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Extremes and Cultures: Investigating the Decline of the Chalcolithic Age in the Tehran Plain with the Environmental Archaeology Approach

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Abstract

Natural hazards in ancient times were among the factors central to the decline of human cultures and civilizations. Climate change periods are associated with increased extreme weather events such as torrential rains and prolonged droughts, thus posing severe challenges to human societies. In the fourth millennium BCE, variable climatic conditions in the Tehran plain caused cultural dynamics to be disrupted. Through an environmental archaeological approach, the present study discusses the possible causes of cultural decline and collapse in this plain in two stages of climate change during the fourth millennium BCE. The data derives from the archaeological site of Mafin Abad, where occurs a situation similar to a series of sites in North Central and Southwest Iran. High-resolution paleoclimate research has been used to reconstruct the climatic conditions of the fourth millennium BCE. This research reflects the importance of environmental sedimentology studies in archaeological sites to identify possible environmental reasons for cultural prosperity and disintegration of prehistoric rural communities.

Keywords: Tehran Plain, Mafin Abad, Fourth Millennium BCE, Climate, Flood.

Article Type: Research Article

Introduction

The Quaternary (Pleistocene and Holocene) was a period of major environmental changes, possibly greater than at any other time in the last 60 million years (Bradley, 2015: 2). Although the climatic events during the Holocene (11.7 ka BP to the present) were not as severe as the Pleistocene (2.58 Ma – 11.7 ka BP), they were able to change ecosystems and human subsistence patterns for centuries. Climatic events had destructive environmental effects in such a way that they caused disruptions in cultural development of societies. Climatic changes increase extreme weather events such as severe storms, torrential rains, prolonged droughts, heat waves, and cold (Hallegatte, 2014: 86–90).

Iran's mostly Mediterranean climate is dominated by Westerlies, Siberian Anticyclone, Subtropical High, and Monsoon. In the past, whenever the status and intensity of these systems changed, it led to climate change and affected Iran's diverse environment (Kehl, 2009). Many large and complex environmental events have so far occurred in the cultural realm of North Central Iran. Warm and dry climate, low rainfall, and high soil salinity have caused the desert to expand in the regional landscape so that only certain areas, such as alluvial fans, have been attractive for human societies to settle. This region covers two large basins of the Salt Lake and the western part of the Central Desert. Most of the prehistoric sites occur in the Salt Lake basin. In this part, there are several sub-basins derived from the permanent rivers of Jajroud, Karaj, Qarachay, and Qomroud (NGO, 2005). These rivers and their tributaries have informed the main settlement patterns of human communities since the Neolithic period in the Salt Lake basin because prehistoric communities needed permanent and abundant water resources for sedentary lifestyle and carrying

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out agricultural, livestock, and industrial related activities. Agriculture in the Tehran plain relied on the two methods of rainfed and irrigation, and, in the historical period, the aqueduct system (Mosadeghi Amini & Molla Salehi, 2015). The environmental conditions of this region have provided suitable soil for pottery, which represented the most important and most developed industrial activity in the region since the sixth millennium BCE (Maghsoudi *et al*, 2015; Chaychi Amirkhiz & Shaikh Baikloo, 2015). The Cheshmeh Ali culture, with its distinct painted red ware (Schmidt, 1935), and the succeeding Sialk III culture (Ghirshman, 1938) spread over large parts of North Central Iran and also northeastern Iran.

From the beginning of the Sialk III cultural period (ca. 4300 – 3400 BCE), due to the Earth's axis shift, the subtropical high pressure and the Intertropical Convergence Zone moved to the more southern latitudes, and therefore the activity of the monsoon in Iran was greatly reduced (Fleitmann *et al*, 2007; Djamali *et al*, 2010; Shaikh Baikloo, 2021a). From this time on, the Iranian climate came to be affected mostly by westerlies, and the forest cover of Zagros began to expand (Stevens *et al,*2001, 2006). This large-scale climate change was certainly coincided with a fundamental change in agricultural activities. Further, thereafter, the decrease in solar activity and the occurrence of cold phases caused drought episodes in Iran (Sharifi *et al*, 2015; Shaikh Baikloo, 2020). The occurrence of at least two important dry events in the fourth millennium BCE put tension on people's subsistence patterns. Adopting an environmental archaeological approach and building on archaeological studies and paleoclimate research, this paper tries to explain the cultural evolution of the fourth millennium BCE. The main question is how extreme weather events related to climate change have influenced prehistoric rural communities in the Tehran Plain.

Methodology

This research is primarily based on environmental sedimentology data from Mafin Abad, Islamshahr, Tehran province. In addition, combining the paleoclimate research in southwest Asia and Europe with the status of habitation in the fourth millennium BCE sites of the Tehran Plain, we reconstruct the Mid-Holocene climate and explain the relationship between climatic changes and the cultural evolutions in the Chalcolithic Age. Environmental changes seem to have played a decisive role in the survival and decline of prehistoric cultures.

The archaeological site of Mafin Abad was excavated in the mid-2000s, yielding remarkable results regarding the environmental sedimentology of the site. Several pits and trenches were excavated around the main mound. Samples taken from each layer and the sediment samples were analyzed by XRD method at the laboratory of Bu-Ali Sina University. Trenches C and D illustrate evidence of a relatively huge flood related to the Siab River (one of the branches of Karaj River) which led to the collapse of this settlement. Furthermore, in the survey around the site, the evidence of a riverbed, probably a former course of the Siab River, was discovered by chance while digging the footings of a building. The Siab River seemingly used to flow in the east of the Mafin Abad site, and over time moved across the plain. This riverine migration may have occurred due to the flood(s) of the river.

Climate Reconstruction

In North Central Iran, the Mid-Holocene (8200–4200 BP) encompasses the Late Neolithic, the Chalcolithic, and the Early Bronze periods (Table. 1). Although in the first half of the Mid-Holocene (mainly between 7400 and 6300 BP), optimal climate generally prevailed, its latter half experienced extreme weather events such as severe droughts and torrential rains as a result of the solar energy oscillations. A 2.7 to 3.7 m thick flood layer in Ur of southern Mesopotamia (Woolley, 1954; Woolley & Moorey, 1982) and a 6 m thick flood layer at Tepe Sanjar, Khuzestan (Sardari Zarchi, 2014) dating to the first half of the fourth millennium BCE reflect adverse climatic conditions. Environmental sedimentology research by Mir Abedin Kaboli at Qara Tepe of Qomroud in the mid-1990s indicated a devastating flood in the mid-fourth millennium BCE. It appears that in this area, from this time to the first millennium BCE, the frequent occurrence of floods has caused changes in the environmental conditions and settlement distribution (Kaboli, 1999: 33, 72, 79, 83, 140–142).

The Greenland temperature change diagram (GISP2) indicates a sudden drop in temperature in the mid-fourth millennium BCE, which lasted for about 200 years between ca. 5500 and 5300 BP. Besides, the humidity diagram shows that in warm periods, the humidity was relatively high, but the temperature drop in the mid-fourth millennium

BCE was likewise followed by a decline in humidity (Alley, 2004a: 65). High-resolution paleoclimate research on the Lake Neor, Ardebil suggests very arid climatic conditions with increasing dust flux during the fourth millennium BCE (Sharifi *et al*, 2015). High-resolution research on Katalekhor Cave, Zanjan evinces dry climate conditions in the early and late centuries of the fourth millennium BCE (Andrews *et al*, 2020). High-resolution (3–20 yr) oxygen and carbon isotopic record in a speleothem from Soreq Cave illustrates two dry events in 5700–5600 BP and 5250–5170 BP and two wet events in 5760–5740 BP and 5500–5450 BP (Bar-Matthews & Ayalon, 2011). Research on the Hashilan Wetland, Kermanshah shows a dry climate and increased in dust storms between 5400 and 5200 BP (Rostami *et al*, 2021). The pollen diagram of the shallow and very salty Maharlou Lake in Fars indicates that between 5700 and 5500 BP, a dry climate occurred during which both Pistacia–Amygdalus scrub and Quercus brantii woodland were at their minimum extent. This period was followed by the expansion of Pistacia–Amygdalus scrub in the area and the spread of Quercus brantii woodlands at higher altitudes (Djamali *et al*, 2009: 123). Research on the Lake Mirabad in Luristan indicates a 600-year severe drought from 5500 to 4900 BP (Stevens *et al*, 2006). Work on the Lake Kongor in the Gorgan plain attests to arid conditions for the period spanning ca. 5700 BP to the end of the fourth millennium BCE (Shumilovskikh *et al*, 2016).

Drawing on high-resolution paleoclimate research, it can be summarized that frequent climate changes occurred in the fourth millennium BCE due to solar energy oscillations and their effects on the earth's climate systems. Probably in ca. 4000–3700 BCE and ca. 3500–3300 BCE, a relatively humid to humid climate prevailed, while the timespans of ca. 3700–3500 BCE and ca. 3300–3000 BCE witnessed a dry to very dry climate. Extreme weather events such as torrential rains and severe droughts are related to dry climatic periods.

Archaeological Studies

Mafin Abad is an archaeological site in the Karaj alluvial fan of the Tehran plain. This settlement was inhabited from the early fifth millennium to the mid-fourth millennium BCE and contains artifacts from the Sialk II period to the early Sialk III6–7b. The nearest river that passes about 1 km west of the site is a branch of the Karaj River, namely Siab. About 4 km to the west flows the seasonal Shadchay River, and 200 m west of it lies the fourth millennium BCE site of Maimanat Abad (Maimoon Abad). To find the reasons behind the formation of the latter site along the Shadchay River, geoarchaeological research has been done (Maghsoudi *et al*, 2013). This site includes two mounds, northern and southern, with evidence from the Sialk III6–7b and IV1 (Yousefi Zoshk, 2012; Yousefi Zoshk *et al*, 2016: 57). This study has shown that in the past, the Shadchay River probably flowed through a different course, and its migration forced the residents of Maimanat Abad to move to a point closer to the river (Maghsoudi *et al*, 2013: 160). According to the chronology of the two mounds, this event occurred in the mid-fourth millennium BCE. The extensive geoarchaeological research by Rashidian (2017; 2019; 2021a,b; 2022) in the Susiana plain also illustrates the impact of the landscape on the distribution of prehistoric sites. The westward migration of rivers of the plain in the Late Village period has caused a change in the distribution pattern of settlements. This situation could probably indicate an increase in extreme weather events (floods and droughts) related to climate change.

Tepe Cheshmeh Ali, first excavated by Schmidt in the 1930s and again by Sarraf and Fazeli in 1997, was inhabited from the Sialk II to the Sialk III4–5 and the Sialk IV period (Fazeli *et al*, 2004; Hessari, 2013: 142, Figure. 51). Tepe Pardis of Gharchak-Varamin was excavated by Fazeli in the 2000s and has evidence of pottery kilns (Fazeli *et al*, 2007: 268–269), slow pottery wheel (Fazeli *et al*, 2007: 421), and water canal (Gillmore *et al,* 2009). This site was inhabited in ca. 5290–4760 BCE and ca. 4025–3700 BCE, and is associated with a cemetery dating from the Iron Age (Fazeli *et al*, 2007; Valipour *et al*, 2009). Tepe Shoghali of Pishva-Varamin was excavated by Hessari in the 2000s and produced evidence from the Sialk II, III, and IV periods (Hessari & Akbari, 2007; 2015). In the nearby area, Hessari also discovered evidence from the Sialk III6–7b and IV Periods during his excavations at Tepe Sofalin of Pishva-Varamin (Hessari *et al*, 2007). Chakhmaq Tepe of Robat Karim was identified in the course of the Tehran plain surveys (Fazeli, 1998; 2001) and systematically surveyed in 2010–2011. Studies shows that the site was inhabited in the Sialk III1–5 period. About 4 sherds belonging to the Sialk III6–7b were also recovered (Yousefi Zoshk & Yousefian, 2012). Tepe Chaltasian, excavated by Yousefi Zoshk (2013), was inhabited from the Sialk III4–5 to IV1. Tepe Ahmad Abad Kuzehgaran, surveyed systematically in 2012, belongs to the Sialk III period (Shaikh Biakloo, 2013). Tepe Zavarevar, identified during the Javad Abad-Varamin survey (Hessari *et al*, 2014), has evidence from the Sialk II to IV period (Ghasemi, 2013).

Other archaeological sites in the Tehran plain including Morteza Gerd (Sialk III1–5), Farhangian (Sialk I to IV), Qara Tepe of Shahriyar (Sialk II and III1–3), Fakhr Abad (Sialk III1–3), Mahdi Khani (Sialk II and III), Sadegh Abadi (Sialk I to III), and Pouienak (Sialk II and III1–3) have been identified during the survey program of the Tehran plain (Fazeli, 1998). Although no cultural layer has been discovered at Farhangian, the site was inhabited from the Sialk I to IV (especially Sialk III4–5) judging from surface pottery (Adibzadeh *et al*, 2014) (Figure. 1, Tables 1 & 2).

Based on the available radiocarbon dates from most of these sites, it is clear that occupations at these centers lasted until the late Sialk III4–5 Period and the early Sialk III6–7b Period, and other sites were established in the Sialk III6–7b Period. Even at the sites that yielded pottery from all the Sialk

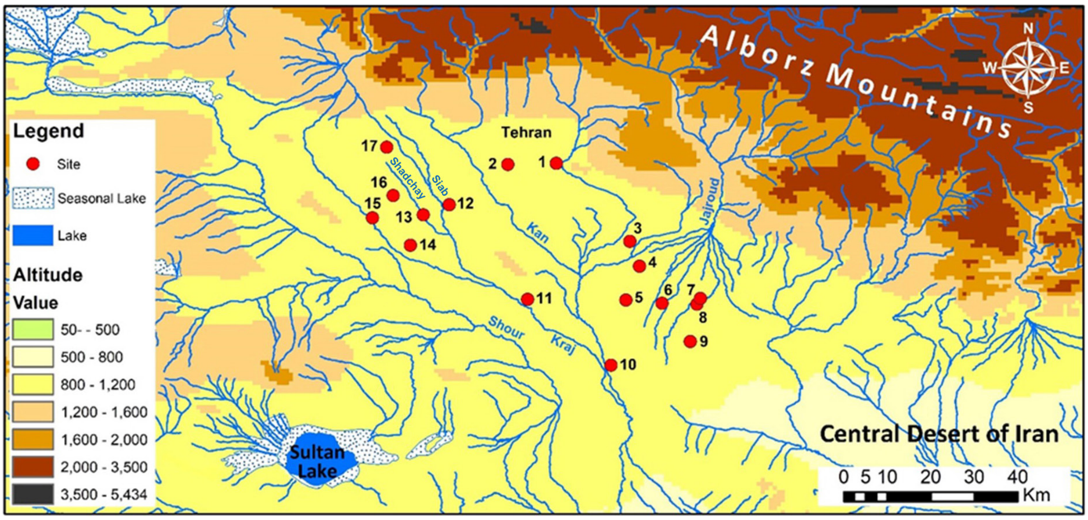

Figure. 1: *The Chalcolithic sites of the Tehran plain. (1) Cheshmeh Ali, (2) Morteza Gerd, (3) Pardis, (4) Pouienak, (5) Ahmad Abad, (6) Chaltasian, (7) Shoghali, (8) Sofalin, (9) Zavarevar, (10) Fakhr Abad, (11) sadegh Abadi, (12) Mafin Abad, (13) Maimanat Abad, (14) Mahdi Khani, (15) Farhangian, (16) Chakhmaq, (17) Qara Tepe Shahriyar*

Table. 1: *Chronology of Tepe Sialk (After:Malek Shahmirzadi, 2012) and North Central Iran (After:Pollard et al, 2013)*

The Sialk Cultural Period	14C dating of the Sialk site (BCE)	Cultural Period of North Central Iran	Chronology of NCI (BCE)
IV	3400-3100	Early Bronze	3400-2900
III6-7b	3750-3400	Late Chalcolithic	3700-3400
III4-5	3900-3750	Middle Chalcolithic	4000-3700
III1-3	4300-3900	Early Chalcolithic	4300-4000
II	5000-4300 (4100?)	Transitional Chalcolithic 2	4600-4300
	5250-5000	Transitional Chalcolithic 1	5200-4600
I	-	Late Neolithic	6000-5200

Table. 2: *The chronology of the Chalcolithic sites of the Tehran plain. "S" stands for Sialk (the Sialk cultural period)*

No	Site	Sialk I1	S.I2-5	S.II1-3	S.III1-3	S.III4-5	S.III6-7b	S.IV	References
		6-5.6ka BP	5.6-5.2	5.2-4.3	4.3-4	4-3.7	3.7-3.4	3.4-2.9	
1	CheshmehAli	-	-	* -	*	?	-	*	Fazeli Nashli *et al*, 2004
2	SadeghAbadi	-	*	*	*	*	*	-	Fazeli Nashli, 2001
3	Pardis	-	-	* -	-	*	-	-	Pollard *et al*, 2013
4	Chakhmaq	-	-	-	*	*	* ?	-	Fazeli Nashli, 2001
5	Farhangian	-	*	*	*	*	*	*	Adibzadeh *et al*, 2014
6	Shoghali	-	-	*	*	*	*	*	Hessari&Akbari, 2007
7	Zavarevar	-	-	*	*	*	*	*	Ghasemi, 2013
8	MahdiKhani	-	-	*	*	*	*	-	Fazeli Nashli, 2001
9	Pouienak	-	-	*	*	-	-	-	Malek Shahmirzadi, 1997
10	QaraTepe	-	-	*	*	-	-	-	Burton-Brown, 1962
11	MafinAbad	-	-	*	*	*	* ?	-	Fazeli Nashli, 2001
12	FakhrAbad	-	-	-	*	-	-	-	Fazeli Nashli, 2001
13	Maimanat A.	-	-	-	-	-	*	*	Fazeli Nashli, 2001
14	MortezaGerd	-	-	-	*	*	-	-	Fazeli Nashli, 2005
15	Sofalin	-	-	-	-	-	*	*	Hessari *et al*, 2007
16	Chaltasian	-	-	-	-	*	*	*	Yousefi Zoshk, 2013
17	AhmadAbad	-	-	-	*	*	* ?	-	Shaikh Baikloo Islam, 2013

III phases in systematic surveys, it is not possible to assume an unequivocal continuity without any interruption. This fact may indicate the possibility of severe climate change in the mid-fourth millennium BCE. Furthermore, it should be noted that the collapse of the Sialk IV culture most probably occurred due to the 5.2 ka BP event (Shaikh Baikloo *et al*, 2016). The recent work on the southern mound of Sialk (Fazeli Nashli *et al,* 2023) attests to this fact. OSL dates in this site show that it collapsed during this climatic event.

Mafin Abad

The site is in the Central District of Islamshahr County, Tehran province at 35° 31′ 20″ N and 51° 13′ 22″ E. The first archaeological studies on the site were carried out by the Department of Archaeology of the University of Tehran as part of the general surveys of the Tehran plain (Fazeli, 1998). In the released report, the dimensions of the site at the time of the survey (1998) were 220 × 252 m (about 5.5 hectares). Based on the exposures made by clandestine excavations, the survey team estimated the depth of the visible cultural deposits to be 14 m (Figures. 2 & 3). At this time, about 50% of the entire height of the mound had vanished due to the high quality of the soil, which was moved to industrial workshops to make bricks and pottery. The first season of excavations was conducted by Ahmad Chaychi Amirkhiz in late 2005/early 2006 with the digging of two stratigraphic trenches (Figure. 4). Results of the stratigraphy indicated that the settlement at this site lasted from the Sialk II to the late Sialk III4–5 (probably the early Sialk III6–7b). It is noteworthy that while three pieces of Sialk III6–7b pottery were recorded in the earlier surveys (Fazeli, 1998; 2005: 181), none of the stratigraphic trenches yielded indications of such pottery (Chaychi, 2006).

Figure. 2: *The main mound of the Mafin Abad archaeological site*

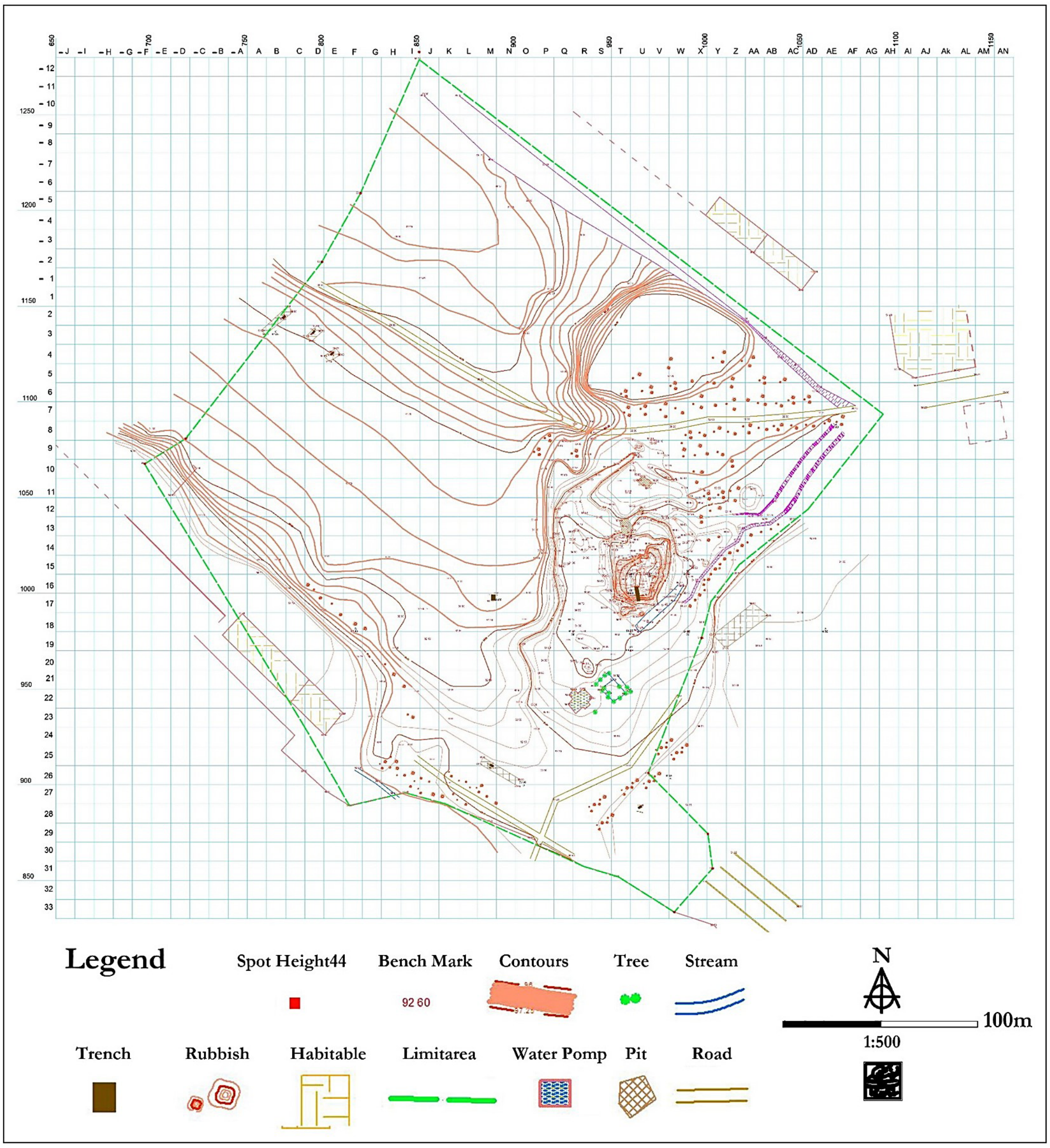

Figure. 3: *The topography of Mafin Abad and the location of excavation trenches (SU1 and SU2) and environmental sedimentology pits/trenches*

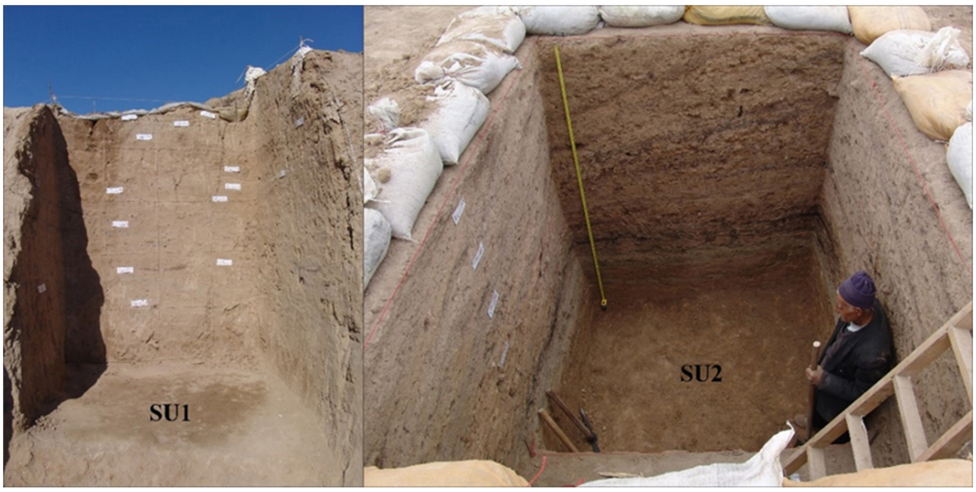

Figure. 4: *Excavated trenches at Mafin Abad (Trench SU1 on the southern slope and Trench SU2 on the west side of the mound)*

During the first season of excavations, some 200 m northeast of the mound and adjacent to the town of Ghaemiyeh, the evidence of an ancient river was discovered under the sediments of the plain (Figure. 5). The Sialk III4–5 pottery was also found beneath the river sediments. This indicates that parts of the site's cultural material was buried under sediments during the flooding of the river. Thus, it can be said that around the mid-fourth millennium BCE, this region probably witnessed great environmental changes due to abrupt climate change.

***Figure.* 5:** *The evidence of sediments from an ancient river in the eastern part of Mafin Abad accidentally discovered by Farshid Mosadeghi Amini*

In the 2007 fieldwork, for environmental sedimentology of Mafin Abad, five pits/trenches designated A, B, C, D, E, F were excavated at relatively suitable distances from the main mound. Trenches A, B, C were excavated in the west part of the mound next to each other and along the northwest, at a distance of approximately 10 m from each other. Pit D in the southwest, Trench E in the south, and Trench F in the southeast of the site were excavated. First, it was necessary to remove garbage, construction debris, and industrial waste from the surface (Chaychi, 2007: 37–45). Trench C and Pit D represent thick sedimentary layers on the Sialk III4–5 culture material. In the following, the stratigraphy of these two trenches is presented (Figure. 6).

Trench C

Initially, an area of 4 ×18 m was cleared of surface debris. Then a trench of 1 ×2 m was dug. Excavation of Trench C was stopped at a depth of 4.2 m below the ground level (Figures 6 & 7).

First layer: The surface layer had loose soil.

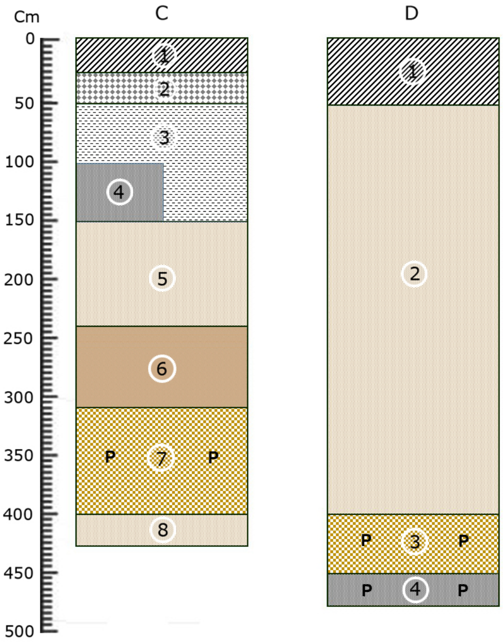

***Figure.* 6:** *Mafin Abad: Stratigraphy of environmental sedimentology. "P" stands for the Sialk III4–5 pottery*

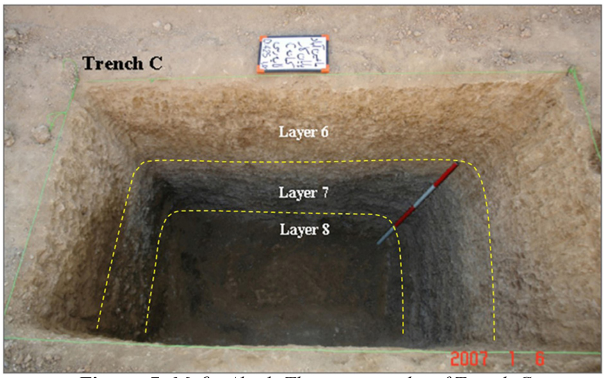

***Figure.* 7:** *Mafin Abad: The stratigraphy of Trench C*

Second layer: This layer contained rubble and rock fragments.

Third layer: This dense layer with a thickness of between 50 and 150 cm included sand and pieces of nylon and fabric.

Fourth layer: This layer contained light gray soil.

Fifth layer: It was a layer of dense silty and clay sediment. The red color of this layer is due to iron oxide and limonite minerals. This sediment was composed of feldspar decomposition. In this layer, there were also large grain destructive particles.

Sixth layer: Features of this layer were almost the same as the previous layer, except that its color was darker.

Seventh layer: This layer contained small and rounded sands, large and small semi-round to angular destructive particles, and 30% to 80% gravel with quartz, feldspar, and fine clay particles. It had negative skewness and ranged from well sorted to moderately sorted. This sediment originated from several sources. There was a small number of the Sialk III4–5 pottery in this layer.

Eighth layer: Due to the presence of iron oxide and limonite minerals, this layer is red in color. Green spots and bands were seen in this layer, which indicates the regeneration of trivalent ions against the roots of plants or organic materials. Carbonaceous materials, manganese oxide, and sulfur were also present. The particles had positive skewness and were poorly sorted. The sedimentation occurred in a low-energy environment.

Pit D

This pit was dug in the southwest quadrant of the site, between the engine room and the mud-brick wall on the south of the mound of Mafin Abad. Excavation of the pit was stopped at a depth of 4.75 m below the ground level (Figures. 6 & 8).

First layer: This topsoil was 50 cm thick and had alluvial, rotating, and angular particles. Further, evaporative particles and sulfur were present in the texture of this layer and calcium carbonate caused adhesion between the particles.

Second layer: It was a 3.5 m thick layer of dense silty and red clay sediments. The red color of this layer is due to iron oxide and limonite minerals. These sediments were composed of feldspar decomposition. Further, coarse-grained destructive particles were found in this layer, but in the test sample, there was more than 67% silt and less than 10% sand. This indicates that the ambient energy has been very low. We know that the granular particles of silt and clay are suspended in the flowing water, settle, and deposit after the intensity of the flow decreases (Folk, 1974: 3). These sediments are alternately seen with layers of coarse-grained sediments carried and deposited by turbidite or tensile currents (Selley, 1996: 126).

Third layer: This layer, similar to the seventh layer of Trench C, was probably a flood layer that led to the abandonment of the Mafin Abad settlement. The third layer had sharp and angular destructive particles. The size of the sand grains was fine and most of the grains were round and semi-round. In this layer were quartz, feldspar, and fine clay particles. Since the sediment originated from several different sources, the particles were of different sizes. This sediment had negative skewness and was well to moderately sorted. In this layer, sherds of the Sialk III4–5 pottery were found.

The pottery of this layer had a red core and a pale brown and pale red coating. It was decorated with vegetal motifs and parallel and zigzag lines, typical to the Sialk III4-5 culture. Due to the depth of this layer and its chronology, which is later than the central and western parts of the site, it seems that the settlement in this period was moved to the southern part of the site. The density of pottery in this layer was higher than in Trenches A, B, and C. At a depth of 25 cm from the top of the layer, coarse pottery was found, with hand- and wheel-made techniques, mostly with insufficient firing. The painted pottery was invariably made of a fine or medium fabric, and the decorative patterns consisted of geometric, vegetal and animal (leopard tail) motifs (Figure. 9).

Figure. 8: *Mafin Abad: The stratigraphy of Pit D. The second layer consists of dense clay sediments with a thickness of 3.5 m*

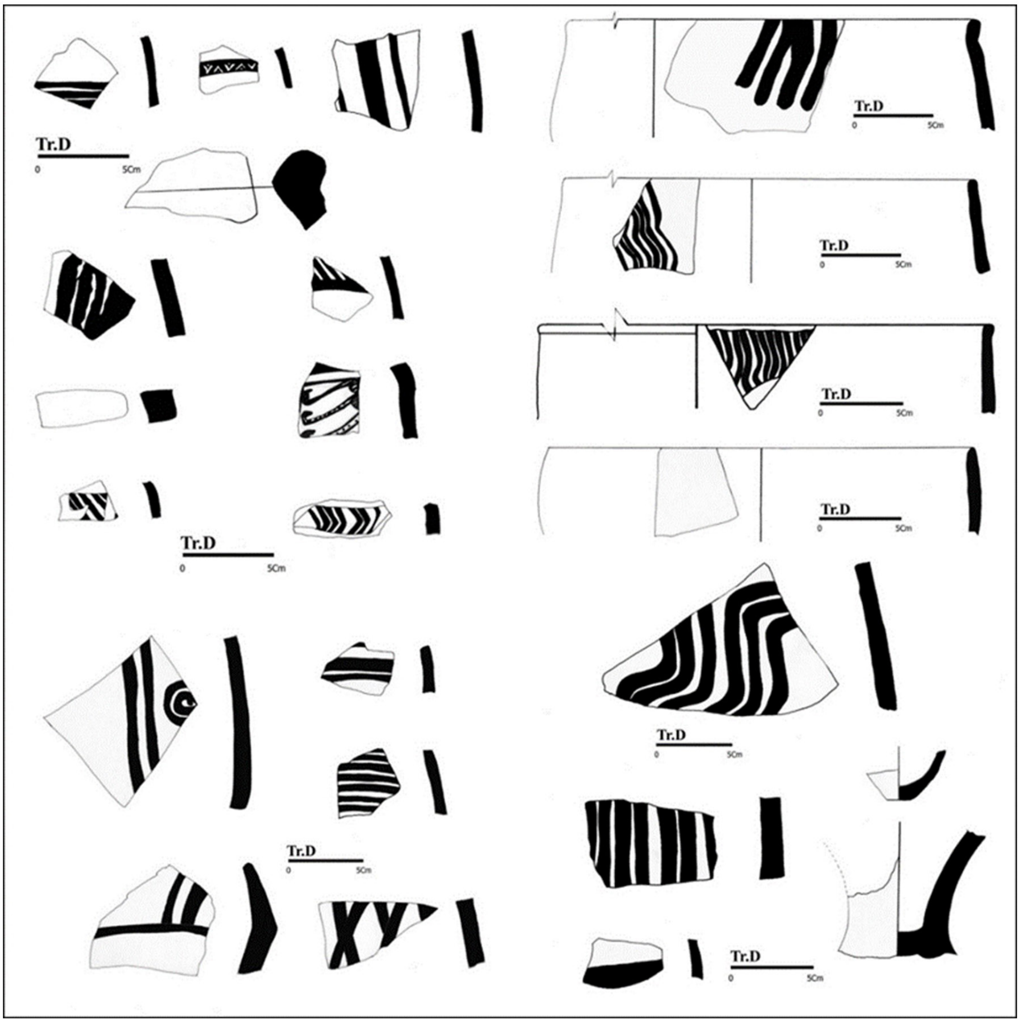

Figure. 9: *Mafin Abad: Decorative patterns on the Sialk III4–5 pottery from Pit D*

Fourth layer: This was a layer of fine-grained gray soil and sand mixed with the Sialk III4–5 pottery (Figure. 9). The gray color indicates the oxidized compounds of the organic matter of the sediments. These materials are mostly formed in regenerative environments and areas where there is not enough oxygen, such as swamps and closed environments (Brookfield, 2008: 15). Besides, the fourth layer contained organic matter, manganese oxide, and sulfur. This fine-grained sediment suggests a low-energy environment.

Discussion

While proximity to water sources was the most important factor in locating prehistoric settlements, it at the same time presented a threat during periods of intensifying climate change-related atmospheric hazards due to torrential rains and river floods (Chaychi Amirkhiz & Shaikh Baikloo, 2020; Rashidian, 2021a). Among the climatic hazards in Iran, flooding is more frequent and its occurrence increases during periods of climate change (Shaikh Baikloo, 2021b). Research on alluvial fans of Jajroud (Varamin, Tehran province) and Haji Arab (Buin Zahra, Qazvin province) indicates the distribution and displacement of prehistoric settlements were contingent on river flows (Gillmore *et al*, 2011; Schmidt *et al*, 2011; Maghsoudi *et al*, 2012, 2013). Droughts and floods were the primary factor in changing the distribution patterns of human settlements. Massive river floods, such as the Qomroud flood in the mid-fourth millennium BCE, could have led to the complete abandonment of an area for several centuries or millennia (Kaboli, 1999: 83).

Prehistoric villages were usually erected in fertile areas and alluvial fans. These areas, however, would turn into unsafe environments for agricultural communities due to the flooding of rivers during extreme rainfalls. Paleoclimate research shows that during the Sialk III period (4200–3400 BCE), abrupt climatic changes occurred. According to GISP2, after the trend of increasing temperature from the early sixth millennium BCE (Sialk I) to the mid-fourth millennium BCE (early Sialk III6–7b), the temperature suddenly dropped. This cooling period has lasted for almost two centuries (Alley, 2004b). Apparently, the humidity has increased during this period.

According to the environmental sedimentology of Mafin Abad, the ancient river adjacent to the site probably overflowed in the late Sialk III4–5 or the early Sialk III6–7b period. Then a huge volume of sediments (without stones) covered the Sialk III4–5 cultural layer. Judging from the characteristics of the level sealing the flood layer, this area was perhaps a wetland for some time, though the claim should be verified by laboratory studies. Torrential rains may have caused floods and the destruction of the prehistoric village at the late Sialk III4–5 or the early Sialk III6–7b period. The Ahmad Abad settlement in Varamin declined around the mid-fourth millennium BCE (Sialk III6–7b). Tepe Shoghali was inhabited during the Sialk II, III, and IV periods, but due to the horizontal stratigraphy of the settlement, it is not possible to speak with certainty about the continuity of settlement during the sixth to fourth millennium BCE. Morteza Gerd was inhabited up to the Sialk III4–5, and Parandak1, Qara Tepe of Shahriyar, Fakhr Abad, and Pouienak were inhabited up to the Sialk III1–3. Further, meager evidence of Sialk III6–7b comes from Chakhmaq Tepe. Chaltasian was inhabited from late Sialk III4–5 to late Sialk III6–7b. Tepe Sofalin and Maimanat Abad flourished during Sialk III6–7b and Sialk IV. It seems that Maimanat Abad was formed after the abandonment of Mafin Abad. Surveyed sites of Sadegh Abadi and Mehdi Khani and excavated sites of Tepe Pardis and Farhangian were inhabited during Sialk III4–5 and were then abandoned until the Iron Age.

Based on the works carried out in Qazvin (Fazeli, 2006), a plain characterized by a semi-arid terrain unlike the Tehran plain, the number of settlements there in Sialk III1–3 reduced to 2 sites (Tepe Ghabristan and Tepe Mahmoudian), and in Sialk III4–5 to only a single site (Tepe Ghabristan). In Sialk III6–7b, the number of sites again rose to 6 (Tepe Ghabristan, Tepe Ismael Abad, Tepe Zagheh2, Tepe Miyan Palan, Tepe Mansour Abad, and Tepe Ebrahim Abad), which is in contrast to the Tehran Plain. The flourishing phases of the Sialk III in the Tehran plain seem to be related to layers 4 and 5. At this time, the Mafin Abad village had reached its maximum area (ca. 5.5 ha).

Conclusion

Paleoclimate research in the Near East, especially in Iran, indicates the occurrence of climatic oscillations during the fourth millennium BCE. These episodes with increasing extreme weather events such as heavy rains and severe droughts could have devastating environmental impacts on the vulnerable region of North Central Iran, which generally has an arid and semi-arid climate. Evidence of extremes has been discovered in the stratigraphy of some sites in this cultural sphere. The uprising of the Karaj, Qomroud, and Qara Chay rivers in the mid-fourth millennium BCE caused flooding of land and the collapse of the rural settlements. Thus, many villages were abandoned and then new villages emerged. These weather hazards related to unstable climate conditions between Sialk III4–5 and Sialk III6–7b can be traced. Therefore, it seems that after the Sialk III4–5 cultural boom, North Central Iran faced frequent climatic and environmental crises, which eventually led to a prolonged cultural decline in the late fourth millennium BCE.

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