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The reviews of post depositional processes: case study of Tepe Ferizi in the Sabzevar plain, North-Eastern Iran

Abstract

Archeological sites, undergoing the processes of abandonment and finally deposition over long periods, change their shape under the influence of natural and unnatural processes and appear in a new topography. During these processes, the natural factors, given the regional and ecological characteristics and contingencies on the one hand and unnatural factors such as various human activities on the other hand, play different roles in changing the shape of the site and its artifacts. In fact, analyzing these factors in the fabric/context of an archeological site can reveal the post-settlement processes at the site. In words by studying post-depositional processes at an archaeological site, we seek information regarding patterns which cause formation, shaping and deformation of the site in its present shape. In this regard, the initial studies at Tepe Ferizi indicate that after deposition process and formation of archeological layers, its current form (and its particular topography) has been affected by natural factors due to specific ecological characteristics of the area. Tepe Ferizi is located in the Northwest of Sabzevar in North-Eastern Iran. Conducted surveys have shown Tepe Ferizi to date to the Bronze Age, with the majority of the remains belonging to the Bactria Margiana Archaeological Complex (BMAC).[1] Considering the dispersion of surface artifacts at this site, it can be regarded as one of the largest BMAC settlements in the Northeast of Iran. This study of post-depositional processes in Ferizi site aims to extract the formation patterns of deposits formation of depositions and cultural layers after the abandonment of site and to examine different climatic, ecological and human factors in these transformations and events.

Keywords: post depositional processes, sabzevar plain, tepe ferizi, bmac, natural processes, cultural processes, ecology

[1]In late third millennium and early second millennium B.C, some changes are made in human communities in Margiana in southeast Turkmenistan, rapidly affecting Bactria oasis in north of Afghanistan leading to formation of a culture called Bactria Margiana Archaeological Complex (BMAC) (Sarianidi 1998: 35). Its chronological time frame spans 2300 or 2200 to 1700 B.C.(Hiebert 1991).

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Introduction

Studying post-depositional processes: theoretical framework, questions, assumptions and methodology

Archeological survey was formed as an independent method for archeological research in early 1970s. Before this time, survey was a preliminary and integral part of excavations. In Procession Archeology, former Soviet archeologists were the first to study the information beyond archeological settlements. Information beyond archeological settlement meant taking into account the natural resources as well as geomorphologic and geological information about the location in which a settlement had been formed. By this way, cultural approach i.e. issues of settlement pattern and relation of settlements with other settlements was studied. Finally in early 1980s, discussion of settlement formation, process of conversion from settlements into archeological sites and finally post-depositional processes entered archaeological theory. Since early1980s, two North American archeologists, Michael Schiffer and Lewis Binford discussed and analyzed the nature of archeological findings, in particular our understanding of formation and post depositional processes in interpreting the past.[1–3] They concluded that archaeological evidence are not static, but ever changing and thus lose some of their information value through their transformational.

In fact, post depositional processes include shape-shifting and transformational processes after formation of layers at a site. These processes are the factors in protection or destruction of archeological evidence after formation of deposits.[4]

Not much is known about the prehistory of Northeast of Iran, in particular Khorasan.[1,5–12] There is little information about prehistoric settlements, diagnostic finds, sequences and prehistoric chronology of this region. This is a fundamental issue, which we aim to investigate in this study, focusing on a prehistoric site in Khorasan. Tepe Ferizi in Sabzevar based on a study of post-depositional processes using archeological survey methods. Studies of Tepe Ferizi show that this site is exposed to natural and cultural transformational processes in long term and main context of its monuments and deposits has changed and they have been extended or destroyed. Different factors

[2]What is called Khorasan here includes some sections of Greater Khorasan which lies within the present political borders of Iran, regarded as Western Khorasan or northeast of Iran (Garazhian , 2008).

have been effective on these transformations. All of these intervening factors which are briefly discussed all are studied as post depositional processes. These factors are analyzed and studied in regional context and based on formation of site. The present study deals with multiple questions. First, what periods are represented at Tepe Ferizi and what is the quality of these finds? Subsequently, what eco-systematic effects have directly affected this site and what is the role of post-depositional processes in these transformations? Is it possible to use Tepe Ferizi as a model for future analysis of post-depositional processes at other sites in the region and if so, what is this model? In order to answer these questions, we proposed the following framework of assumptions: Archaeological survey of Tepe Ferizi demonstrates that his site has evidence of Late Chalcolithic and Bronze Age periods, in particular the Late Bronze Age culture of BMAC. Additionally, thus site has been subject to natural and cultural transformative processes, its material culture and deposits removed from their original context and distributed as dispersed layers across the surface of mounds. Multiple factors have played a role on these transformations. All of these factors, that we will discuss briefly, can be analyzed under the general label of post-depositional processes. These factors will be discussed and analyzed in the regional context and in relation to the formation context of the site. The main model of research in this paper is mostly based on archaeological survey with a specific goal in mind. In the present paper, theories of geomorphological science, natural geography and geology assist in understanding of these processes. In the present paper, we maintain a positivist and logical outlook in order to acquire and investigate data that can be analyzed in a perceptual manner.

Background history of archeological studies of sabzevar plain

On the plain of Sabzevar, archeological activities have been limited and the small amount of data is mostly the result of brief surveys and work. In the spring of 2008, a Franco-Iranian team composed of interdisciplinary scholars investigated Tepe Damghani, located on the southeastern periphery of the modern city of Sabzevar. Their probes and surveys led to the discovery of evidence from Chalcolithic to the Iron Age. Another project, in May and June of 2012, with the goal of evaluating the possibility and feasibility of creating an open-air museum for the site of Tepe Damghani, excavated a range of test trenches, which discovered interesting evidence for interaction between humans and the natural and formation processes in their environment. Moreover, Tepe Damghani was subjected to geophysical data collection through three methods of GPR, Seismic and electrical methods, all of which are of paramount importance in using geoarchaeological approaches in this study prospect. These methods are very useful in identification and assessment of promising locations for further excavation and studies.

Geomorphological and ecological contexts of Sabzevar Plain

The related region is located in eastern longitude of 57° and 30′ to 57° and 51′ and northern latitudes of 36° and 8′ to 36° and 21′. It is about 978 m above sea level, with an area of approximately 20502 km^2.[13] Generally, Sabzevar region includes three plains: Sabzevar, Davarzan and Jovein (Figure 1). Sabzevar plain is located south of Joghatai Mountain range, which runs parallel to three mountain ranges of northern highlands of Khorasan and is adjacent to desert regions of northeast Iran. On a north-south axis, the zone of interest is to the north of Kale Shur River in Sabzevar. Siah Kuh mountain, with an approximate altitude of 2040 m is located in north of Sabzevar plain and its alluvial fan extends southwards, ending at a range of mounds known locally as Kalout (yardangs).[14] In between the yardangs and Siah Kuh Mountain is covered with a sand and gravel formation and is known as the northern plain. No archeological site has been reported from this northern Plain until now. The southern plain, which is the Sabzevar Plain, is also an alluvial fan which starts from the foot of these mounds and continues to Kale Shur riverbed. All of the identified sites in this region have been centralized in the southern plain. Sabzevar region is not rich in natural resources and fertile soil, but the strategic position of this region in northeast of Iran should not be overlooked, particularly with regards to its extraterritorial relations, which has been an important factor in formation of widespread settlements of the Bronze Age in this region.[15] Based on hydrological studies, in prehistoric periods, the only water sources available to human settlements were streams of Kale Eidgah and Gelyan in east and west of Sabzevar Plain. Thus, all identified settlements appear to have been formed along these two streams (Figure 2).[14] In general, environmental limitations and ecological circumstances in the region have produced special conditions for settlement formation. By looking at ecological conditions of prehistoric sites in Sabzevar Plain and the contemporary settlements in adjacent plains,[16,17] it appears that prehistoric sites on Sabzevar plain have been formed in unstable locations on alluvial fans, next to the main waterways. Although this ecology has resulted in unstable positions of settlements, it has also provided the necessary context for their formation. Considering the evidence, this ecological model can be generalized to prehistoric settlements in northeastern Iranian Plateau along the margin of the Central Desert.[16]

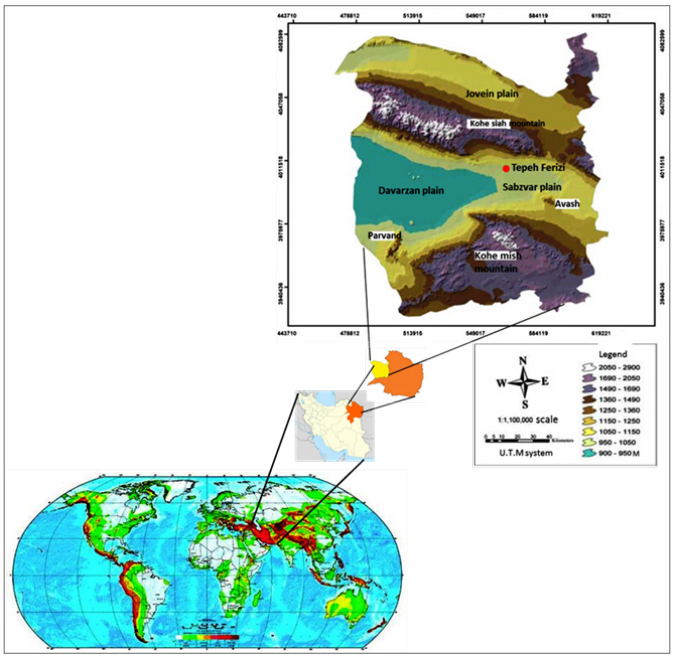

Figure 1 Position of Sabzevar Plain and its Topography.

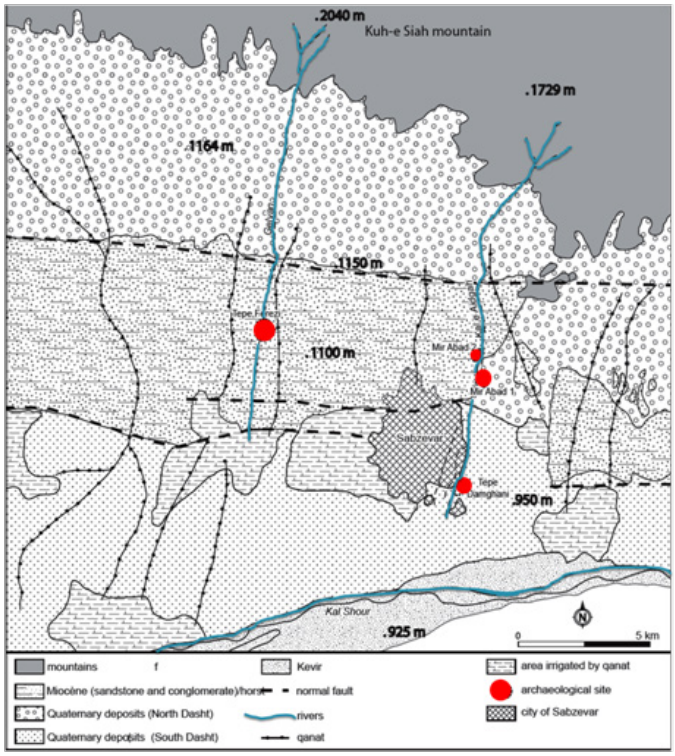

Figure 2 Geomorphologic contexts of Sabzevar Plain and Settlement Pattern of Sites identified in this landscape.

Ferizi[2] site and bactria margiana archaeological complex (BMAC)

The site of Tepe Ferizi is located 5 km to the northeast of the modern city of Sabzevar (57°36′50′′E and 36°15′30′′N and altitude of 1050 m) next to the Sabzevar –Esfraien Road, south of the mounds of Miocene period and beside Gelyan stream. What is referred to as Tepe Ferizi includes a wide area with visible ceramic dispersion, comprised of mounds and adjacent farmlands (Figure 3). The dispersion of cultural artifacts is not uniform in nature. Considering the pattern of dispersion, it seems that layers are formed horizontally and next to one another.[18] The database of the Ministry of Cultural Heritage sites the area of Tepe Ferizi to be several hectares (exceeding 18 hectares). Considering concurrent settlement patterns of Sabzevar Plain and the type of surface dispersion of artifacts, a settlement of such size is unexpected and it seems that the artifacts have lost their original context under natural and cultural processes and been dispersed over an extensive surface. Short term and long term geomorphological processes have had considerable effect on displacement of these deposits and their dispersion over extensive surface.

Based on a study of pottery data by Omran Garazhian & Leila Papoli Yazdi,[18] ceramics of Tepe Ferizi can be compared with of Hissar Ia, Ic, IIa, IIIc[19] and Namazgah V and VI[20,21] which encompass Chalcolithic to Late Bronze Age. These studies highlight mutual interactions of Tepe Ferizi with Kope Dagh basin and Iranian Plateau during that time frame. Based on surveys conducted by the author[22] and analysis of the ceramic samples, artifacts of Late Chalcolithic and Bactria-Margiana Archaeological Complex (BMAC)[23] were identified (Figure 4) (Table 1). Generally, these potsherds are wheel-made and have red, buff and sometimes gray paste with mineral temper of sand and gravel. Painted specimens have simple designs in the form of parallel and intercepting lines and geometrical motifs. Occasionally they are handmade, which is usually dated to the Late Chalcolithic and are comparable to ceramics of Hissar I[19] in northeastern Iran, but most of the ceramic samples from Ferizi are comparable to ceramic forms of BMAC at Gonur[24,25] in Margiana Oasis of southeastern Turkmenistan, Shahrak Firoozeh close to Neyshabur in Khorasan[26–28] and Hissar IIIc in northeastern Iran.[19] Considering the conducted surveys as part of the study of Post-depositional processes of at this site, it seems that Tepe Ferizi was an extensive settlement of BMAC (1700-2200 B.C.) and ceramic samples related to Late Chalcolithic period were displaced data which were brought there from the northern plain with the intensive fluvial activity.

We will discuss below the natural and cultural factors and processes affecting the artifacts and morphology of the site generally labeled as Post-depositional processes.

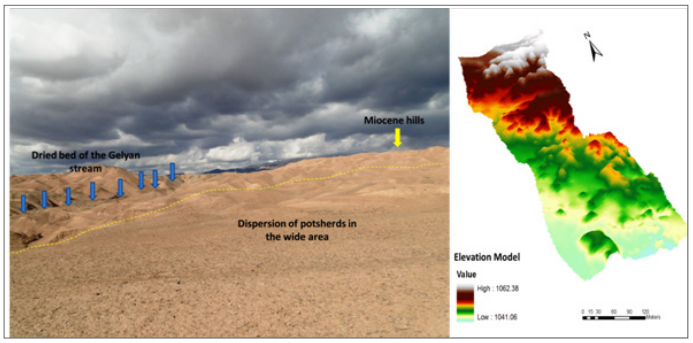

Figure 3 Topography and perspective of Tepe Ferizi.

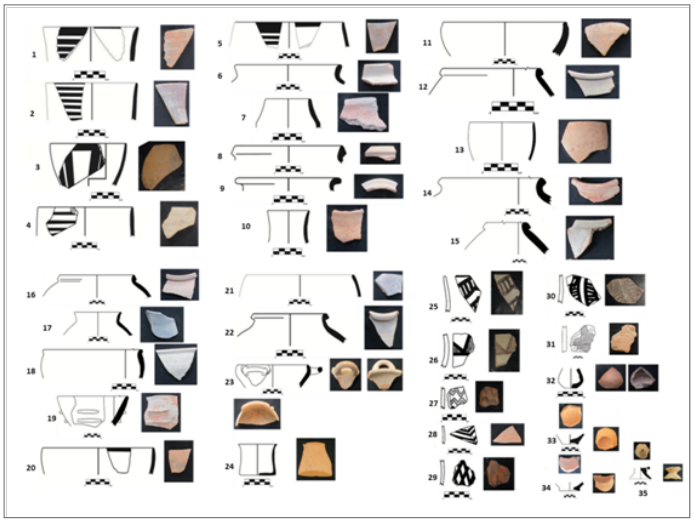

Figure 4 Studied potsherds Samples of Tepe Ferizi.

[3]The site of Tepe Ferizi takes its name from a wild plant called Feriz which grows in this region. This plant has a structure similar to grass and grows in hot and dry climates.

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Table 1 Comparative chronology of Tepe Ferizi ceramic samples

Relative and proposed chronology	Comparison source		
	Western Khorasan	**Iran Plateau**	**Kope Dagh, Margiana and Bactria Oases**
Late Chalcolithic		Hissar Ia Schmidt,Erich F.(1937,Plate III)	
Late Chalcolithic		Hissar Ib Schmidt,Erich F.(1937,Plate IV)	
Late Chalcolithic		Hissar IIa Schmidt,Erich F.(1937,Pl.XXL,XXII)	
Late Chalcolithic		Hissar Ia Schmidt,Erich F.(1937,Plate III)	
Late Chalcolithic		Hissar Ib Schmidt,Erich F.(1937,Plate IV)	
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2009: T.I,N.20,21 &T.IV,N.84)Nishapur.p, Hiebert & Dyson 2002:Fig.9.3))	HissarIIIC (Schmidt 1937: Pl.XLIII,H3305)	Gonur(Udemuradov 2002: Type.23)
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2009: (T.III,N.101&293		
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2011: (T.VI,N.11&T.VII,N.182&T.VIII,N.163,168) Nishapur.p, Hiebert & Dyson 2002:Fig.9.6))	HissarIIIb (Schmidt 1937: Pl.XXXLII,H2358)	Gonur(Udemuradov 2002: Type.2,N.125)
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2011: (T.VII,N.166&T.VIII,N.72)		Gonur(Udemuradov 2002: Type.23,N.81)
Late Bronze Age(BMAC)		HissarIIIb (Schmidt 1937: Pl.XXXVIII,H2608 & 3967)	
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2009: :T.I,N.37 &T.III,N.194,197)		
Late Bronze Age(BMAC)			Gonur(Udemuradov 2002: Type.9,N.84)
Late Bronze Age(BMAC)		HissarIIIC (Schmidt 1937: Pl.XLII,H3614)	Gonur(Udemuradov 2002: Type.3,N.9,22)
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2011: :T.VI,N.48)		
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2009::T.IV,N.40)		
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2011::T. VIII,N.136) Nishapur.p, Hiebert & Dyson 2002:Fig.9.6))	HissarIIIb (Schmidt 1937: Pl.XXXVII,H2358)	
Middle and Late Bronze Age		HissarIIIC (Schmidt 1937: Pl.XLII,H3584)	Gonur(Udemuradov 2002: Type.11,N72 & Type.12) Gotzelt, Thomas (1996, fig.1145) Namazgah V
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2009: :T.I,N.81 & T.III,N.40)		Gonur(Udemuradov 2002: Type.2,N35) (Hiebert 1994:41,fig4.2,1.A.3)
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2009: :T.I,N.18)		Gonur (Hiebert 1994a:41,fig4.2,1.A.3) (Udemuradov 2002: Type.2)
Late Bronze Age(BMAC)		HissarIIIb,C (Schmidt 1937: Pl.XLII,H3014 & pl.XXXVIII,H4975)	

Table continued....

Relative and proposed chronology	Comparison source		
Late Bronze Age(BMAC)	Nishapur.p, Hiebert & Dyson 2002:Fig.9.6))		(Udemuradov 2002: Type.9,N136)
Iron Age I,II		Ozbaki (Majid Zadeh , 2010: pictures 58,70,73,75))	
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2011:: T.VII,N.199&T.VIII,N.138)	HissarIIIC (Schmidt 1937: Pl.XLII,H4307 & Pl.LVII,H2381)	
Late Chalcolithic		Hissar Ia Schmidt,Erich F.(1937,Plate III)	
Late Chalcolithic		Hissar Ic Schmidt,Erich F.(1937,Pl.IX)	
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2011: :T.VIII,N.153)		
Late Bronze Age(BMAC)			(Udemuradov 2002: Type.1,2)
Late Bronze Age(BMAC)	Shahrak Firooz(Basafa , 2009: :T.I,N.91)		(Udemuradov 2002: Type.1,2)
Late Bronze Age(BMAC)		Khurab(Stein 1937:Pl.XXXIII,15)And Shahdad(Hakemi 1999:632, GH.1)	Gonur(Hibert 1994: 46,Fig.2,A.2; Sarianidi 1998: 39,Fig.12; Udemoradov 2002: 36,Type4; Shortughai(Francfort 1989: 349)

Natural factors and processes

Alluvial fan

Alluvial fans are common landforms at foothills of mountains, created by sudden reduction of river flow power resulting from change in topographiccal slope.[29] When passing through steep and narrow valleys and entering larger open valleys or plains, rivers leave some of their sediment load in a conical form, where the vertex is towards upstream of the river and is called Alluvial fan.[30] Alluvial fans, which are important geomorphologic features and result of changes in Quaternary Period, are regarded as suitable contexts for human activities by supplying enough water and soil.[31] Studies have shown that most of the prehistoric settlements have been founded on the middle and end parts of alluvial fans, driven by access to suitable soil and enough water for agriculture, ceramic making and other activities.[32] Even today, settlements are found at the end of alluvial fans and agricultural activities in these sections are centered in these parts. This settlement model has also been observed in Sabzevar Plain and sites have been formed between the middle and end parts of alluvial fans (Figure 5). It seems that the opportunity for formation of long-term settlements in southern plain of Sabzevar is due to the fine-grained deposits of its bed. A Study of the braided streams demonstrates that they passed through these sites and overtime changes in their course resulting in dislocation of sites. In Tepe Ferizi as well, one of the main reasons for formation of settlement with horizontal layers across a wide span is the change of the course of these braided rivers. Another factor is the relationship between deep cutting of the main channels on the alluvial fans and finding suitable location for settlements in prehistory.[33] This positioning which has direct relationship with depth of main channels can also be observed on southern plain of Sabzevar. Here, sites have been formed beside shallow sections of water channels to facilitate exploit and transfer of water, as dry farming is not possible.[22] The dried bed of Gelyan stream which is regarded as one of the two main water sources in prehistoric period (Bronze Age) is located west of Tepe Ferizi today. These streams sprang out of Siah Kuh Mountain ranges in the north of the region and entered the southern plain after passing through the northern plain and mounds of The Miocene period. Based on conversation with farmers, even today particularly wet years, a small amount of water flows in this bed in early spring. Moreover, construction of a stone bridge which has been frequently repaired in recent centuries- over the bed of this stream in the southwestern part of the site, implicates that this stream must have had abundant flow during some months of the year in recent centuries, to the point that it disrupted passage and required a bridge. Based on the accumulation process of deposits in the section created in west of the Tepe Ferizi, dry and wet periods can be suggested (Figure 6) (Ibid, 115). These sediments are made of coarse-grained deposits of the northern plain and identical to deposits on the surface of the site. Varying thickness of these deposits shows varying volume of Gelyan stream during different periods. This trend can also be observed in the excavated probes at Tepe Damghani[9] indicating that Kale Eidgah stream also had such trend. Based on these sediments at Tepe Damghani, wet and dry period can be identified. Braided rivers relating to this stream play a major role in horizontal expansion of Tepe Ferizi. These rivers led to expansion of the site by constantly changing transverse route. In fact, this stream is one of the most effective factors in formation, expansion, destruction and afterwards, morphological change of the site. Alluvial fans have spatially distinctive sections. In cases where climatic or tectonic factors intervene, alluvial fans can be divided into active and inactive sections. Active sections of the alluvial fans are the sections which are always vulnerable to flood water while inactive sections are only sparely threatened by flood water.[34] Identification of active and inactive sections of alluvial fans can be evaluated in

terms of submergibility using simple geomorphological indices such as drainage pattern, morphology of fan area and serration index, color of fan deposits in satellite images, maximum depth of fan deposit sections and weathering indices such as weathering of alluvium and porosity of calcite boulders. As mentioned above, Tepe Ferizi has been formed on alluvial fan of the Gelyan stream. The intensity of processes affecting this site and the transformation of artifacts in a vast area shows that site was location on an active part of the alluvial fan at the time of settlement. It seems that these activities continued up to recent centuries but are currently inactive. Based on the indices of active and inactive points of the alluvial fan, it can be concluded that the point on which Tepe Ferizi is located is currently inactive. These indices include:

a. Morphology of the surface of alluvial fan which shows deep cuts

b. Intensive weathering of debris

c. Serration index or high ruggedness of the surface

d. Soil formation and soil horizontation, this soil horizonation is visible in the southern part of the site where farmlands are located.

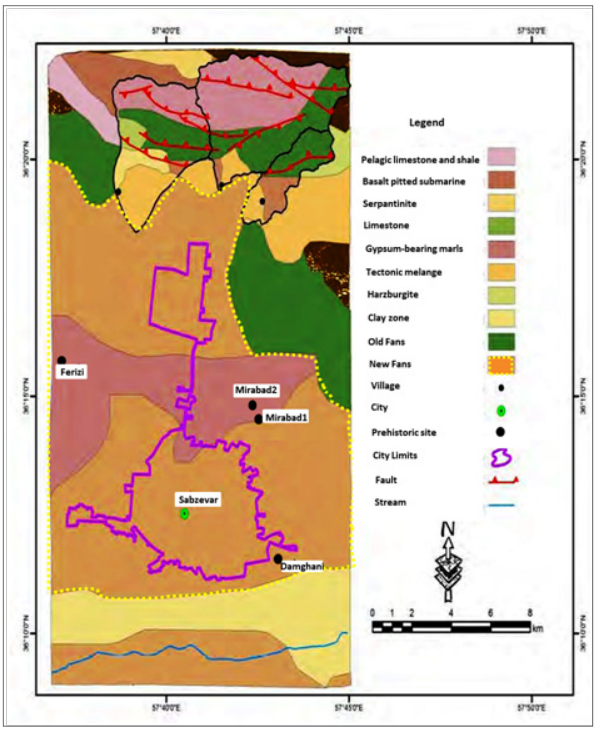

Figure 5 Location of Archeological Sites in middle to end parts of the alluvial fans.

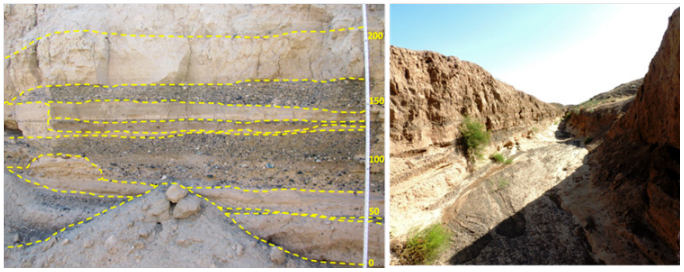

Figure 6 Dried bed of a stream (Bronze Age) identified in west of the site and the section which shows process of accumulation of deposits. Dried bed of a stream (Bronze Age) identified in west of the site and the section which shows process of accumulation of deposits.

Erosion Factor

Erosion factor is also one of the most common processes affecting surface geomorphology and its phenomena. This factor is more intensive particularly in hot and dry climates like as the studied zone. Water and wind erosion are most common. Particularly, location of Tepe Ferizi beside mounds of Miocene period which are comprised of soft and porous texture has intensified this case. The produced plan of erosion in the studied region (Figure 7) shows that the zone in which archaeological sites are located i.e. Tepe Ferizi in the west and Mirabad 1,2 and Tepe Damghani in the east, had the highest rate of erosion.[22,35–37]

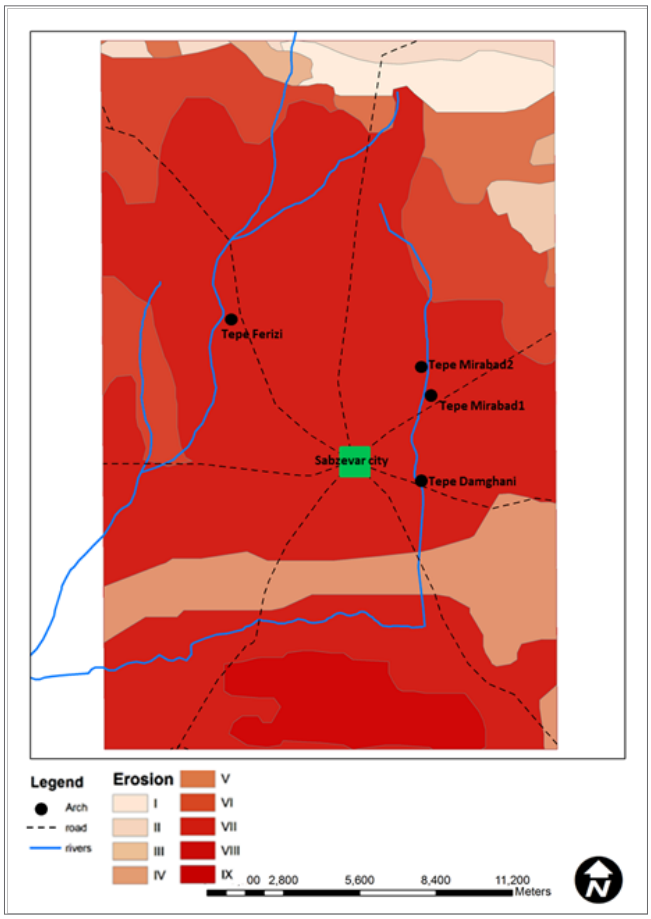

Figure 7 Map for classification of erosion rate in the studied region.

Sedimentary deposits of the Ferizi site

During foot survey of the site and the southern edge of the mounds, an accumulation of deposits was identified at certain points of the site. These deposits were denser in four points of mounds (Figure 8). These four points are:

a. X 57° 37′ 26.9″ Y 36° 15′ 42.01″

b. X 57° 37′ 23.7″ Y 36° 15′ 40″

c. X 57° 37′ 27.5″ Y 36° 15′ 39.6″

d. X 57° 37′ 41″ Y 36° 20′ 59.3″

This deposit includes four classes of natural and cultural materials:

A. Coarse-grained deposits as sand and gravels. These coarse-grained deposits have a similar nature as deposits of the northern plain.

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B. Rounded and angular stone pieces in small and large sizes (cobble and boulder): all of these ophiolite[3] rocks include Pillow Lava, Dolerite, Gabbro, Peridotites, whose origin and deposits are located in ophiolite belt of Sabzevar a few kilometers to the north of the site (Figure 9A).

C. Wheel-made and handmade painted potsherds with red paste and linear and geometrical decorations in a spectrum of dark brown to black. Considering relative chronology these potsherds date to the Chalcolithic and specifically Late Chalcolithic periods (Figure 9b).

D. Rounded potsherds (Figure 9c): In surveys of Tepe Ferizi , ceramic samples have been identified that are note worthy.[38]

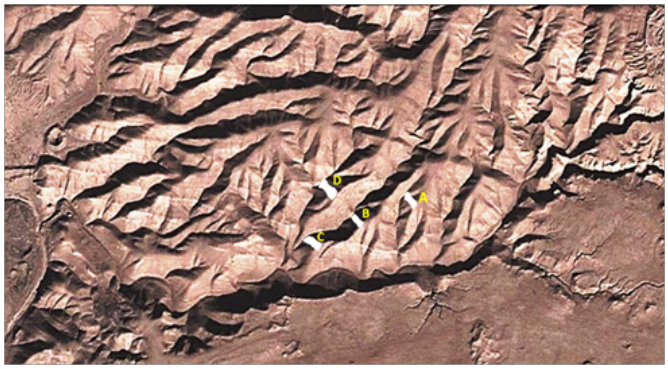

Figure 8 Topography of the site, the points in which a accumulation of deposits along with the cultural materials has been identified.

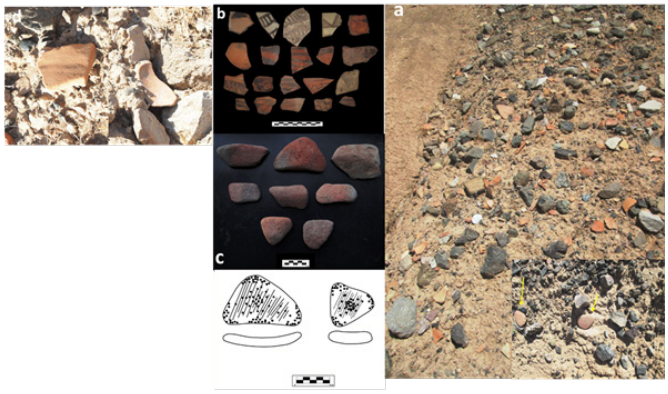

Figure 9 (a) Flood deposits containing cultural materials, ophiolite rocks. (b) Painted potsherds identified among the flood deposits. (c) Rounded potsherds among the flood deposit. (d) Potsherds which have not pas.

These potsherds are usually in the form of triangles, ellipses and circles and the edges have been uniformly rounded. They range in color from red to brown and have gravel as temper. Due to the climatic condition of the region, these potsherds have been weathered by natural and their side effects and have very porous surfaces. For this reason, it is not clear whether they were been made by hand or wheel. At first glance, these potsherds seemed to be having had a specific use as a standard object such as counting tokens or ceramic tools, but this hypothesis is not acceptable for the following reasons:

[4]The word ophiolite applies to a set of stratified rocks which are resulted from crystallization and cooling of mantled magma. These deposits are green and were considered as accessible different rock sources for constructing stone dishes, tools… etc in prehistoric times.

I. These potsherds have been identified in specific points at the site among a accumulation of the flood deposits and different stone pieces.

II. Formation context of the site has fine-grained deposits context while these rounded pieces have been identified among the coarse-grained deposits similar in nature to the deposits of northern plain.

III. Analysis of these coarse-grained deposits shows that these deposits have been transferred from the upstream regions along with intensive flood flows to their current location.

IV. According to geomorphologists who study rounding of rocks, these potsherds are dislocated from their original context and moved for kilometers due to flood flows during processes that lasted several thousand years (Amir Ahmadi, personal communication, 2013)

V. The presence of the ophiolite stone pieces among the deposits that contain these rounded potsherds shows that these pieces have been transferred here due to natural processes of Sabzevar ophiolite belt located several kilometers to the north of Tepe Ferizi.

VI. Moreover, we identified ceramic samples had not completed this rounding process and can be clearly identified as a piece of pottery vessel (Figure 9d).

VII. Rounding rate in all angles of the potsherds is equal and regular, which according to geomorphologists is congruent with rounding of stone pieces due to water currents (Amir Ahmadi, personal communication, 2013).

VIII. Considering that standard objects such as tokens follow special relative pattern,[39,40] some of these similar pieces were evaluated in terms of size and weight (Table 2). No special pattern was observed in weight or size system of these pieces.

Table 2 specifications of number of rounded potsherds

Weight gr.	Thickness .mm	Width .cm	Length .cm	Piece
97/9	4	2-Aug	5-Oct	1
65/5	14	6	1-Jul	2
166/3	15	8-Jul	8-Nov	3
105/7	15	1-May	5-Nov	4
41/2	11	5-Apr	7	5
77/1	13	7-Apr	9	6
50/3	6	5	5-Aug	7
73/5	8	5-May	5-Jun	8

Based on the mentioned points, we can reject the hypothesis that the special form of these pieces was due to a special application like counting tokens or alike. In this regard, these forms are potsherds that have been transferred to this location from upstream (northern plain), where necessary contexts for formation of prehistoric settlements are more favorable. These objects were transferred due to natural processes and flood flows in long term, losing their angles and becoming rounded due to this displacement similar to rounded river stones. This conclusion is based on surface surveys and makes use of geomorphologists' experiences. For more assurance, there is need for microscopic analyses and we hope to be able to do so in near future. On the other hand, to this day, no site has been reported in northern

plain of Sabzevar. The surface of the northern plain is less suitable for farming than southern plain due its coarse deposits of sand and rubble; hence the lack of necessary conexts for formation of the agricultural settlement sites. On the northern plain, however, surface flows are more accessible and water resources are more suitable for formation of human settlements. Abundant pastures for grazing in Siah Kuh Mountain range and its highlands also provided the opportunity for formation of human settlements with a subsistence economy based on animal husbandry. It seems that evidence of settlements from Neolithic and Chalcolithic periods can be identified by further surveys and analysis of the northern plain. The evidence from Tepe Ferizi, as discussed above, also supports this hypothesis. It is evident that sites of the northern plain, after being abandoned due to dynamic and active geomorphological conditions of the region, have been buried under piles of deposit and destroyed due to transformational processes.[22,38]

Mounds of miocene age

These mounds (Figure 10), which were formed during Miocene period and constitute the interface between northern plain and southern plain, are made from marl and gypseous marl and have very soft and porous textures. These phenomena are regarded as units of rugged terrain and the current topography of these mounds results from some geomorphological facies such as badlands–trenches that are affected by water and wind erosion in long term. General direction of these mounds is aligned with water streams (north-south) and wind streams (northeast –southwest, east –west) in a north–south direction.[41] In this regard, factor of erosion and unsteady bed of the mounds has had considerable effect on Tepe Ferizi and its artifacts and has dissolved cultural deposits and made them disappear in long term.

Figure 10 Hilly lands of Miocene age, view from south.

Cultural processes affecting artifacts and transformation of the site

What is now visible of Tepe Ferizi is mostly affected by natural processes and cultural processes have had a negligible role in the direction of these transformations. It should be noted, however, that a cultural process following a natural process at time of settlement (horizontal expansion of the site by resulting from change in river course) caused more vulnerability. That is the horizontal expansion of layers with low thickness.[22] Some of the cultural processes that have affected the site after formation of layers include agricultural activities, illicit excavations and excavations of wells, mills and qanats (aqueducts) (Figure 11a) (Figure 11b).

Figure 11 (a) Farmlands in south of the site. (b) Unauthorized excavations in surface of the site.

Conclusion

The site of Tepe Ferizi shows extensive settlement of Bactria Margiana Archaeological Complex (BMAC). The dynamic and active geomorphological conditions of the region on long-term and short term time scales, ecological circumstances and limitations of the region and formation context the site have created unsteady and unreliable conditions for the settlement. These conditions caused the site to adapt to the existing unsteady conditions i.e. location on the active alluvial fan and interaction with it in order to have access to the required water resources. This adaptation has had considerable effect on settlement trend and pattern analysis of spaces and formation of the site. These factors have been clearly observed at Tepe Damghani[42] i.e. centralization of residential and burial spaces and interaction of human with natural factors. After abandonment and formation of cultural layers, the same factors also affected transformation of deposits and artifacts. Surface water flows, alluvial fan, mounds of Miocene age, tectonics, climatic flows and consequently human factors such as agricultural activities were effective on these transformations. Coarse-grained deposits with different nature along with cultural data such as painted ceramics of the Chalcolithic period and rounded potsherds indicate the existence of intensive flood flows in the region which had the ability to dislocate deposits over long distances. On the other hand, these deposits and their material culture demonstrate the presence of prehistoric settlements[4] in northern plain of Sabzevar unrecognized until now. The model which is suggested for transformation of Tepe Ferizi after the formation of the cultural layers is as follows: The site has been formed after abandonment as a low-rising hill with a

[5]These settlements may not necessarily be accessible on the surface at today, because the surface of the plain has probably been raised since over 5000 years ago

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mild slope along the mounds of the Miocene period. Subsequently, intensive flood flows reach mounds of Miocene period from the northern plane carrying cultural data, penetrating the Miocene mounds due to their soft and porous texture and reaching southern plain and surface of Tepe Ferizi, causing transformation of the deposits at the site and scattering its artifacts over an extensive area. On the other hand, material culture carried by these flows has been combined with cultural artifacts of Tepe Ferizi resulting to our misinterpretation of the site chronology. Also, erosion trend of the mounds of Miocene period, due to climatic conditions of the region, caused mixture of the archeological deposits with the context that formed these mounds. Due to these factors, we see today a vastly transformed shape of an archaeological site, so that it is not possible to identify the boundary for artifacts scattering and site transformations. In general, the extracted patterns for post-depositional processes in this ecosystem and their effect on archeological deposits have had a uniform process, but on a closer inspection, one can see that geomorphological phenomena, site formation context and its formation position have influenced the effects of these processes on the site and its deposits in different ways and with varying degrees. Overall, western Khorasan (northeast) as a cultural zone in prehistoric period has remained poorly understood which considering the transformative nature of the discussed processes, is not unexpected. It is evident that natural and cultural processes in this ecosystem are effective on formation of settlements, both at time of settlement foundation and afterwards. The diagram presented below showcases all of these processes in time and place (Figure 12).

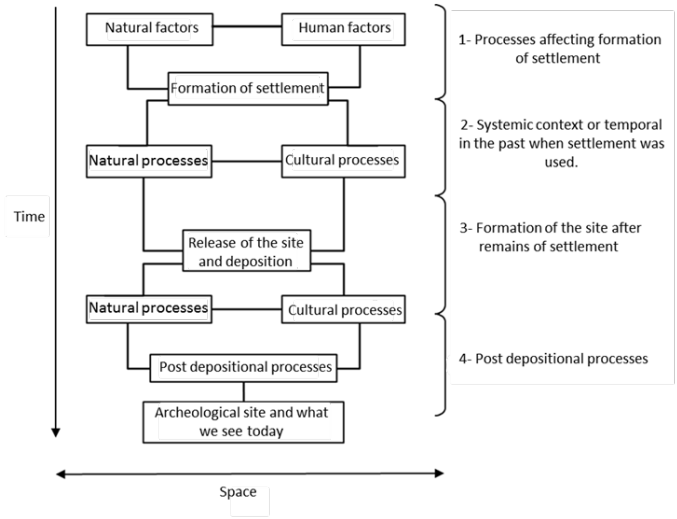

Figure 12 Role of natural and cultural processes in formation of an archeological site.

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Conflict of interest

Author declares that there is no conflict of interest.

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