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RESEARCH ARTICLE

Neolithic Analysis of the Southern High Zagros: Khanmirza Basin (Chaharmahal and Bakhtiari)

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Abstract

This study examines the process of Neolithisation in the southern High Zagros, with particular focus on the Khanmirza basin in Chaharmahal and Bakhtiari Province, Iran. Despite extensive research in the northern and central Zagros, the southern sector has remained comparatively underexplored, resulting in significant gaps in our understanding of early settlement development in this mountainous region. Through systematic archaeological survey and settlement pattern analysis conducted over two field seasons, twenty Neolithic sites were identified, including several yielding both lithic and ceramic assemblages. The results indicate a gradual and locally adaptive transition from Epipalaeolithic lifeways to Neolithic subsistence strategies. Evidence from Qal'eh Rostam and other surveyed sites suggests seasonal occupation patterns, persistence of geometric microlithic traditions, and the emergence of coarse, plant-tempered pottery associated with early Neolithic phases. The spatial distribution of sites across plains, valleys, and upland zones points to a flexible settlement system likely incorporating vertical mobility and mixed subsistence practices, including pastoralism, limited cultivation, and continued hunting. The findings highlight the High Zagros as an active and regionally distinctive participant in the broader Neolithic transformation of Southwest Asia. The study underscores the need for targeted excavations and absolute dating programs to refine the chronological and cultural framework of Neolithisation in southern Chaharmahal and Bakhtiari.

Keywords: Neolithisation, High Zagros, Khanmirza, Settlement Patterns, Qal'eh Rostam, Central Zagros, Epipalaeolithic–Neolithic Transition

Introduction

The Chaharmahal and Bakhtiari region, particularly its southern areas, has been one of the key centers of human settlement since the Paleolithic period due to its favorable environmental conditions. The geographical features of this region, including abundant water resources, open plains, and suitable pastures, have long provided an ideal setting for agricultural and pastoral activities. These capacities enabled the development and continuity of the two main sedentary livelihood strategies—animal husbandry and farming—for its inhabitants. In addition, the presence of strategic communication routes has been another important factor influencing the location and distribution of human communities in this area (Zagarell, 1982: 37).

Based on historical sources and travel accounts, the communication routes in this region, particularly through Lordegan, have played a key role in connecting southern and southwestern Iran with the eastern territories and the central plateau—a function that continues to the present day. In this study, the Neolithic archaeology and settlement sequence of the High Zagros, with a focus on southern Chaharmahal and Bakhtiari, are analyzed based on data obtained from field surveys. The geographical diversity of the region and its surroundings, including cold mountainous areas, temperate central zones, and hot, arid southern regions—has been a decisive factor in the formation and expansion of prehistoric settlements.

However, most prehistoric research has focused on cultural interactions between Fars and Khuzestan, while other regions have received considerably less attention. Studies conducted in Chaharmahal and Bakhtiari have also largely been limited to mountainous and foothill areas, leaving the southern parts of the province in need of comprehensive and systematic investigation. Therefore, for a precise analysis of the Neolithization process, it appears essential to study each region independently and subsequently provide a targeted, integrative analysis based on well-defined research questions.

As noted, despite the cultural richness of the region, prior to extensive field surveys and stratigraphic excavations, it was believed that Neolithic evidence in this area was limited to the Qal'eh Rostam site, which was investigated through stratigraphic excavation by Allen Zagarell. He argued that the ceramics from Qal'eh Rostam exhibit local regional characteristics and cannot be compared with any of the cultural areas of Fars or Khuzestan (Zagarell, 1982: 58). However, with the initiation of field surveys, it became clear that numerous contemporary and similar sites exist throughout the region, some of whose cultural materials are comparable with neighboring areas.

Most previous surveys and excavations, primarily aimed at identifying and documenting archaeological sites. In May 2024, the first author of this article, as part of a doctoral dissertation and with official permission from the Iranian Center for Archaeological Research (ICAR), conducted a comprehensive review of archaeological studies in the southern part of Chaharmahal and Bakhtiari Province, covering the counties of Lordegan, Khanmirza, and Falard. One of the main objectives of this new field research was to provide relative chronology and to map the archaeological sequence from the Paleolithic to the Bronze Age.

Additionally, the study aimed to examine the role of environmental variables in site selection and the formation of human habitats, conduct comparative analyses of surface finds, investigate cultural interactions, and explore both intra- and inter-regional connections. In the present article, the archaeological findings from Khanmirza County are introduced and analyzed in line with these research objectives.

Physiography of the Region

Chaharmahal and Bakhtiari Province, with an area of 16,532 km², is located between 31°09' and 32°48' N latitude and 49°28' and 51°25' E longitude (Greenwich Meridian), in the southern Zagros Mountains of southwestern Iran. The province is highly rugged, with mountains and hills covering approximately 74% of its area, while plains are limited in extent and mostly intermontane. The highest and lowest points are Zard-Kuh Peak at 4,211 m and the southern lowlands at around 711 m above sea level, respectively (Jafari, 1989: 27).

Khanmirza County borders Borujen, Kiar, Falard, Lordegan, Semirom, and Ardal counties, covering an area of approximately 936 km² (Fig. 1). The region comprises two distinct ecological zones: the northern part is mountainous and hilly, while the southern part consists of extensive, nearly flat plains (Fig. 2). The general geomorphological trend of this part of the Zagros runs northwest–southeast and is characterized by parallel valleys. The landscape, a combination of high mountains, deep valleys, and alluvial plains, supports diverse land uses (Zagarell, 1982: 27). The region's limestone mountains display diverse geological formations. Some, such as the Bakhtiari Conglomerate, are of particular importance for sourcing raw materials for stone tool production due to the quality of available lithic resources.

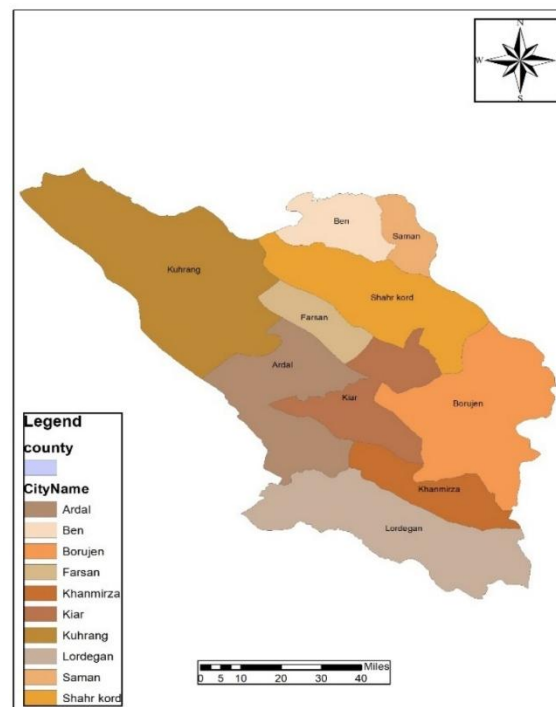


Figure 1. Location of Khanmirza County in Chaharmahal and Bakhtiari Province (Babamir Satehi, 2024a).

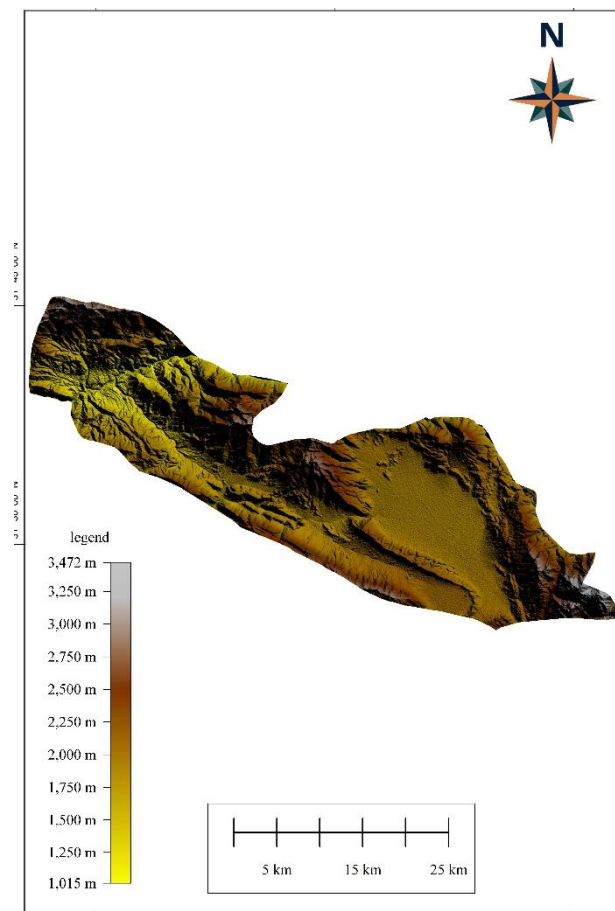


Figure 2. Topographic map of the study area (Babamir Sathi, 2024a).

Research Method

Field surveys in southern Chaharmahal and Bakhtiari were conducted considering the region's topography, extent, limitations, and archaeological potential. The study was primarily based on systematic area surveys, dividing the landscape into mountains, valleys, and plains. Surveys were planned according to available time, team size, and topographic conditions. 1:25,000 topographic maps were used for better spatial understanding, and all areas were systematically traversed. Archaeological site locations were recorded using GPS, and their geographic and environmental coordinates were noted.

The field survey was comprehensive and step-by-step, and all accessible areas, including plains, hills and hillocks, alluvial valleys, and passable mountain slopes, were surveyed. In the meantime, we also surveyed some of the difficult and very high-altitude areas where, according to local information, there were caves or rock shelter and there might be used as human habitation. Overall this field survey conducted by two groups of 5 who were familiar with the region's environment attempt to cover all the area of the surveyed region, which left only limited unsurvey areas.

After nearly a century has passed since archaeological studies became a scientific discipline, there is still no agreement regarding the exact characteristics and criteria that define an archaeological site. During two intensive survey seasons conducted in the southern part of Chaharmahal and Bakhtiari Province, area contains sufficient concentration and diagnostic significance of recovered cultural materials to warrant classification as evidence of human occupation was considered an archaeological site. It should be noted that numerous were encountered which, due to limited quantity of cultural materials and their dispersed distribution, were classified either as nomadic temporary campsites (Vārgah) or off-site non-site.

Although sampling was conducted randomly, archaeological materials, particularly lithics and ceramics, were collected. Typological and chronological criteria guide ceramic sampling. After each survey, all collected ceramics were laid out in a “ceramic bank,” and only diagnostic samples were retained. Technical features, decoration, form, and chronological information of each piece were recorded in Excel for subsequent statistical and archaeological analyses. Site and mound distributions were also documented and analyzed based on settlement pattern survey methods.

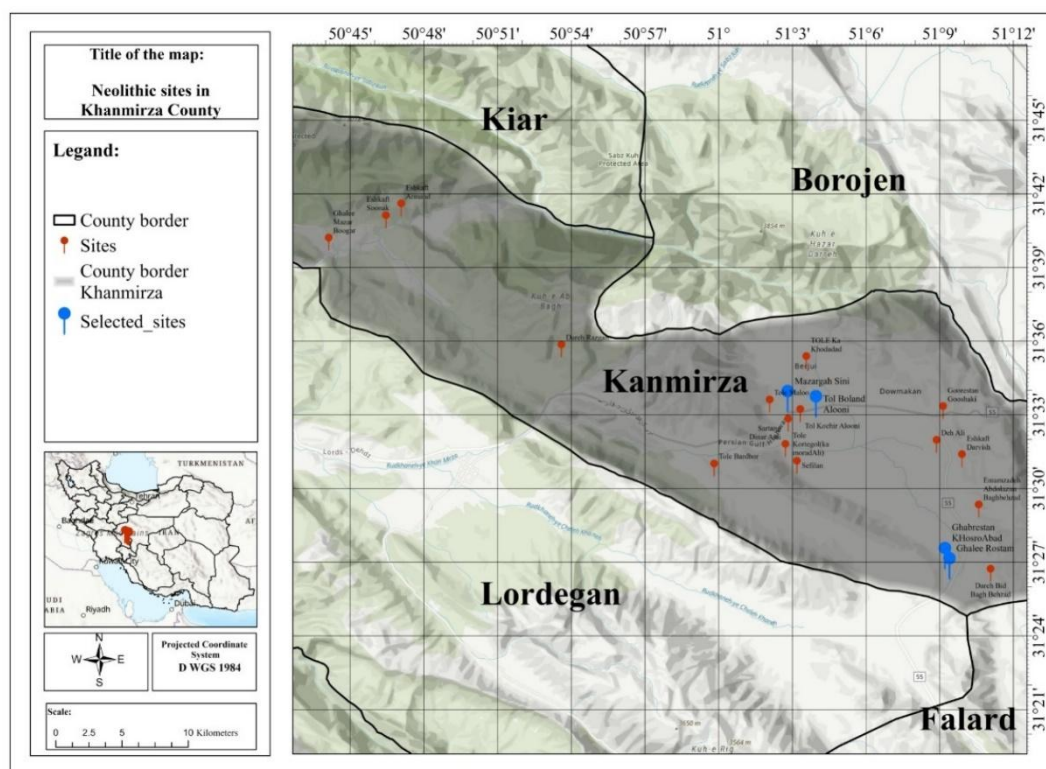


Figure 3. Distribution of Neolithic sites in the Khanmirza area (Babamir Satchi, 2024a).

Research Background

The High Zagros and the Bakhtiari-inhabited region, despite their considerable archaeological potential, have received comparatively limited scholarly attention. In this regard, Chaharmahal and Bakhtiari Province remains significantly less investigated than neighboring provinces such

as Khuzestan, Fars, and Isfahan (Nowrūzi & Heydari Dastenaee, 2018). Given the region's environmental capacity and strategic geographical position within the Zagros range, the process of Neolithization represents a crucial topic that merits systematic archaeological inquiry.

Archaeological research in the Bakhtiari region during the first half of the twentieth century was largely confined to parts of Khuzestan, while the highland areas received little attention. Travel accounts and early scholarly reports on the Bakhtiari uplands rarely mentioned the archaeological remains of the region. It appears that the lowland cultural centers of Khuzestan and Fars were considered more attractive to early archaeologists. Consequently, both fieldwork and theoretical research in Chaharmahal and Bakhtiari began considerably later than in adjacent regions, and early investigations were generally sporadic and short-term.

A major turning point was the four-season research project conducted by Allen Zagarell beginning in 1974 in Lordegan and Khanmirza counties. His work was exceptional in both scope and methodological rigor and played a decisive role in introducing the Bakhtiari highlands to broaden archaeological discourse. Zagarell's research focused on identifying prehistoric settlements, examining nomadic occupations, and evaluating the role of mobile pastoralism in the cultural developments of the Zagros (Zagarell 1982: 17). He argued that a nomadic archaeology approach could illuminate one of the most adaptive subsistence strategies developed in response to the Zagros environment.

Stratigraphic excavations at Qal'eh Rostam and Tappeh Gerd Chellehgah led to the initial reconstruction of the prehistoric cultural sequence of the region and its division into three principal phases (Nissen & Zagarell 1976). The cultural sequence established at Qal'eh Rostam became a key reference framework for Neolithic sites in the Bakhtiari highlands. Ceramics from Tappeh Gerd Chellehgah were largely compared with those of the Bakun B cultural horizon (Pottery Neolithic/Chalcolithic).

Following the Islamic Revolution, archaeological research in the region resumed after a fifteen-year hiatus. Although some investigations remained unpublished, excavations at sites such as Tappeh Gerdu Sofla and Tappeh Qanbari marked an important stage in the revival of archaeological studies in the province. Subsequent test soundings and regional surveys expanded archaeological documentation across several counties. Between 2007 and 2011, systematic survey programs identified hundreds of sites ranging from the Epipaleolithic to the Iron Age.

Setting aside several surveys and excavations whose reports were never published, the excavations at Gardu Sofla Mound in Kuhrang County and Qanbari Mound in Lordegan should be regarded as turning points in the initiation of archaeological research in Chaharmahal and Bakhtiari Province (Nowrūzi, 1995). Subsequently, trial trenches were conducted at Qal'eh Afghan Mound in Khanmirza as well as at several sites in Borujen and Boldaji (Nowrūzi, 1996, 1997). This was followed by several field survey programs in Borujen and an archaeological investigation of the Karun 4 Dam reservoir area (Nowrūzi, 2009: 165).

Between 2007 and 2011, nearly all regions of the province were subjected to archaeological survey. Three major survey projects in Lordegan (Rezvani, 2009), Khanmirza and Sardsh (Rezvani, 2010), and Armand and Manj (Rezvani, 2011) led respectively to the identification of 265, 150, and 102 archaeological sites dating to various periods, including the Epipaleolithic, Neolithic, Chalcolithic, and Iron Age. In addition, the archaeobotanical, zooarchaeological, and absolute dating studies of the remains recovered from the excavations at Qal'eh Rostam are particularly noteworthy (Daujat et al., 2016: 115).

Nevertheless, it must be acknowledged that most of the research conducted in Khanmirza lacked clearly defined scientific questions and was primarily aimed at the preliminary identification and documentation of sites. Existing reports indicate that the entire geographical extent of Khanmirza was not systematically surveyed, largely due to the vastness of the region. In some cases, archaeological teams refrained from investigating certain areas because of limited accessibility and survey constraints. Considering these shortcomings, challenges, and emerging research needs, the first author of the present article undertook, in 2024, a comprehensive reassessment of field studies in southern Chaharmahal and Bakhtiari, formulating explicit research questions with particular emphasis on the process of Neolithization.

Nevertheless, many investigations in Khanmirza lacked clearly defined research questions, and substantial portions of the region remained insufficiently surveyed due to logistical and accessibility constraints. In response to these gaps, a comprehensive reassessment of archaeological fieldwork in southern Chaharmahal and Bakhtiari was undertaken in 2024, with particular emphasis on evaluating the Neolithization process through explicitly defined research questions.

The Study Area and the Concept of Neolithization

The concept of the “Neolithic” is among the most debated terms in archaeology. Since its introduction in the second half of the nineteenth century, scholars have disagreed over its definition and scope. Initially, the term primarily denoted technological change; however, by the early twentieth century it evolved into a multidimensional concept encompassing not only technological developments but also economic and social transformations. The transition from hunter-gatherer lifeways to village-based farming and herding societies has remained central to archaeological and anthropological research for over a century. In Iran, the Neolithic is generally associated with the emergence of sedentism and the domestication of plants and animals (Hole, 1987). The Zagros region holds particular significance for examining the technological, economic, and even mobile pastoral dimensions of this process.

Today, “Neolithization” is no longer confined to the transition from the Epipaleolithic to the Neolithic or to developments such as food production, permanent settlement, and pottery manufacture. Rather, it is understood as a long-term and complex process extending into the Chalcolithic period (Zeder & Smith 2009; Robinson et al., 2011). It encompasses chronology, technology, social organization, demography, belief systems, and even cognitive transformations (Whittle, 1996). Consequently, defining its precise beginning and end is

challenging; it is best approached as a dynamic social process—a perspective particularly relevant to southwestern Iran and the present study area.

Nevertheless, analyzing Neolithization within regional and supra-regional frameworks requires robust and stratified datasets. The scarcity of extensive excavations and the reliance on surface surveys remain major obstacles. Interpretations must be situated within broader theoretical models that identify Southwest Asia as a “core zone” of Neolithic development (Özdoğan, 2005). Alternative perspectives emphasize gradual learning processes and the transmission of technologies and subsistence practices through regional interaction networks (Whittle 1996).

Agriculture has been interpreted as a process of energy management and post-glacial human adaptation. Diffusionist models attribute its spread to the migration of farming communities; ancient DNA studies suggest that the expansion of agriculture into Europe was largely driven by movements of populations from Anatolia and Southwest Asia (Haak et al., 2010). Other studies stress endogenous development, whereby local communities adopted innovations through experimentation, risk-taking, and cultural interaction (Lichter, 2005). Neolithization thus appears to have resulted from a combination of these mechanisms and must be evaluated within its specific environmental and historical context.

Recent and ongoing research has demonstrated that in the steppes, foothills, and highland plains of the Zagros–Taurus arc—encompassing western Iran, eastern and northeastern Iraq, and southeastern Turkey—there existed centers that experienced Neolithization parallel to the Late Pleistocene–Early Holocene developments in the Levant. Although interconnected, these centers appear to have followed relatively independent and distinctive trajectories rather than being solely influenced by a single external core.

A key factor in this process was the presence of wild progenitors of many later domesticated species, including goat, sheep, pig, and cattle, as well as wild cereals and legumes in Early Holocene Iran. These ecological advantages coincided with favorable rainfall patterns and cultivable alluvial plains, conditions that were attractive and sustainable for early farming communities even in the absence of irrigation systems (Zohary & Hopf, 2000). Consequently, these regions are as significant as the southern Levant for understanding the origins of agriculture, storage practices, and the emergence of sedentary communities.

In examining the spread of the Neolithic lifeway across Iran, it is useful to distinguish several geographical zones: the Central Zagros; the Northern Zagros and Azerbaijan; the Southern Zagros and Khuzestan; Fars and the south; the Central Plateau; the northeast; and the southeast. Evidence suggests that Neolithization in each of these regions developed under specific environmental and cultural conditions. The Central Zagros, in particular, may be considered a “core zone” in which human groups underwent Neolithization without strong external influence.

The notion that the Neolithic “revolution” began later in Iran than elsewhere (Hole, 1999) likely reflects the relative scarcity of systematic research compared to Iraq, Turkey, and the

Levant rather than actual chronological delay. Factors such as heavy sedimentation and the lack of intensive, systematic surveys have hindered the identification and excavation of transitional Neolithic sites (Darabi & Fazeli Nashli, 2009). Nevertheless, recent excavations at sites such as Sheikh-e Abad, Chia Sabz-e Sharqi, and Chogha Golan have underscored the importance of the Central Zagros in the earliest stages of the Neolithic.

Recent surveys in the present study area—situated within the Central Zagros—have likewise identified significant sites whose targeted excavation would substantially enhance our understanding of the Neolithization process in this part of the Zagros region.

Research Findings

The materials recovered from field surveys in the Khanmirza area primarily consist of ceramic fragments and lithic artifacts. Only a limited number of sites yielded both categories of material simultaneously. Over the course of two survey seasons, a total of twenty Neolithic sites were identified in the study area, of which only five produced both lithic and ceramic assemblages. This section presents and analyzes the findings from four significant settlement sites in accordance with the objectives and research questions of the present study.

- Qal'eh Rostam Sileh

The site of Qal'eh Rostam Sileh holds particular importance for the study of the Iranian Neolithic, as it represents one of the earliest known high-altitude settlements in the High Zagros along the southern margin of the Iranian Central Plateau. The mound is located near the village of Sileh, within agricultural fields on the plain, at an elevation of 1,968 m above sea level. Settlement at nearly 2,000 m implies long and severe winters, raising important questions about the ecological and economic factors that made this area attractive during the Neolithic period. The site currently covers approximately 0.6 hectares (Fig. 4A).

The mound was first identified in 1974 during surveys conducted by Allen Zagarell. It is circular in shape, measuring about 50 m in diameter and rising roughly 2 m above the surrounding terrain. Recent observations indicate that both its original extent and height have been reduced due to neglect and modern disturbances, and the surface has been considerably leveled.

Ceramic sherds and lithic artifacts are widely scattered across the surface (Fig. 4B-D). The ceramic assemblage can be classified into three main groups. The first group consists of coarse, plain, and porous wares with a fragile texture. The temper includes vegetal and mineral inclusions, and firing was incomplete. These ceramics likely date to the Early Neolithic. The second group comprises red Neolithic wares containing calcareous particles and a combination of vegetal temper and red sand. The most common forms are large, open-mouthed bowls. The third group includes buff-colored wares with predominantly vegetal temper, occasionally mixed with mineral inclusions. The cores are incompletely oxidized, appearing gray to black. Some vessels are decorated with red-painted motifs, primarily geometric designs such as zigzag bands, concentric checkerboard patterns, hatched squares, and concentric curved lines (Fig. 5). A few unusual anthropomorphic motifs are also present. The cultural materials of Phase I

represent a newly recognized phenomenon and suggest a previously unidentified stage of the Neolithic sequence in the Bakhtiari region (Table 1).

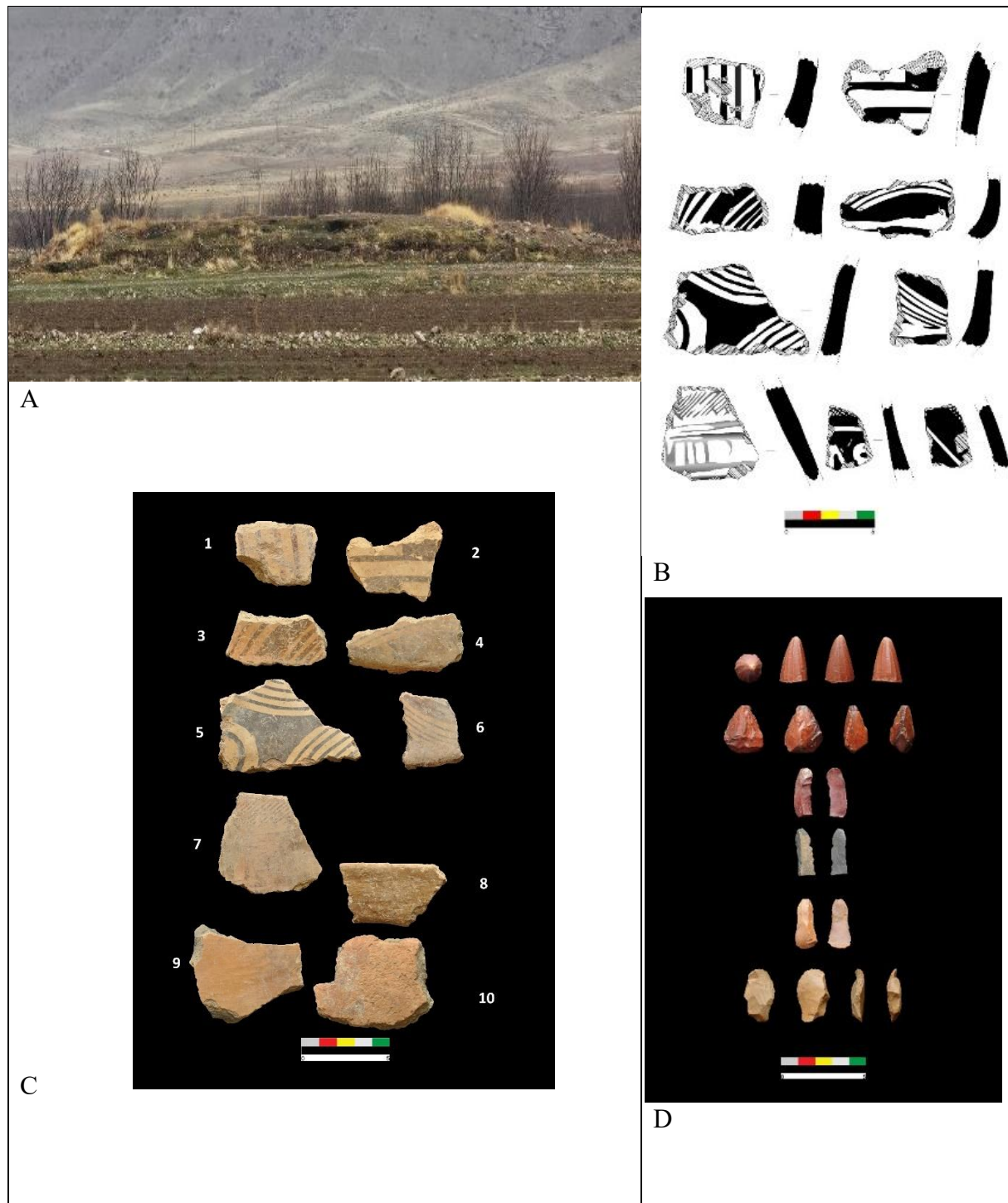


Figure 4. The Qal'eh Rostam and surface finds recovered from the site: A: Site; B: Neolithic pottery design; C: Neolithic potsherds; D: Stone Tools (Babamir Satehi, 2024a, 2024b).

Table 1. Descriptive Analysis of the Pottery Assemblage from Qal'eh Rostam Khanmirza.

Catalog Number	Description	Image of Potsherd	Comparative Parallels
1	Ware Type: Buff ware; Fragment/Form: Body Sherd; Paste Color: Buff; Thickness: Medium; Manufacture Quality: Well made; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Adequate / Well fired; Decoration: Painted, Geometric, Vertical Lines.		----
2	Ware Type: Buff ware; Fragment/Form: Body Sherd; Paste Color: Buff; Thickness: Medium; Manufacture Quality: Well made; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Adequate / Well fired; Decoration: Painted, Geometric, parallel horizontal lines.		 Khanipour, 2017: 160
3	Ware Type: Buff ware; Fragment/Form: Body Sherd; Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Medium; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Inadequate / Poorly fired; Decoration: Painted, Geometric, diagonal lines.		 Khanipour, 2023: 69
4	Ware Type: Buff ware; Fragment/Form: Lower body sherd (toward base); Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Medium; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Poorly fired; Decoration: Painted, Geometric, Fine diagonal lines.		----
5	Ware Type: Buff ware; Fragment/Form: Lower body sherd (toward base); Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Medium; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Well fired / Adequate; Decoration: Painted, Geometric, hatching lines.		----
6	Ware Type: Buff ware; Fragment/Form: Lower body sherd; Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Medium; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Poorly fired; Decoration: Painted, Geometric, diagonal lines.		----
7	Ware Type: Buff ware; Fragment/Form: Lower Rim sherd; Paste Color: Buff; Thickness: Medium; Manufacture Quality: Medium; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Well fired / Adequate; Decoration: Painted, Geometric, hatching lines.		 Malek Shahmirzadi, 2011: 53

8	Ware Type: Brown ware; Fragment/Form: Rim sherd; Paste Color: Brown; Thickness: Medium; Manufacture Quality: Poor; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Poorly fired; Decoration: Unpainted.		----
9	Ware Type: Orange ware; Fragment/Form: Body sherd; Paste Color: Orange; Thickness: Medium; Manufacture Quality: Well made; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Well fired / Adequate; Decoration: Unpainted.		----
10	Ware Type: Orange ware; Fragment/Form: Body sherd; Paste Color: Orange; Thickness: Medium; Manufacture Quality: Poor; Slip: Thin; Temper: Fine white inclusions; Manufacturing Technique: Handmade; Firing: Poorly fired; Decoration: Unpainted.		----

In 1975, a brief sounding was conducted over several days through the excavation of two trenches, designated A and B, each measuring 1 × 5 m. These trenches were opened in the northwestern sector at the highest point of the mound. Excavation followed a metric method, with deposits removed in 10–15 cm arbitrary levels. The thickness of the Neolithic deposits in these trenches was reported to be approximately 4 m.

Laboratory analyses of the recovered materials suggest that the site was likely occupied on a temporary basis. According to the studies of Bernbeck, Nissen, and Zagarell, the settlement was probably inhabited from early spring to autumn and was not suitable for winter occupation. It is worth noting that the region continues to experience extremely cold and frosty winters today. Permanent occupation therefore appears unlikely, as the area does not naturally provide favorable conditions for animal husbandry unless adequate shelter and fodder were secured for livestock throughout the long and severe winter season.

These groups may have practiced a form of vertical transhumance or mobile pastoralism, involving cyclical movement from lowland villages to highland camps in order to secure sufficient pasture for their herds. Alternatively, they may have followed a nomadic pastoral system characterized by high mobility along vertical or horizontal routes. This pattern of seasonal mobility is still observed today in areas near the site, including Chenar, Rig, and Shirmard.

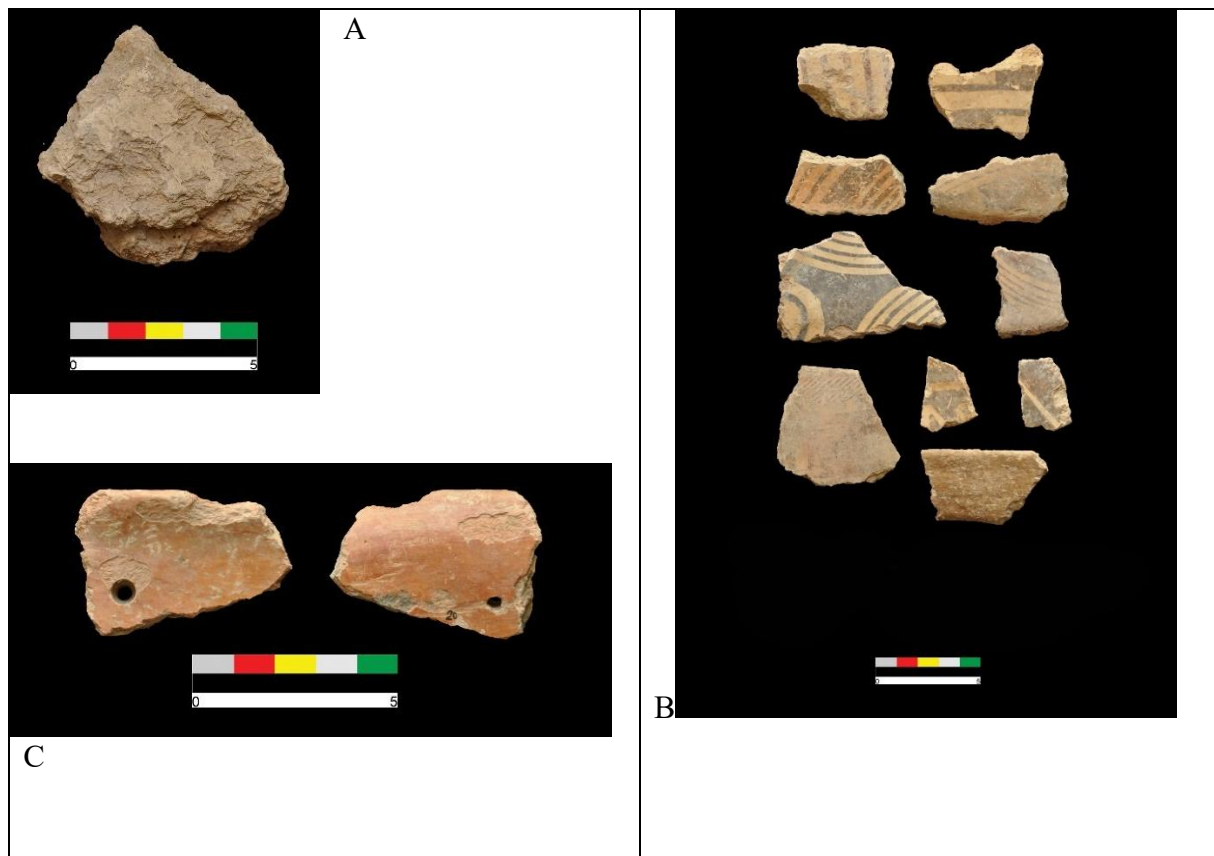


Figure 5. Ceramic Groups I, II, and III (A, B, and C) recovered from the Qal'eh Rostam Khanmirza site (Babamir Sathi, 2024a).

- Tall-e Boland-e Aluni Site

This site consists of a high mound with a conical shape, the eastern slope of which is more elongated (Fig. 6A). The surface of the conical mound is oval; its long and short diameters are approximately 16 m and 13 m, respectively, oriented west-east. The mound is located near the town of Aluni, about 130 meters from the Aluni–Deh-Sahra road, with an elevation of 1,846 meters above sea level. The distribution of cultural materials, including pottery and stone tools, across the mound and surrounding lands is extensive (Fig. 6B; Table 2). The surrounding land is primarily used for irrigated agriculture. Evidence of multiple illegal excavations on the mound, as well as a cross-section in its northern part, represents damage to the site.

The stone artifacts from the site consist of a few simple, unretouched stone tools. A core was also recovered, from which flakes were removed vertically; repeated flaking has shaped it into a trapezoidal form, apparently used as a bilateral scraper (Fig. 6C).

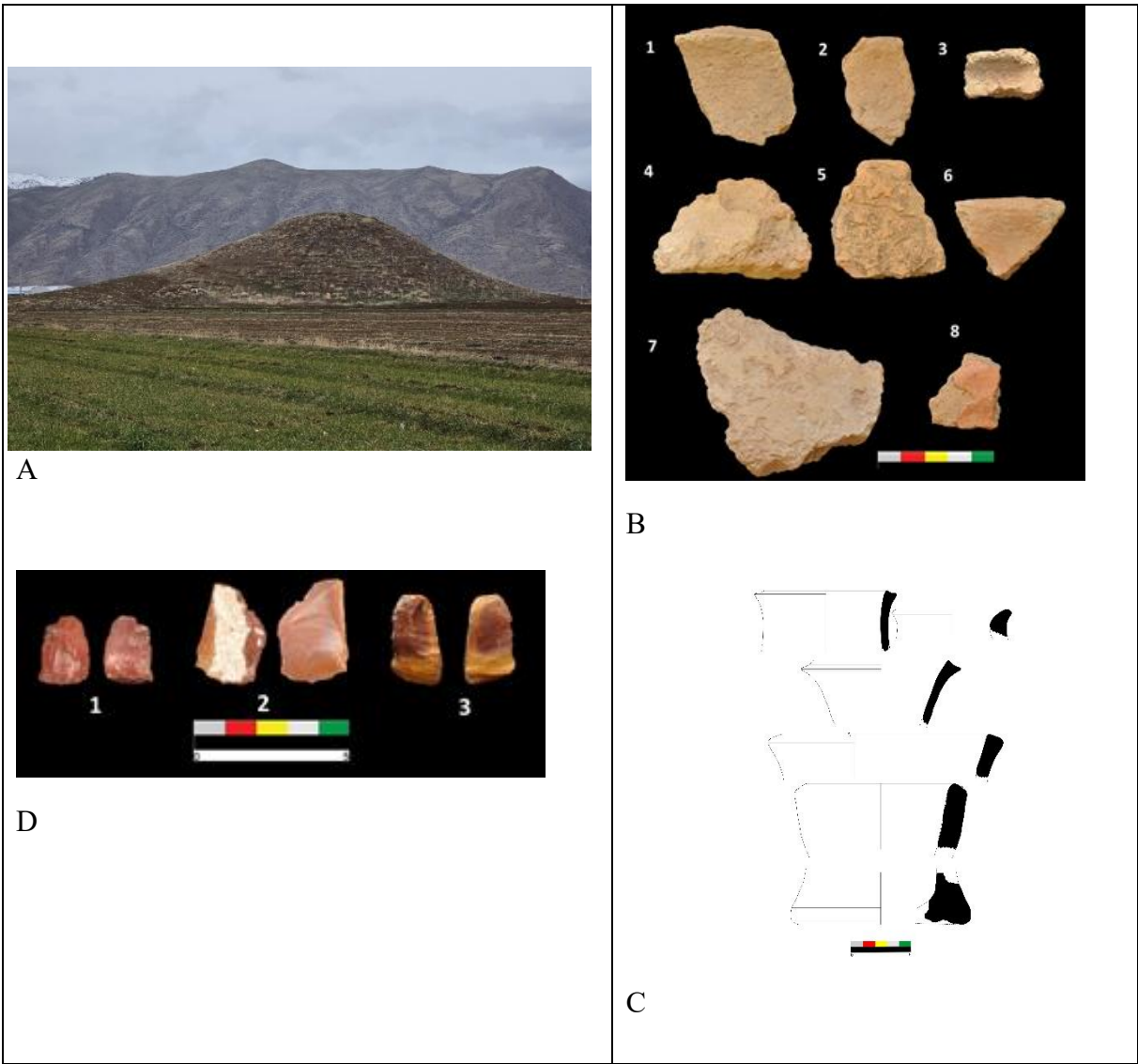


Figure 6. The Tal Boland Aluni and surface finds recovered from the site (Babamir Sathi, 2024a).

Table 2. Description of Ceramics from the Tal Boland Aluni Khanmirza Site (Babamir Sathi, 2024a).

Catalog Number	Description	Image of Potsherd	Comparative Parallels
1	Ware Type: Buff ware; Fragment/Form: Rim; Paste Color: Buff; Thickness: Medium; Manufacture Quality: Low-quality; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Inadequate; Decoration: Unpainted.		 Darabi, 2018: 35
2	Ware Type: Buff ware; Fragment/Form: Body Sherd; Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Low-quality; Slip: Thin; Temper: Mineral; Manufacturing		

	Technique: Handmade; Firing: Inadequate; Decoration: Unpainted.		Darabi, 2018: 35
3	Ware Type: Buff ware; Fragment/Form: Rim; Paste Color: Orange; Thickness: Medium; Manufacture Quality: Medium; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Adequate; Decoration: Unpainted.		----
4	Ware Type: Buff ware; Fragment/Form: Body; Paste Color: Buff; Thickness: Medium; Manufacture Quality: Low-quality; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Poorly fired; Decoration: Unpainted.		 Pourmomeni, 2023: 70
5	Ware Type: Buff ware; Fragment/Form: Rim; Paste Color: Orange; Thickness: Medium; Manufacture Quality: Low-quality; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Inadequate; Decoration: Unpainted.		 Malek Shahmirzadi, 2011: 66
6	Ware Type: Buff ware; Fragment/Form: Rim; Paste Color: Light Orange; Thickness: Thin; Manufacture Quality: Well-made; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Adequate; Decoration: Unpainted.		 Malek Shahmirzadi, 2011: 59
7	Ware Type: Buff ware; Fragment/Form: Body; Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Low; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Inadequate Decoration: Unpainted.		 Malek Shahmirzadi, 2011: 69
8	Ware Type: Brown ware; Fragment/Form: Body; Paste Color: Orange; Thickness: Medium; Manufacture Quality: Well-made; Slip: Thin; Temper: Mineral; Manufacturing Technique: Handmade; Firing: Adequate; Decoration: Unpainted.		 Darabi, 2024: 45

- Mazargeh Sini / Sini Cemetery Site

This site is a small natural mound with a circular shape, approximately 55 m in diameter and about 3 m high relative to the surrounding terrain, located at the entrance of Sini village (Fig. 7A). The mound is near the Aluni–Lordegan road and the entrance to Sini village, with an

elevation of 1,851 meters above sea level. The surface of the mound has been used as a cemetery for roughly the past 200 years.

Cultural materials include Neolithic (Early and Middle) pottery fragments, flakes, cores, and stone tools (Fig. 7B). The distribution of these finds is concentrated mainly in the cultivated lands east of the mound, as well as in agricultural fields across the paved road to the west. This indicates that part of the western side of the mound has been lost due to road construction.

The lithic assemblage of the site is divided into two categories: 1) Simple artifacts; 2) Retouched artifacts. The first category includes unretouched cores of conical, semi-conical, cylindrical, and sub-cartridge shapes. Flakes, tools, microblades, and microliths were removed from these cores. The cores feature striking platforms in circular and triangular shapes. Their ventral surfaces are smooth and mostly retain primary cortex. Flaking was mainly performed on the dorsal surfaces. Some tools resemble awls with curved tips. Red, gray, cream, and smoky chert were used in manufacturing these artifacts. The approximate chronological assignment of these artifacts likely spans the Late Epipaleolithic and Neolithic periods (Fig. 7C).

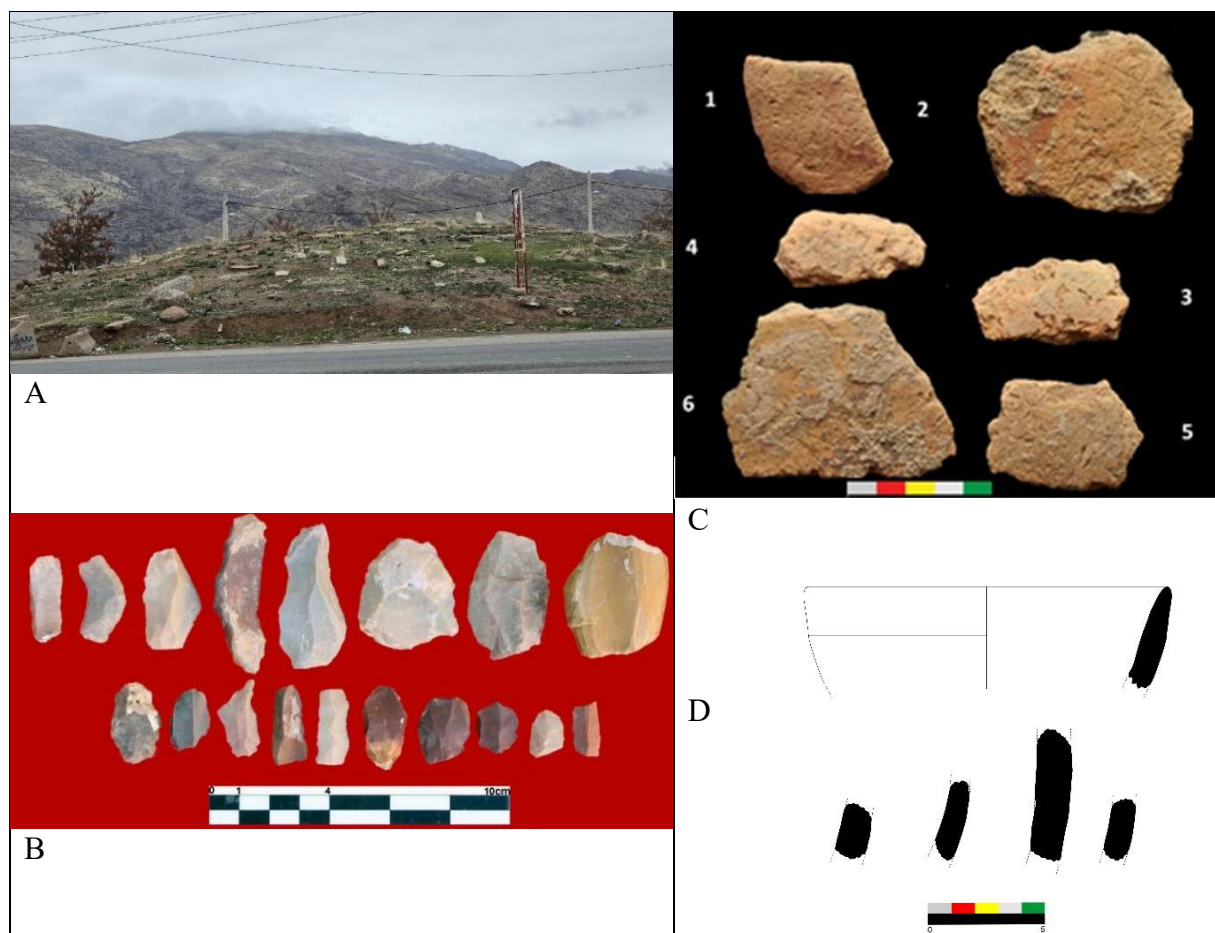
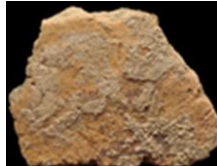


Figure 7. Sini Cemetery (Mazargeh Sini) Site and Surface Finds (Babamir Satehi, 2024a, 2024b).

Table 3. Description of the pottery from the Sini Cemetery site, Khanmirza.

Catalog Number	Description	Image of Potsherd	Comparative Parallels
1	Ware Type: Buff ware; Fragment/Form: Rim; Paste Color: Brown; Thickness: Medium; Manufacture Quality: Low; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Inadequate; Decoration: Unpainted.		 Khanipour, 2017: 69
2	Ware Type: Buff ware; Fragment/Form: Body Sherd; Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Low; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Inadequate; Decoration: Unpainted.		 Malek Shahmirzadi, 2011: 66
3	Ware Type: Buff ware; Fragment/Form: Body Sherd; Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Low; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Inadequate / Poorly fired; Decoration: Unpainted.		 Mohammadifar et al., 2003: 35
4	Ware Type: Buff ware; Fragment/Form: Lower body sherd (toward base); Paste Color: Light Buff; Thickness: Medium; Manufacture Quality: Medium; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Poorly fired; Decoration: Unpainted.		----
5	Ware Type: Buff ware; Fragment/Form: Body sherd; Paste Color: Brown; Thickness: Medium; Manufacture Quality: Low; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Inadequate; Decoration: Unpainted.		 Heydari Dastenayi, 2017: fig. 3
6	Ware Type: Buff ware; Fragment/Form: Body sherd; Paste Color: Brown; Thickness: Medium; Manufacture Quality: Low; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Poorly fired; Decoration: Unpainted.		----

- Khosrowabad Cemetery

This site has an irregular geometric shape and is located approximately 5 meters from the Sileh–Javanmardi road. The surface of the site has been used as the cemetery of the inhabitants of Khosrowabad village; consequently, it is covered with both old and modern tombstones. The site measures approximately 50 m in length, 30 m in width, and 2 m in height relative to the surrounding terrain (Fig. 8A). The southern part of the site has been disturbed by agricultural activities, and parts of its surface have been leveled. The mound is situated near the

Khosrowabad–Sileh road, with an elevation of 1,922 meters above sea level. Pottery fragments recovered from the surface are buff and orange in color, and according to relative chronology, they date to the Early and Middle Neolithic periods (Fig. 8B). The lithic assemblage includes conical, semi-conical, cylindrical, and sub-cartridge cores, as well as flakes, tools, microblades, and microliths. Red, gray, cream, and smoky chert were used in the manufacture of these artifacts. The approximate chronological assignment of these artifacts likely spans the Late Epipaleolithic and Neolithic periods (Fig. 8C; Table 4).

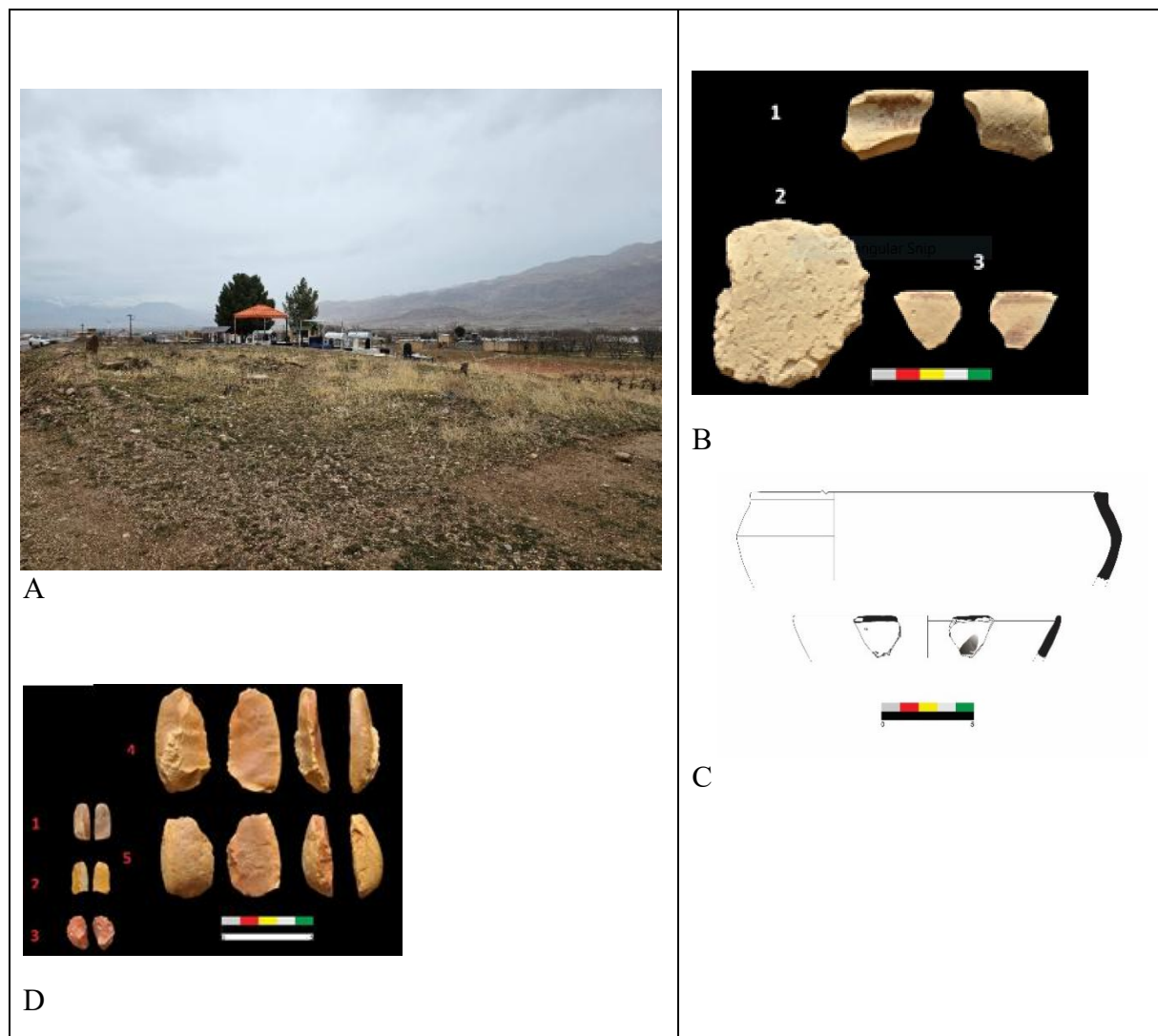


Figure 8. Khosrowabad Cemetery and surface finds (Babamir Satehi, 2024a).

Table 4. Description of the Pottery from the Khosrowabad Cemetery, Khanmirza.

Catalog Number	Description	Image of Potsherd	Comparative Parallels
1	Ware Type: Buff ware; Fragment/Form: Rim; Paste Color: Light Buff; Thickness: Thin; Manufacture Quality: Well made; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Adequate / Well fired; Decoration: Painted, bold horizontal lines.		 Zagarell, 1982: 203
2	Ware Type: Buff ware; Fragment/Form: Body Sherd; Paste Color: Buff; Thickness: Medium; Manufacture Quality: Low; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Inadequate; Decoration: Unpainted.		 Balmaki, 2018: 215
3	Ware Type: Buff ware; Fragment/Form: Rim; Paste Color: Light Buff; Thickness: Thin; Manufacture Quality: Well-made; Slip: Thin; Temper: Plant (Organic); Manufacturing Technique: Handmade; Firing: Adequate; Decoration: Painted, geometric motifs below the rim of the vessel.		----

Let us now further analyze the findings of the present fieldwork within the broader framework of Neolithization. The study of Neolithization in Iran is far more complex than in neighboring regions. Frank Hole attributed the origins of Neolithization in western Iran to the western Fertile Crescent, suggesting that post-Younger Dryas vegetation recovery in the Levant occurred faster than in the Zagros. This population movement from the west into Iran led to the establishment of the earliest Neolithic sites, including Ganj Dareh, Ali Kosh, Guran, and Abdol Hossein (Hole, 1999: 22).

Until a few decades ago, research on the Neolithic in the Central Zagros relied heavily on 1960s–1970s studies emphasizing regional formation, diffusion of Neolithic packages, and migration-driven innovation transfer. These studies focused primarily on domestication and sedentism (Braidwood, 1961), leaving knowledge gaps regarding the continuity of Neolithization in later stages, such as the Pottery Neolithic. By the late 1970s, the Central Zagros and western Iran fell outside mainstream Neolithic research, with attention shifting to the western Fertile Crescent and the southern and northern Levant (Zeder, 2008: 243). Since then, only a handful of minor excavations and reassessments have taken place, with limited comprehensive research in the region. Most investigations involved repetitive surveys or extensive artifact collection, often lacking clear scientific questions or objectives.

This highlights the need for revisiting previous excavations and conducting new fieldwork to re-examine Neolithization in Central Zagros using modern approaches, including endogenous developmental factors and localized learning. Shifts in subsistence strategies across the Zagros appear partially driven by population growth, gradual climatic warming, and the

expansion of arable lowlands, which allowed communities to maximize resource use in favorable areas.

Conditions in the high Zagros, particularly in southern Chaharmahal and Bakhtiari, differ significantly. The lack of targeted, systematic fieldwork makes the excavation at Qal'eh Rostam essential. Stratigraphic analysis divides the Neolithic occupation into four main phases: Phases III and II (7100–6700 BCE) and Phases I and 0 (6300–6000 BCE). Although no ceramics were recovered from the deepest layers (pre-pottery Neolithic) (Nissen & Zagarell, 1976), information for Phase III remains limited, and excavation did not reach untouched deposits. Therefore, understanding the pre-pottery Neolithic in southern Chaharmahal and Bakhtiari currently relies on comparative modeling with western Zagros sites and lowland sites such as Guran, Chogha Bonut, Sarab, and Ali Kosh. Ceramic analysis indicates that Phases III and II at Qal'eh Rostam closely resemble western Zagros sites like Guran and Sarab, while Phase I potteries show only limited technical similarity with materials from the Kor Basin (Bernbeck, 2010). Zagarell's assessment of the distinctive nature of the pottery Neolithic in the Bakhtiari mountains remains a key reference (Zagarell, 1982: 27).

Evidence from Qal'eh Rostam suggests seasonal occupation from early spring to late autumn. Dental wear and age-at-death studies show two main slaughter periods: late summer–autumn for first- and second-year animals and spring for those at the end of year one and beginning of year two. This implies that the site was likely uninhabitable during winter due to unsuitable conditions for livestock. While the absence of permanent structures (Zagarell, 1982; Nissen & Zagarell, 1976; Bernbeck, 1992) supports semi-nomadic pastoralism, limited excavation area cautions against overgeneralization. The challenging terrain, scarce water sources, heavy winter snow, and difficult access in the Zagros likely limited agriculture to dry farming in small, scattered communities. Consequently, Neolithic settlements in this region likely developed locally, adapting to mountainous conditions, and formed the basis for early villages whose subsistence strategies, settlement patterns, and tools remained largely stable until the land reforms. Seasonal vertical mobility or transhumance appears to have been a key aspect of their pastoralist lifestyle.

Technologically, the assemblages show continuity with Epipaleolithic traditions. Geometric microliths were widely used, and Phase III ceramics at Qal'eh Rostam are coarse, porous, and likely belong to the Early Neolithic. These potteries, often containing plant-tempered clay, have been observed at multiple sites, including Khanmirza. Phase I yielded both early ceramics and geometric microliths closely resembling Epipaleolithic and early Neolithic types. The co-occurrence of microliths and porous ceramics underscores the potential of southern Chaharmahal and Bakhtiari, including the Khanmirza area, for studying the Neolithization process in the high Zagros.

The southern Chaharmahal and Bakhtiari regions encompass both mountainous and lowland zones. Archaeological evidence suggests that following favorable climatic changes in the 8th–7th millennia BCE, inhabitants exploited both mountain caves and lowland areas. Seasonal pastoralism in lowlands and settlements in uplands indicate that many Neolithic

innovations have roots in the Epipaleolithic, with environmental and social processes from that period shaping Neolithic lifeways in this region.

Livestock management has played a central role in the economy and society of the Near East since the early domestication of sheep and goats during the Neolithic. In the mountainous regions of the Zagros, pastoralism remained the dominant economic activity until less than a century ago, allowing local communities to make efficient use of the limited and scattered resources of the highlands (Amanollahi-Baharvand, 1975; Barth, 1961). Previous research has focused on two key milestones: the domestication of animals from the Epipaleolithic to the early Neolithic and the emergence of fully nomadic pastoralism in the mid-to-late sixth millennium BCE (Abdi, 2003).

Studies at Qal'eh Rostam indicate that goats were the dominant domestic species. At Qal'eh Rostam, 97% of identified faunal remains belong to goats, while the remaining 3% include cattle, wild boar, gazelle, rabbits, carnivores, and turtles. This suggests that the inhabitants maintained large herds of sheep and goats and relied extensively on them (Mashkour, 2001).

Ethnographic observations show that goats are more mobile than sheep and are more easily moved during seasonal migrations to highland pastures. Consequently, sheep were kept in lower areas, while goats exploited higher pastures. This herd management strategy during the Neolithic in the Zagros, including at Qal'eh Rostam, is consistent with patterns observed at other Neolithic sites such as Sarab and Asiab (Mashkour & Abdi, 2002).

Animal slaughter patterns at Qal'eh Rostam and similar sites indicate that goats were primarily exploited by targeting young males, whereas sheep were domesticated slightly later and in smaller numbers. This reflects a gradual but continuous expansion of pastoralism and use of local animal resources. Moreover, the absence of permanent structures and the dispersed nature of archaeological finds suggest that human groups were predominantly semi-nomadic pastoralists, with high mobility to exploit both foothill and upland pastures as part of their subsistence strategy (Mashkour, 2005).

The cores and lithic tools recovered from Qal'eh Rostam, Tall-e Boland-e Aluni, Sini Cemetery, and Khosrowabad Cemetery include conical, semi-conical, cylindrical, and sub-cartridge forms. Flakes and microliths were produced from red, gray, cream, and smoky chert, with dates likely spanning from the Epipaleolithic to the Neolithic. At Sini and Khosrowabad cemeteries, most flakes and tools are unretouched, with some retouched items, reflecting local hunting and animal-processing activities.

Pottery fragments recovered from these sites are buff and orange in color and, based on relative chronology, are attributed to the Early and Middle Neolithic. The presence of these ceramics, along with lithic tools, indicates that occupation at these sites continued from the pre-ceramic Neolithic to the ceramic Neolithic.

Overall, the sites of Qal'eh Rostam, Tall-e Boland-e Aluni, Sini Cemetery, and Khosrowabad Cemetery represent settlement networks in Central Zagros where pastoralism and herd management were organized seasonally and based on local environmental resources. The combination of faunal remains, lithic tools, and ceramics provides clear evidence for the central role of goats and pastoralism in the formation of the region's earliest agricultural and livestock-based communities.

Conclusion

Any attempt to formulate definitive hypotheses regarding the process of Neolithisation in the southern High Zagros, particularly in the Khanmirza region, must begin with an acknowledgment of the fundamental scarcity of archaeological data. Meaningful reconstruction of early settlement trajectories in this area requires systematic, problem-oriented excavations supported by absolute dating programs. At present, interpretations remain necessarily provisional. While substantial research has been conducted in the northern and central Zagros, especially in Lorestan and Kermanshah, the southern sector of the High Zagros in Chaharmahal and Bakhtiari has received comparatively limited scholarly attention. Nearly half a century after the first field investigations in the province, our understanding of the beginnings of Neolithic settlement in its southern part remains fragmentary. The present study therefore represents an initial but essential step toward clarifying the nature of Neolithisation in this environmentally and culturally significant region.

The archaeological challenges of the area extend beyond the absence of a secure chronological framework. There is also a clear imbalance in the geographical distribution of research. Most excavations and surveys of Neolithic sites have been concentrated in the northern and central parts of the province, whereas the southern zone has remained largely underexplored. Except for Qal'eh Rostam, published information on Neolithic sites in southern Chaharmahal and Bakhtiari is extremely limited. In this context, systematic surface surveys—despite their inherent limitations—play a crucial role in identifying prehistoric settlements and outlining preliminary patterns of occupation.

Environmental factors have always exerted a decisive influence on the emergence and development of human settlements. The transition from the Epipalaeolithic to the Neolithic was closely tied to ecological opportunities and constraints, and the High Zagros presents a distinctive environmental setting. Khanmirza, characterized by broad plains, intermontane valleys, and access to upland pastures, offered considerable ecological potential for early communities. The distribution pattern of sites identified in the present survey supports the idea that this region provided favorable conditions for settlement, particularly during periods of climatic amelioration in the early Holocene.

The cultural materials documented during the survey suggest a long-term trajectory of human presence shaped by shifting settlement strategies. Evidence for Paleolithic occupation appears to be concentrated primarily in caves and rock shelters, with the notable exception of the Kuh-e Sorkh site, where open-air evidence was identified. This pattern reflects the adaptive logic of highly mobile hunter-gatherer groups operating within rugged mountainous terrain. During the Epipalaeolithic, however, settlement dynamics appear to have diversified. While

mountain zones continued to be occupied, signs of temporary presence in piedmont areas and occasionally in plains begin to emerge. The discovery of bladelets and pressure-flaked cores—technologies commonly associated with both Epipalaeolithic and early Neolithic contexts—indicates continuity in lithic traditions alongside evolving subsistence practices. Until stratified excavations and absolute dating programs are implemented, these materials remain crucial indicators of transitional processes in the region.

The close spatial relationship between habitable caves and open-air sites such as Qal'eh Rostam, Khosrowabad Cemetery, Sini Cemetery, and Tal Boland Aluni suggests that early communities may have practiced a combined settlement system during the initial stages of the Epipalaeolithic–Neolithic transition. It is plausible that caves and rock shelters continued to function as seasonal or task-specific camps, while open settlements in the plains gradually assumed greater importance. Over time, as social organization, subsistence strategies, and technological capacities developed, more permanent occupation of lowland areas likely became feasible.

This gradual shift should not be understood as a sudden rupture but rather as the outcome of cumulative adaptations. The transition to Neolithic lifeways in Khanmirza appears to reflect the interplay of relatively favorable environmental conditions and the flexible integration of herding, cultivation, and continued hunting practices. Instead of a rigid transformation from foraging to farming, the evidence suggests a prolonged period of mixed economies in which pastoralism and small-scale agriculture were incorporated into preexisting mobility patterns. Such adaptive flexibility would have been particularly advantageous in a mountainous landscape characterized by seasonal variability and ecological diversity.

In sum, the available data indicate that southern Chaharmahal and Bakhtiari—and especially the Khanmirza basin—holds substantial potential for illuminating the Neolithisation of the High Zagros. The region's environmental diversity, its combination of cave and open-air sites, and the presence of diagnostic lithic and ceramic materials all point to a complex and locally grounded process of cultural transformation. Future excavations guided by clearly defined research questions will be essential for refining this preliminary framework. Nevertheless, even at this stage, it is evident that the Neolithic transition in Khanmirza was shaped not only by broader regional developments but also by enduring local traditions and adaptive strategies rooted in the mountainous ecology of the High Zagros.

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