this phase, the regional study continued under the direction of Mehdi Mortazavi and other researchers affiliated with the University of Sistan and Baluchestan, who were also responsible for the academic training of students (Mortazavi 2005; 2006). In addition to these efforts, the works of Hossein Moradi, Hossein Sarhaddi Dadian, and Mardadi in Sarzab County have provided valuable insights into the region's archaeological landscape (Sarhaddi-Dadian 2021; 2024). Furthermore, the collaborative study conducted by Moradi, Sarhaddi-Dadian, and Soltani in Iranshahr city has been recognised as a key contribution to the understanding of the area's cultural heritage (Moradi *et al*. 2014; Mutin *et al*. 2017). Notably, excavations in southern Baluchestan, particularly in Chabahar City and the Damb-Koh region, have yielded significant archaeological findings, further enriching scholarly understanding of this historically important area (Hesari 2017; 2021).

Research Methodology

The present study was conducted utilising a dual-method approach, which included both library-based research and field investigation. In the initial phase, a comprehensive review of historical and geographical texts was undertaken to gather all available sources pertaining to the studied region. The second phase focused on field investigations, during which the research team conducted site visits to collect significant samples of cultural materials. After the collection process, the technical attributes, morphological features, and stylistic characteristics of the pottery obtained from Parthian-era sites were systematically documented and classified. Subsequently, these findings were compared and analysed in relation to contemporaneous sites located in the southeastern region of Iran. This comparative analysis aimed to identify potential cultural, technological, and historical connections between the studied sites and their regional counterparts.

This study is based on a Geographic Information System (GIS) analysis of the results derived from an archaeological survey conducted along the Sarbaz River. As one of the longest rivers in the central region of Baluchestan, the Sarbaz River traverses a significant distance before ultimately discharging into the Oman Sea. A portion of the riverine corridor was systematically investigated through archaeological survey, with surface cultural materials collected from identified sites using a non-probabilistic sampling approach. The geographic coordinates of all sites were meticulously recorded using GPS technology, enabling a comprehensive analysis of their spatial distribution. This data was subsequently utilised to reconstruct the archaeological landscape of the region, providing insights into the historical and cultural dynamics of the area.

Natural Geography of Sarbaz County

Based on the findings from the accompanying studies, the southern half of the Sarbaz River can be divided into three distinct geographical areas. 1-Central Area:The central section of the Sarbaz River is characterised by condensed mountains, with the highest mass observed in the vicinity of the Sarbaz Castle. In this area, the density of the mountains decreases, accompanied by an increase in the amount

of flat land. The course of the sub-rivers flowing from the east and west toward the Sarbaz River is clearly visible in this section (Figure.2).

Figure.2: *The central part of the Sarbaz River, where the mountains are denser .*

Southern Area: The southern area of the Sarbaz River begins in the southern region of Rask City and extends toward the central area. This section is characterised by flat, stony terrain along the banks of the Sarbaz river, with most of the flat lands situated at a considerable elevation above the riverbed. Access to the riverbed is limited to certain areas. In this section, the seasonal Ashar River flows into the Sarbaz River in the Heydar region, forminga fertile agricultural area (Figure. 3).

Figure.3: *The southern part of Sarbaz, where mountain density decreases .*

Southeastern Area: The third region is located in the southeastern portion of Sarbaz City, near the former border with Pakistan. Unlike the central region, this area features flat terrain, bordering Chabahar city and the Dashtiari region's flatlands to the south. It has a greater prevalence of flat lands and a smoother, more manageable water flow. In the southern part of this section, particularly in the agricultural area adjacent to the Sarzab River, the presence of flat lands with accessible water has facilitated the establishment of human settlements since prehistoric period. This area exhibits the highest concentration of prehistoric sites, with some natural features emerging as hills elevated above the surrounding flat land (Sarhadi-Dadian 2024); (Figure. 4).

Figure.4: *The southern part of Sarbaz city, characterised by flat lands .*

Aquatic Sources

The Sarbaz River serves as the most significant water source in the region, originating in the Khash Mountains to the north. The river flows through various sections of the city from north to south and reaches the southern region, which is on the border of Chabahar. Here, the density of mountains decreases and flat lands begins to dominate. In this region, the seasonal Lashar River sources from the western side, as well as the valleys of Nikshahr (Negaresh *et al*. 2013). As it follows eastward, it merges with the Sarbaz River and continues southeastward. It reaches the Sarbaz River in the Heydar area, located in the southwestern part of the city centre. After passing through the mountains of Sarbaz district and merging with the Kajo River, which also originates from Nikshahr Mountains in the west, this river flows southeast into the smooth and fertile sedimentary plain of Dashtiari, known as Bahu Kalat. Ultimately, it empties into the Makran Sea (Oman) in the vicinity of Goatar Bay in the east of Chabahar, close to the border between Iran and Pakistan (Negaresh *et al*. 2013).

Exploration of the Ancient Settlements of Sarbaz City

The archaeological survey conducted by the authors in two areas of Sarbaz identified and recorded a total of 121 ancient sites. The majority of these sites are situated along the river courses and ma-

jor thoroughfares, exhibiting a linear distribution. They encompass three distinct settlement phases: prehistoric, historical, and Islamic periods. Specifically, there are 17 sites associated with the prehistoric period, 27 with the historical period, and 31 with the Islamic period, in addition to one dam. The survey also identified and recorded two prehistoric cemeteries, 37 historical cemeteries, and 48 Islamic-era cemeteries (Figure. 5). The sites are situated at elevations between 100 and 1,242 metres above sea level. According to the surveys, this range is optimal for habitation, with the greatest concentration of sites found between 500 and 700 metres above sea level. Out of all sites identified, 55 were constructed at altitudes ranging from 300 to 500 metres, while 27 were erected at altitudes between 100-300 metres (Figure. 6).

It is important to note that the total number of sites included in this statistical analysis exceeds the actual number of sites on the ground. Given the multi-period nature of many of the sites examined in this research, it is essential to analyse them across different periods in accordance with the questions and objectives raised.

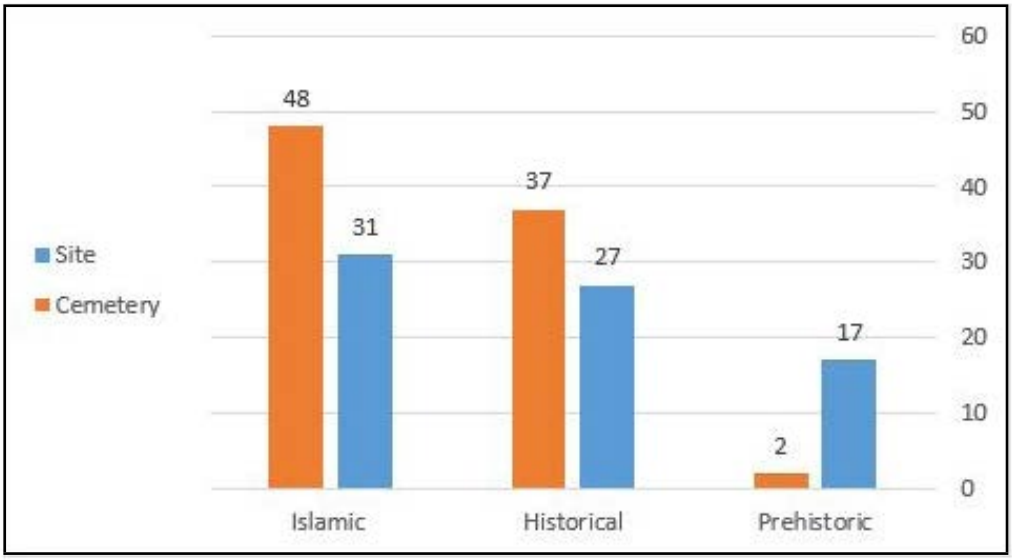


Figure. 5: *Number and type of ancient sites categorised by period.*

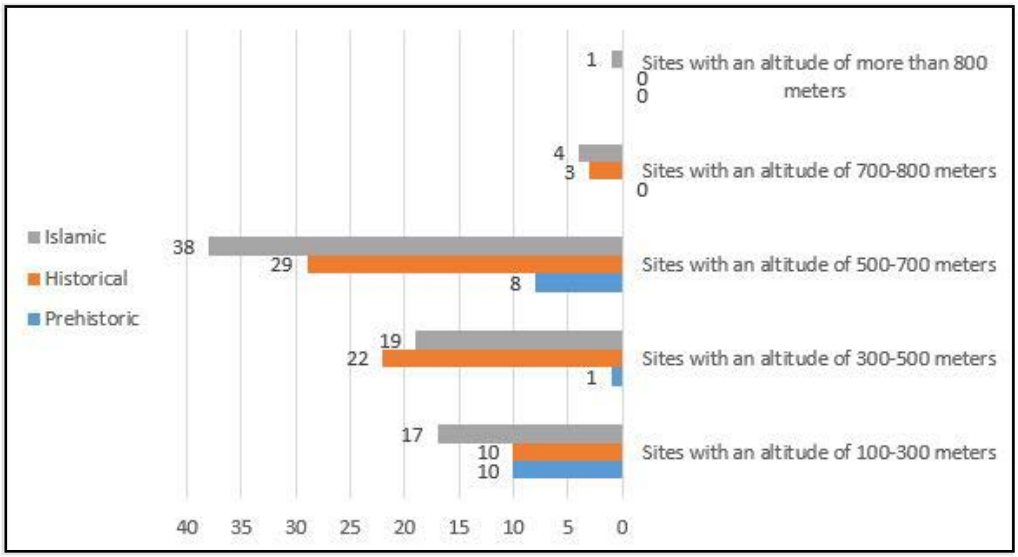


Figure. 6: *Distribution of Sites based on elevation .*

During the prehistoric period, most sites were constructed in the southern region of Sarbaz City, with a limited number located in the eastern areas. Alternatively, during the historical period, in addition to the increase in the number of enclosures, the distribution pattern also underwent a transformation. This meant that the central parts of this region, alongside the southern and eastern parts, also became inhabited, housing the majority of sites from this period. During the Islamic period, it can be argued that the inhabitants of the region established settlements following the patterns observed in the historical era. As illustrated in Figure 7, the greatest concentration of Islamic period settlements was found in the central regions.

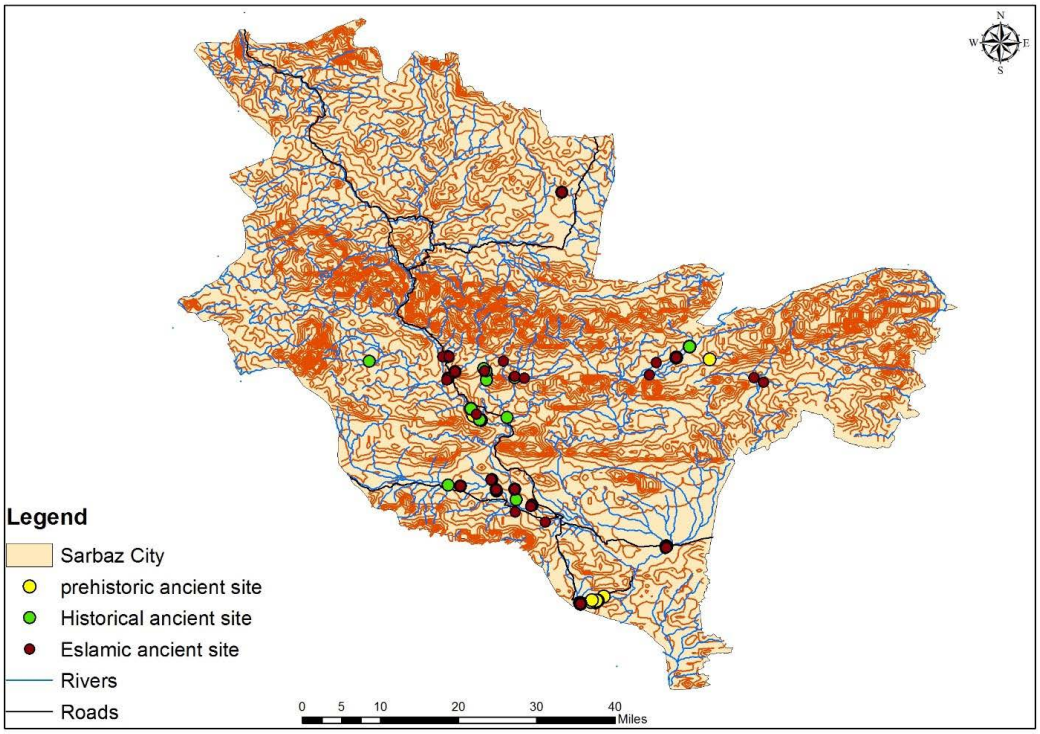


Figure. 7: *The distribution of ancient sites according to their period.*

Pottery Samples Typology

A typological analysis of the pottery allows for its classification into four main categories in terms of chronology and based on the results of the typological study. These categories are as follows: 1. Chalcolithic pottery 2. Bronze pottery 3. Historical pottery 4. Islamic pottery.

The most well-known examples of Chalcolithic pottery are from Makran and Baluchestan in Pakistan, particularly, the Miri II and IIIa types, which date back approximately 4000 to 3300 BCE. These artefacts appears to be part of the local tradition in the eastern Baluchistan region of Iran and the western Baluchestan region of Pakistan. The pottery from this culture includes grey pottery with thick black motifs inside the vessel and red-ware pottery with geometric motifs on the outer body (Sarhaddi-Dadian *et al*. 2020: Figures 4-7). Furthermore, the evolution of reddish engraved pottery in Makran appears to have been influenced more by the traditions of Kerman pottery, particularly in the Soghan Plain and Halil Rood region. It is important to note that the pottery tradition during the Chalcolithic period is not confined to this specific style. The Chalcolithic pottery collection from Chah Hosseini and Dasht Bampur which is contemporaneous with Miri II, includes examples of pottery with geometric patterns applied to the edge of the container (Moradi 2015). In the Bronze Age in the Baluchistan region (approximately 3000 to 2000 BCE), particularly in Sarbaz, a unified tradition emerged throughout Baluchestan (Moradi 2016: 64-70). This is evidenced by the appearance of grey pottery with the Emir and Faiz Mohammad type (Wright 1985; Mortazavi 2006). It is evident that the patterned red-ware pottery also endured during this period. It appears that two principal pottery traditions are present in the Sarbaz area. The reddish pottery is thought to have originated in the Bampur Plain, while the provenance of the grey-ware pottery remains uncertain (Seyyed Sajjadi 2023). The pottery produced in both the red and grey varieties is characterised by a prevalence of geometric patterns, with occasional instances of animal and plant motifs. The relative

dating of Bampur and Miri Qalat allows us to consider the beginning of the Bronze Age to span from the beginning of the third millennium (3000-2900 BCE) to the last centuries of the same millennium, around 2000 BCE. (Tables. 1A and 1B).

The scarcity of information from the end of the Bronze Age to the historical period in Sarbaz is a significant limitation for our understanding of this region. As with other areas of southeastern Iran, there is a notable gap in our knowledge of the cultural developments that occurred during this period. The earliest evidence of post-Bronze Age Iran can be traced back to the Parthian period, which is characterised by the emergence of a unified pottery tradition known as Londo in the south-eastern and southern regions of the country. The carved pottery from the Londo historical period has been found in various locations throughout Iran and Pakistan, including Sartarsar, Baluchistan, Sistan, Kerman, and numerous regions along the southern and northern coasts of the Persian Gulf. The dominant pottery tradition can be dated to the Parthian period (approximately 300 BCE to 200 AD) (Seyyed Sajjadi 1989). Some believe that the history of Londo or Nemurd pottery dates back to the first millennium BCE (De Cardi 1951). The pottery tradition that originated in the historical period continued until shortly before the advent of Islam throughout the Iranian plateau. Eventually, it was replaced by the common pottery of the Islamic period, which includes glazed pottery with a large variety.

Table. 1A: *Typology of Sarbaz City's pottery and comparison of it with those in neighbouring areas*

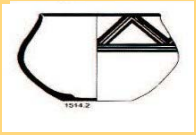
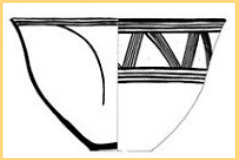
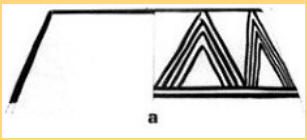
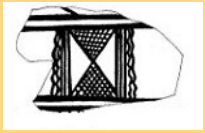
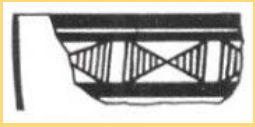
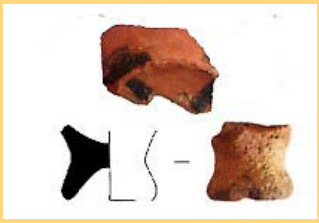
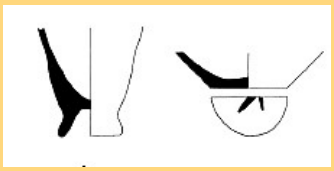
Sarbaz Sites	Bampur 1-4	Miri Qalat 3b	Shahr-I Sokhta
 Keshari	 De Cardi 1970: Figure.23, no.181	 Didier 2007: Figure. 62, no.57/22	 Salvatori and Vidale 1997: Figure.191.no.IIII-III
 Keshari	 Seyyed Sajjadi 2006:147	 Didier 2007: Figure. 82, no.145/11	 Biscione 1981: Figure.10.15. no.a I-II
 Keshari	 De Cardi 1970: Figure.23, no.187	 Didier 2007:Figure.22.no.4	 Salvatori and Vidale 1997: Figure.191.no.10
 Keshari	 De Cardi 1970: Figure.25, no.240	 Didier 2007:Figure.7.no.3	 Seyyed Sajjadi 2019: Table.1.no.8
 Qalat Pishin	 Stein 1937:PI.XII	 Left:Didier 2007: Figure.8, no.7 Right:Jarrije and Lechevallier 1979: Figure.24.no.6, Mehrgrah VI	 Salvatori and Vidale 1997: Figure.188.no.9,II-III

Table. 1B: *Typology of Sarbaz City's pottery and comparison of it with those in neighbouring areas (After: Moradi 2015, figures.8-3,8-5)*

Sarbaz	Bampur	Kech-Makran
		
		
		
		
		

Ancient Settlements in Prehistoric Times

In prehistoric times, settlements were established in places that were most suitable and accessible in terms of elevation, communication routes, slope, soil type, access to surface water, vegetation, etc. As illustrated in Figure 10, these settlements were often constructed in flat, lowland areas adjacent to rivers in order to mitigate the risk of damage from seasonal flooding and to ensure easy access to agricultural land and water resources. It appears that despite the challenging communication routes of the period, residents established their cemeteries at considerable distances from their settlements. In addition to the settlements, two cemeteries have been identified in the Sarbaz region, one in the Sarbaz section and another between the central and eastern zones of this area. The prehistoric Sarbaz period is generally dated between 3500 and 2000 BCE (Figures. 8 and 9); (Sarhaddi-Dadian *et al*. 2020).

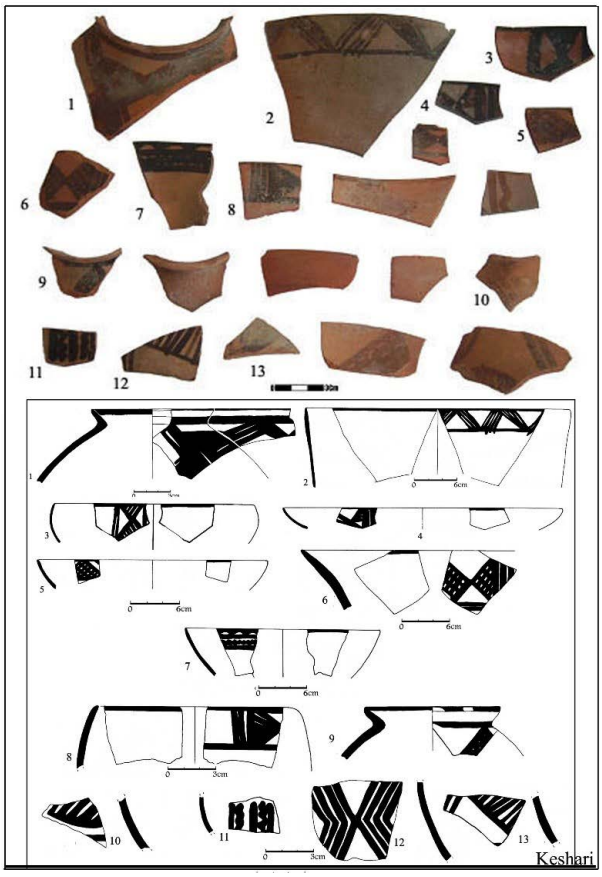


Figure. 8: *Samples of prehistoric pottery from Sarbaz City.*

The prehistoric sites in question were constructed at altitudes ranging from 100 to 700 metres above sea level. Among these sites, 10 are situated at altitudes between 100 and 300 metres, 1 is between 300 and 500 metres, and 8 are situated at altitudes between 500 and 700 metres above sea level (Figure.10). Furthermore, most sites from this period, excluding cemeteries, encompass an area of between 400 and 7,000 square metres. Only three sites exceed the dimensions of other settlements, with the largest measuring 25,000, 30,000 and 40,000 square metres, respectively (Figure. 11).

The dispersion and relocation of the residents in the Sarbaz region during this period were directly influenced by the geographic and climatic conditions of the region. Like many other prehistoric civilisations, the residents had to adapt to their environment due to the lack of appropriate technology to exploit available resources. According to the statistical data, most settlements established during this period were situated at the lowest feasible altitude. This choice was advantageous because these altitudes allowed for the deposition of river sediments that facilitate the growth of wilding plants, while the reduced velocity of water flow made it more usable. Considering the aforementioned con-

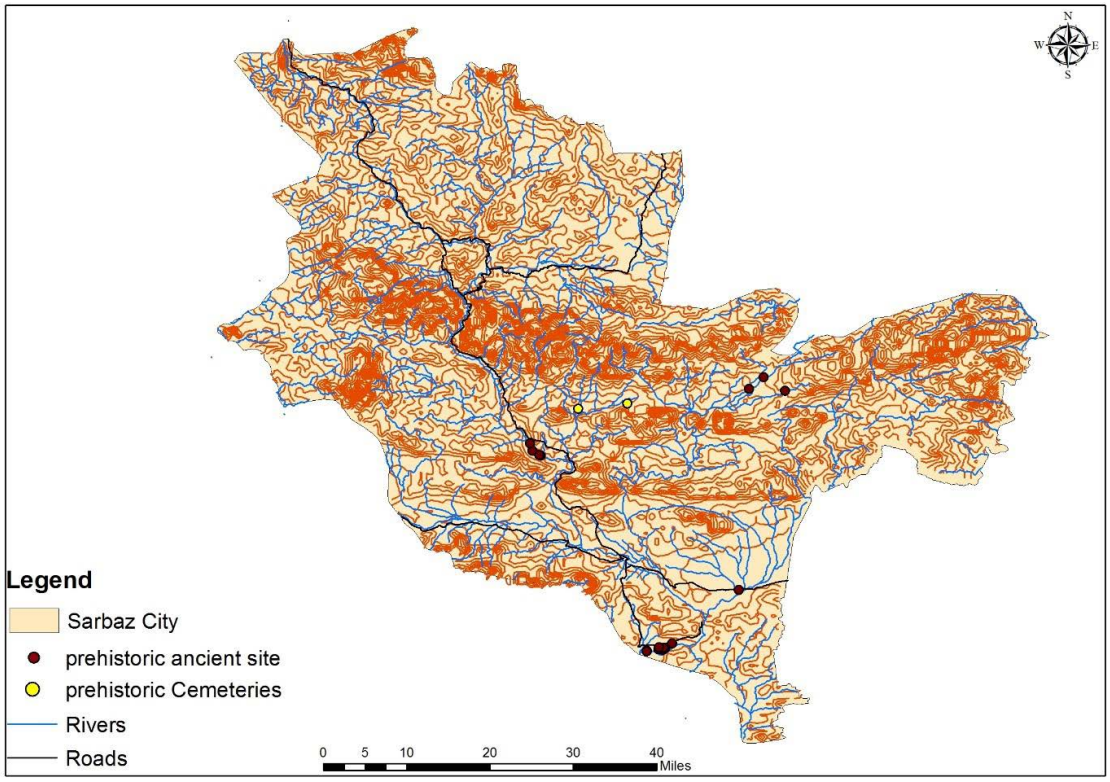


Figure. 9: *The location of the sites in relation to the prehistoric cemetery.*

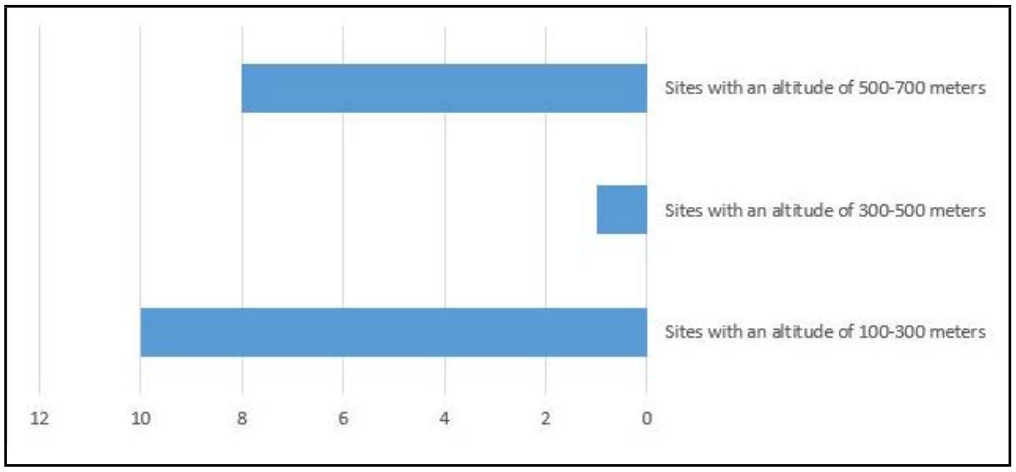


Figure. 10: *The altitudes of prehistoric sites.*

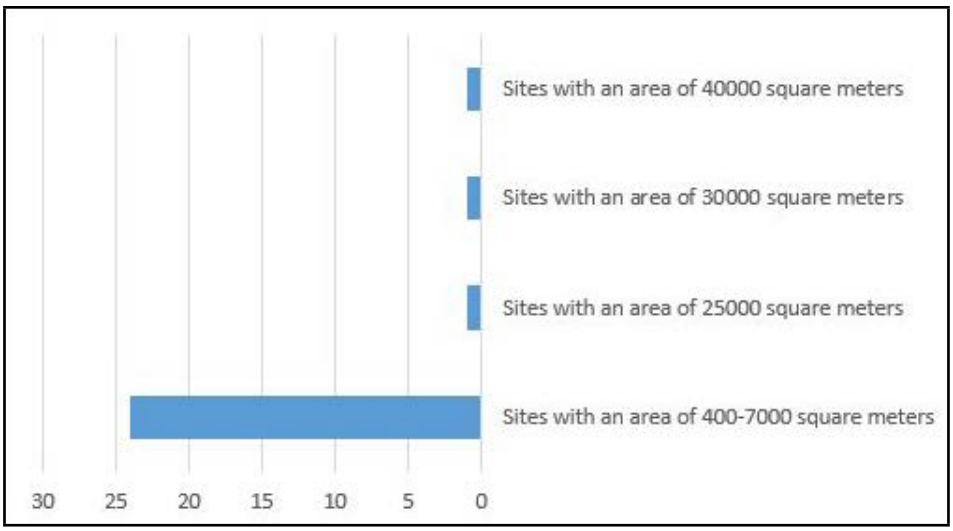


Figure. 11: *The extents of prehistoric sites.*

ditions and the stony nature of the mountains in the Sarbaz region, the vegetation in these elevated areas was more conducive to human habitation (Figure. 12).

Figure. 12: *Vegetation in the southern areas of Sarbaz*

It is important to note that beyond the extensive areas discussed, two additional regions are situated at altitudes of 100–300 metres, and another area at 500–700 metres above sea level (see Tables 2 and 3).

Ancient Settlements in Historical Times

The historical period is characterised by a shift in the settlement pattern of ancient settlements compared to those observed in prehistoric times. During this period, while several enclosures were constructed following the settlement pattern observed in the previous period, a number of other enclosures were established in novel locations and at elevated altitudes. It can be observed that there are 10 Sites situated at altitudes of 100-300 metres, 22 Sites at 300-500 metres, 29 Sites at 500-700 metres, and 3 Sites at 700-800 metres above sea level (Figure. 13). Furthermore, most sites in this region are less than

Table. 2: *Catalogue of the prehistoric sites in Sarbaz County.*

Area ID	Name of Site	Latitude	Longitude	Area	Prehistoric Historic, Islamic
1	Tepe Keshari Hasan	287485	362474	30000	Prehistoric
2	Pardo Kelat 1	287342	360709	4000	Prehistoric
3	Parod Kalat 2	287320	360593	2500	Prehistoric
4	Tepe Keshari 2	273444	359845	7000	Prehistoric
5	Tepe Keshari	273743	361228	3000	Prehistoric
6	Tepe Keshari 4	273712	360952	900	Prehistoric
7	Tepe Keshari 5	273836	359960	900	Prehistoric
8	Tepe Kalat Pishin	284942	375363	25000	P&H&I
9	Den Char site	273207	357576	600	P&H&I
10	Mey Escon site	273052	357646	600	P&H&I
11	Forest site 1	210921	337067	2500	P&H
12	Forest site 2	211025	336835	2000	P&H
13	Shushkim site	211855	335481	5000	Pre
14	Dan Hashemabad site	213252	335055	40000	P&H
15	Mordar site	226088	380183	3000	P&H
16	Ganjankoh site	223807	377408	2000	P&H&I
17	Mechinek site	293429	384330	400	Pre

Table. 3: *Catalogue of the prehistoric cemeteries in Sarbaz County.*

Area ID	Name of Cemetery	Latitude	Longitude	Area	Pre&H&I
1	Akshy Kruchan	220989	353829	120	Pre&Is
2	Pashamak	219928	344327	6000	Pre&H&Is

one hectare in size. As in the preceding period, three Sites are larger, measuring approximately 19,300, 25,000, and 40,000 square metres (Figure. 14), are located at elevations of 192, 324, and 571 metres above sea level, respectively.

Notably, two of the three sites were inhabited during the prehistoric era and were reoccupied in the historical era. This illustrates their geographical significance and, consequently, their economic and political importance (Tables 4 and 5).

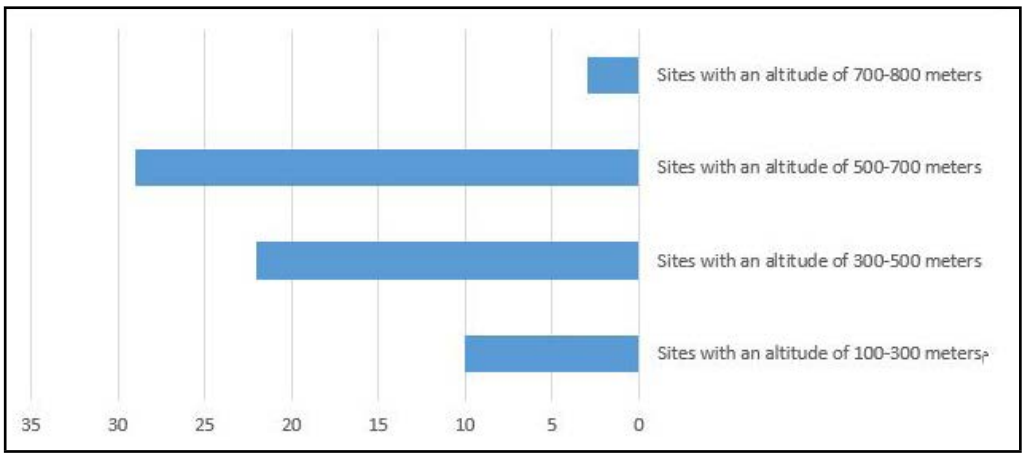


Figure. 13: *The altitudes of the Historical sites.*

Figure. 14: *The extents of the historical sites.*

Table. 4: *Catalogue of the historical sites in Sarbaz County.*

Site ID	Name	Longitude	Latitude	Area	Pre&H&Is
1	Tepe Kalat Pishin	375363	2884942	25000	Pre&H&Is
2	Donchar	357576	2873207	600	Pre&H&Is
3	Meyeskan	357646	2873052	600	Pre&H&Is
4	Pishin1	353762	2957929	600	H&Is
5	Sirjan	332834	2897387	4000	H&Is
6	Qaleberenji	347679	2893441	1000	H&Is
7	Lasharkahi1	330362	2897546	10000	H
8	Lasharkahi2	339358	2898634	175	H&Is
9	Lasharkahi3	340340	2896332	600	H&Is
10	Lasharkahi 4	340241	2896614	19300	H&Is
11	Hedar 1	344370	2894526	4500	H
12	Zaranmandi-Hedar1	344068	2896663	3000	H&Is
13	Jangal1	337067	2910921	2500	Pre&H&Is
14	Jangal2	336835	2911025	2000	Pre&H
15	Beris1	338256	2920339	4000	H
16	Beris2	338228	2919210	5000	H
17	Beris3	338169	2921100	900	H
18	Beris4	337643	2921593	1800	H
19	Don Hashem Abad	335055	2913252	40000	Pre&H
20	Guranbarin	330354	2923962	1500	H
21	Nazarabad	330349	2919573	3000	H&Is
22	Roodkor	331711	2920906	1000	H&Is
23	Pashamak	342474	2911451	1500	H
24	Moorder	380183	2926088	3000	Pre&H
25	Ganjankooh	377408	2923807	2000	Pre&H&Is
26	Tepe-Qale-Pashamak	344097	2919713	2500	H
27	Tepe-Qale-Delush	314047	2923089	5600	H

Table. 5: *Catalogue of the historical cemeteries in Sarbaz County.*

Cem ID	Cemetery Name	Longitude	Latitude	Area	Pre&H&Is
1	Damb Pishin1	373309	276805	1200	H
2	Dambi Kondor	373295	271067	1400	H&Is
3	Hut Abad	345771	292722	2000	H&Is
4	Pol Nikshahr	322267	298073	400	H&Is
5	Firooz Abad	341341	208147	5000	H&Is
6	Pashamak Dar	343773	219538	500	H&Is
7	Pashamak Kor	341784	226404	5000	H&Is
8	Pol Vakak	336691	218044	4500	H&Is
9	Dambi AhmadAbad	322350	232232	6500	H&Is
10	Morder	379832	226489	750	H&Is
11	Pashamak	344327	219928	6000	Pre&Is&H
12	Seyed Pooneri1	343532	218882	5000	H&Is
13	Seyed Pooneri1	344177	218527	900	H&Is
14	Sia Soong	393371	218874	900	H&Is
15	Mola Abad	360181	272588	6000	H&Is
16	Dambi Mey Eskan	358261	273064	900	H&Is
17	Abnamay2	347320	293365	37500	H&Is
18	Dambi Hedar1	344354	294339	8000	H
19	Dambi Hedar2	344110	294342	6000	H
20	Dambi Hedar3	345448	293187	200	H
21	Dambi Hedar4	345542	292909	600	H&Is
22	Dambi Hedar5	345612	294111	12000	H
23	Dambi Zehdar	344380	293723	7000	H
24	Dambi Lashar Kahi1	330726	297741	450	H
25	Dambi Lashar Kahi2	330028	297691	100	H
26	Dambi Lashar Kahi3	339771	298577	200	H
27	Dambi Lashar Kahi4	339150	299569	10000	H
28	Dambi Beris5	339997	220145	900	H
29	Dambi Hashemabad	336081	212349	1600	H
30	Dambi Firozabad2	340780	206092	2500	H
31	Dambi Osman Abad	336924	210772	100	H
32	DambiPashamak Kor2	342217	212011	200	H
33	Dambi Do Pet	337746	221428	500	H
34	Dambi Bid Lat	334607	213716	12	H
35	Dambi Pachal	388919	220352	100	H
36	Dambi Shoorak	395351	218719	900	H&Is
37	Dambi Ali Abad	429571	232162	750	H

The location of the settlements at higher altitudes, despite the awareness of seasonal floods, suggests an increased control that these inhabitants possessed over water flow. It is likely that the residents of this area employed a technique to reduce the velocity of water flow and retain it in elevated, flatter areas, which are today designated as Hotak. This method not only served to store a portion of the floodwater, but also allowed for the deposition of suspended particles, resulting in the formation of a sedimentary soil type that was beneficial for agricultural activities (Khoobfekrbarabadi *et al*. 2019). Furthermore, the rise in the number of settlements and their spread across the region, along with the growth in the number of cemeteries, suggests a population rise in the Sarbaz region during the historical

period. Unlike the prehistoric era, cemeteries were established in close proximity to human settlements during this era (Figures. 15 and 16). This may be indicative of two distinct subjects within this area of study. Firstly, the utilisation of historical knowledge combined with the assessment of local requirements has facilitated advancements in water technology, exemplified by the construction of artificial dams in the region, which in turn contributed to population growth. Furthermore, this increase in population has enhanced environmental productivity, resulting in an expansion of settlements. However, alongside this growth, the lack of improvement in health standards, has led the death rate to rise to levels comparable with the birth rate, resulting in cemeteries being formed at a rate exceeds the growth of settlements in the region.

Ancient Settlements in the Islamic Era

The Islamic era marks the apogee of the formation of ancient sites in the Sarbaz region, as evidenced by the largest number of sites and cemeteries. This illustrates a continuation of the population growth in the region, that commenced during the historical era and significantly expanded during the Islamic era (Figure. 17). Similar to the historical period, the rise in the number of settlements in this region was accompanied by technological advancements and increases in land productivity, achieved through the construction of dams along seasonal rivers and the implementation of effective water control measures (Figure. 18).

The aforementioned sites are situated at altitudes ranging from 100 to 1,242 metres above sea level. A total of 17 Sites are situated at altitudes between 100 and 300 metres, 19 Sites are between 300 and 500 metres, 38 Sites between 500 and700 metres, four Sites between 700 and 800 metres, and one area is at 1242 metres above sea level (Figure. 19). The Islamic sites can be categorised by size. Of the total 31 settlements, 27 have areas between 150 and 5000 square metres, one site is approximately 15000 metres, and another is 30000 square metres. Lashar Kahi no. 4, with an area of 19,300 square metres, is one of the few settlements that includes evidence of both historical and Islamic periods. It is located at an altitude between 300 and 500 metres above sea level. Furthermore, the former Kalat site, covering an area of approximately 25,000 square metres, is the sole site in the region to encompass all three periods: prehistoric, historical, and Islamic. It is situated at an altitude of 100-300 metres above sea level (Figure. 20) (Tables 6 and 7).

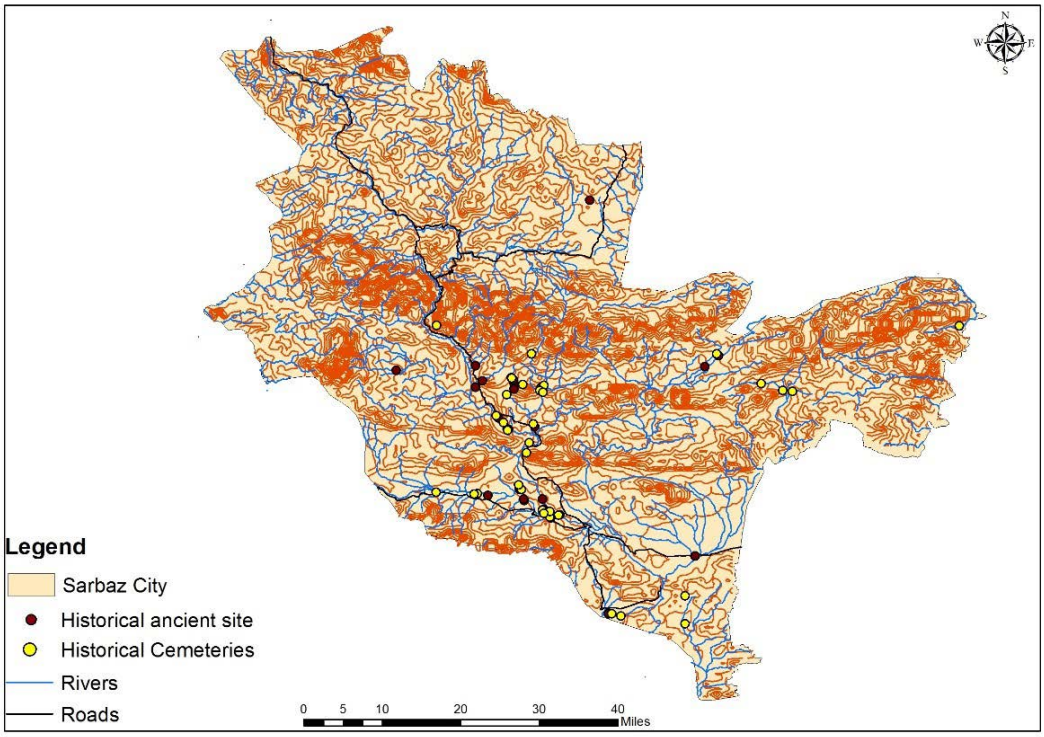


Figure.15: *The location of the sites in relation to the historic cemetery.*

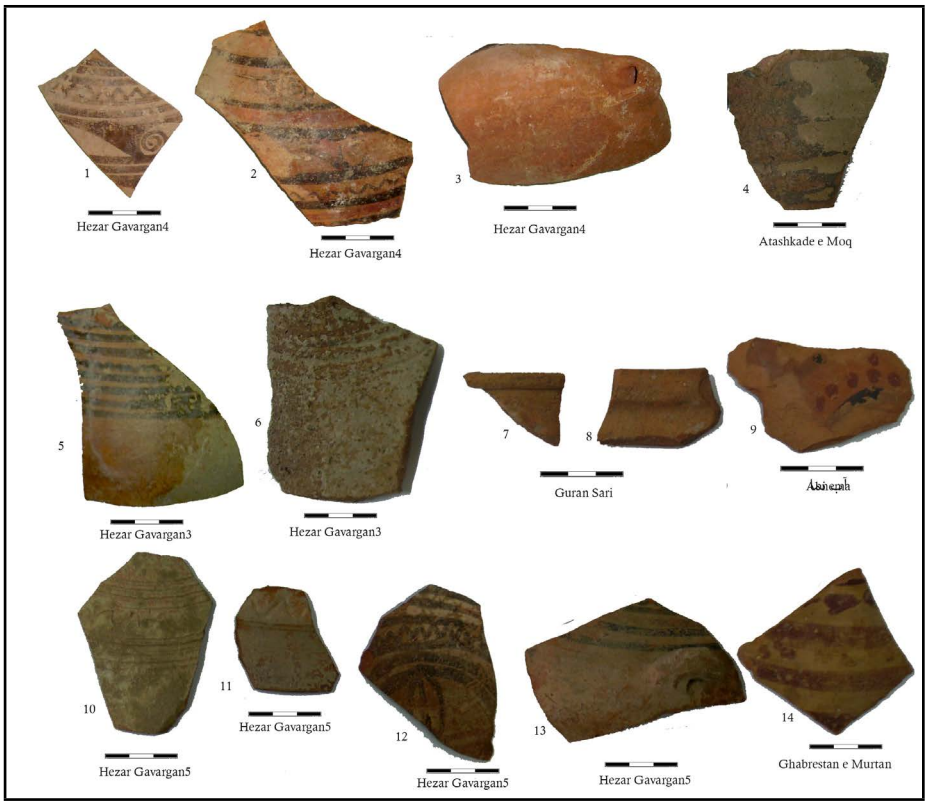


Figure. 16: *Examples of pottery samples from the historic period of Sarbaz City.*

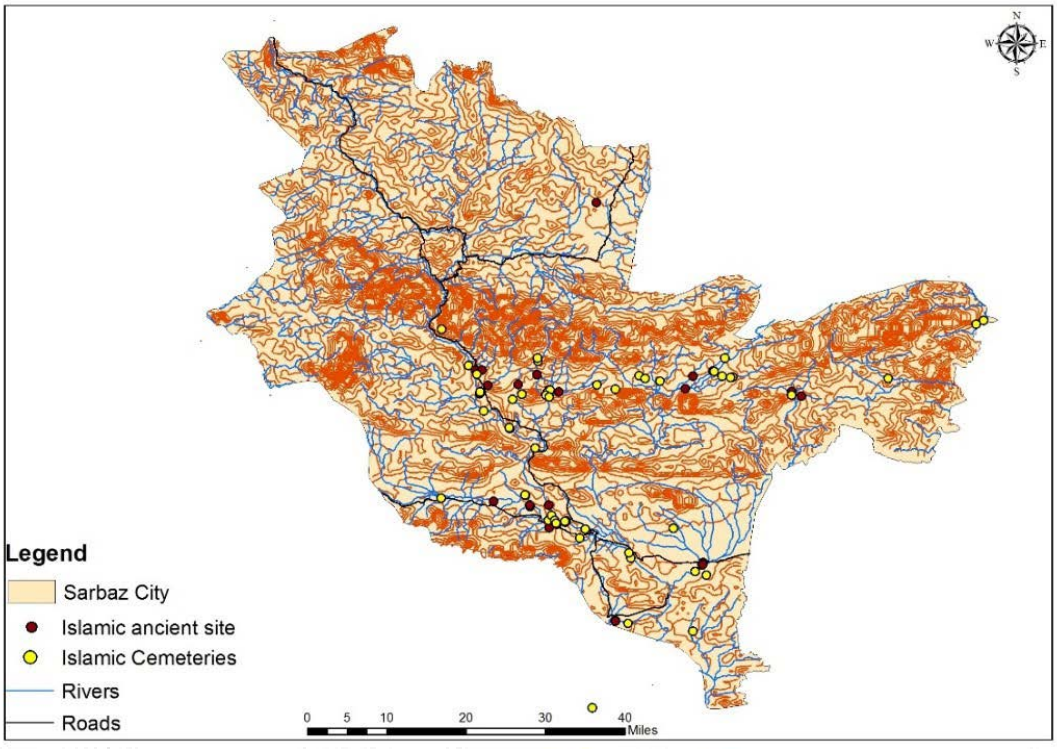


Figure.17: *The locations of the sites in relation to the Islamic cemetery.*

Figure. 18: *: Evidence of construction of dams on seasonal rivers in Sarbaz City.*

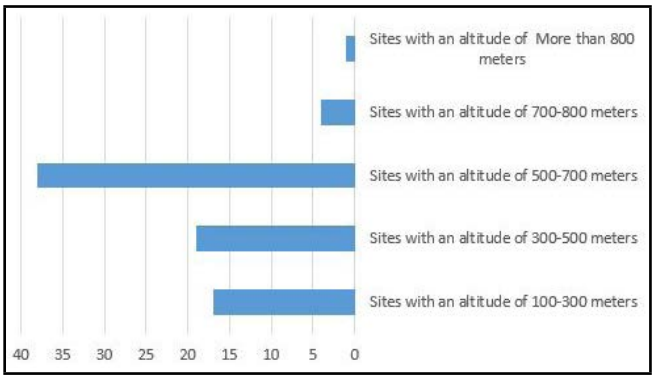


Figure. 19: *The elevations of Islamic sites.*

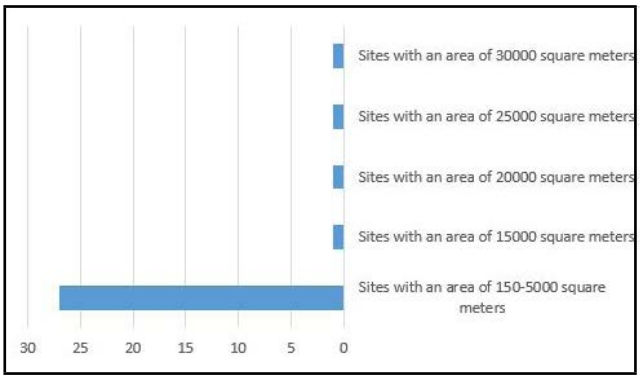


Figure. 20: *The sizes of Islamic sites.*

As previously stated, Sarbaz City is a region characterised by the presence of compact mountains, which poses significant challenges in identifying suitable land for agricultural and settlement purposes, while also providing protection from the adverse effects of weather-related disasters, such as floods. Consequently, the number of prehistoric settlements is constrained to areas with the lowest probability of damage from natural disasters. This fact provides a rationale for the existence of common settlements throughout the prehistoric, historic, and Islamic periods. It seems reasonable to posit that these settlements were established in locations that offered a combination of favourable geographical, climatic, and even economic, political, and social conditions. These factors have influenced the formation of the settlement cycle in the area in question. This cyclical development can be observed in some of the settlements in the Sarbaz region. Out of the total number of sites, four sites include all three periods: prehistoric, historical and Islamic. Four sites encompass both prehistoric and historic

Table. 6: *Catalogue of the Islamic sites in Sarbaz County.*

Site ID	Names	Longitude	Latitude	Area	Pre&H&Is
1	Tepe Kalat Pishin	375363	284942	25000	Pre&H&Is
2	Don Char	357576	273207	600	Pre&H&Is
3	Mey Eskan	357646	273052	600	Pre&H&Is
4	Pishin1	353762	257929	600	Pre&H&Is
5	Tepe Pishin1	375178	284458	2500	Is
6	Tepe Pishin2	375324	284610	3000	Is
7	Sirjan	332834	2897387	4000	H&Is
8	Qale Berenji	347679	293441	1000	H&Is
9	Lashar Kahi2	339358	298634	175	H&Is
10	Lashar Kahi3	340340	296332	600	H&Is
11	Lashar Kahi4	340241	296614	19300	H&Is
12	Zaran Mandi Hedar1	344068	296663	3000	H&Is
13	Koh Gerdo	344131	291990	30000	Is
14	Qale Berenji	347417	293102	2400	Is
15	Dambi Lashar Kahi4	339226	298707	3000	Is
16	Ziarat Baftan	350399	289907	5000	Is
17	Hashem Abad 1	336173	212188	5000	Is
18	Bogan	393377	219649	2500	Is
19	Ganj Abad	329238	223979	600	Is
20	Goran Baren2	330532	223984	900	Is
21	Nazar Abad	330349	219573	3000	H&Is
22	Rood Kor	331711	220906	1000	H&Is
23	Qale Shah Joyan	330078	219207	2500	Is
24	Kalat Beris	337852	221073	900	Is
25	Band Sangi Keray Koor	341735	223081	150	Is
26	Ganjan Koh	377408	223807	2000	Pre&H&Is
27	Zebahri	371820	220259	2100	Is
28	Qale Bahman	344055	219919	750	Is
29	Dambi Shorok	395351	218719	900	H&Is
30	Dambi Klir Don	346096	219550	15000	Is
31	Mortan5	373297	222761	150	Is

settlements, while the historical-Islamic period also includes 11 settlements (Figure. 21). In addition to settlements, cemeteries have also been used in different periods. One cemetery embraces all three periods: pre-historic, historical, and Islamic; one combines pre-historic and Islamic cemeteries, while 18 cemeteries are from historical and Islamic cemeteries (Figure. 22).

Based on archaeological evidence, it can be concluded that the site includes an Islamic school that dates from the Seljuk period to the contemporary period (from the 5th to the 13th century AH); (Figure. 23).

Analysis

All man-made works are part of the cultural structures that lead to the formation and then change of the settlement pattern. The reciprocal relationship between humans and the environment that was established during the prehistoric era in the Sarbaz region led to the exploitation of the environment. Key factors such as altitude, slope, access to water, vegetation, and weather significantly influenced the formation of early civilisation in this region. However, seasonal floods hindered the expansion of settlements during this period. As the relationship

Table .7: *Catalogue of the Islamic sites in Sarbaz County.*

Cem ID	Cemetery Name	Longitude	Latitude	Area	Pre&H&Is
1	Damd Pishin2	376056	282434	900	Is
2	Dambi Kondor	373295	281067	1400	H&Is
3	NoorAbad1	360767	285859	1800	Is
4	NoorAbad2	360337	286886	600	Is
5	Takhshi	369398	291952	10000	Is
6	Warmetek	373787	283158	2400	Is
7	Goorshun	330119	219554	7000	Is
8	Qale Qadim Hedar	344338	293668	2000	Is
9	Hedar Benda	344000	293549	28000	Is
10	Bendegah Hedar	344640	294548	300	Is
11	Hedar3	345289	293552	1500	Is
12	Hut Abad	345771	292722	2000	H&Is
13	Jekikoor	351484	291760	1000	Is
14	Pole Nikshahr	322267	298073	400	H&Is
15	Hashemabad	336081	212349	600	Is
16	Firuz Aabad	341341	208147	5000	H&Is
17	Parood	329443	223121	1700	Is
18	Poori	330856	215728	900	Is
19	Gerey Koor	341896	225799	5000	Is
20	Ziyarat	327798	224910	6500	Is
21	Peshamak Kor	343773	219538	500	H&Is
22	Peshamak Kor3	341784	226404	5000	H&Is
23	Pol Wakak	336691	218044	4500	H&Is
24	Donbi Ahmad abad	322350	232232	6500	H&Is
25	Ganjankooh	377678	223673	2500	Is
26	Hatag	412909	222299	2400	Is
27	Rahimabad Bogan1	432316	234092	1500	Is
28	Rahimabad Bogan2	430775	233285	5000	Is
29	Safarabad	338648	219066	2500	Is
30	Meyken Dep	381391	222573	1000	Is
31	Mordar	379832	226489	750	H&Is
32	Vankok	357655	220149	90000	Is
33	Akshi Krochan	353829	220989	120	Pre&H&Is
34	Pashamak	344327	219928	6000	Pre&H&Is
35	Seyed Pooneri1	343532	218882	5000	H&Is
36	Seyed Pooneri2	344177	218527	900	H&Is
37	Sia Soong	393371	218874	900	H&Is
38	Bala Getani	380933	222460	1500	Is
39	Beta Geden	352938	255463	1200	Is
40	Band1	362388	222910	1200	Is
41	Band2	363681	222312	2000	Is
42	Beg	366657	221782	900	Is
43	Jenter Boor2	379232	222756	400	Is
44	Dambi Mola Abad	360181	272588	6000	H&Is
45	Dambi Abnama2	347320	293365	37500	H&Is
46	Dambi Hedar5	345542	292909	600	H&Is
47	Dambi Lashar Kahi4	339226	298707	3000	Is
48	Ziarat Baftan	350399	289907	5000	Is

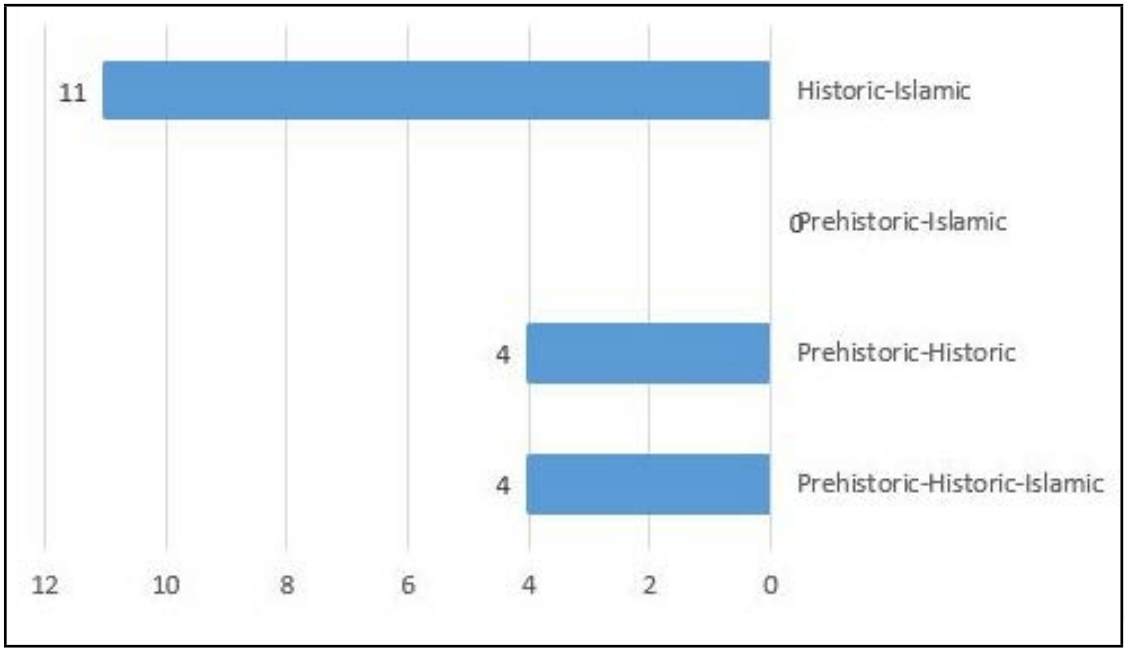


***Figure. 21**: The evolution of settlements.*

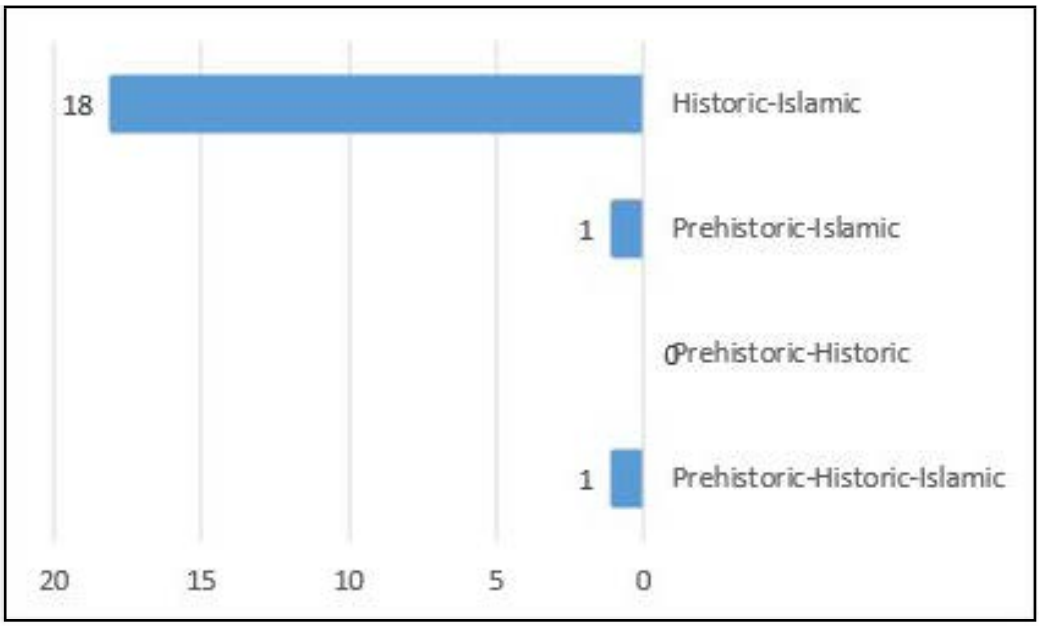


***Figure. 22:**cemeteries in different periods.*

between humans and the environment intensified, the residents gained a deeper understanding of their surroundings, leading to the utilisation of technology for further resource exploitation. This resulted in the expanded utilisation of environmental and water resources. The impact of the environment on human decision-making is evident in the broader distribution of historical and Islamic sites, which has occurred at a greater rate and to a greater extent than in prehistoric times. Consequently, following the establishment of the settlements, the relationship between humans and their environment resulted in modifications to the selection of locations, utilisation of the environment and, ultimately, a transformation in the settlement pattern from one period to the next.

Figure. 23: *Samples of Islamic-period pottery from Sarbaz City.*

Conclusion

The settlement pattern IN the Sarbaz region is directly influenced by the region's geographical environment. The region is predominantly mountainous- 95% of the area classified as such. During the summer monsoon season, seasonal floods caused by the monsoons of the Indian Ocean significantly affect the region, destroying infrastructure and other structures. Given the modest alterations in the region's climate over the millennia, it can be posited that these conditions have persisted to some extent since prehistoric times until the present. For this reason, inhabitants of the prehistoric period in the Sarbaz region settled in areas with favourable geomorphological conditions. This includes the construction of enclosures at specific elevations, the suitability of gradients, the appropriate size of the settlements relative to the surrounding environment, adequate access and communication routes, the avoidance of flood risk, and other pertinent considerations. It is crucial to acknowledge the residents' relative knowledge of their environment, which has resulted in the formation of appropriate technology for its exploitation. Consequently, the natural resource base utilised by the residents underwent expansion, leading to an increase in the regional population.

This condition is evident in both the historical and Islamic periods, particularly in settlement patterns and the increase in the number of enclosures. It seems reasonable to posit that the most significant factor was utilising a technique designated as Hotak during the historical and Islamic periods. Furthermore, the construction of dams and aqueducts is another notable contributing factor. This is why the ancient people of the Sarbaz region have selected the areas where the settlement remnants are now situated as the most appropriate locations for accommodation, in comparison to other potential sites.

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