پژوهش‌های باستان‌شناسی ایران

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دانشگاه بوعلی سینا

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گروه باستان‌شناسی دانشکدهٔ هنر و معماری دانشگاه بوعلی سینا

ویژگی‌های کلی مقالهٔ مورد پذیرش

هدف نشریهٔ علمی‌پژوهشی *پژوهش‌های باستان‌شناسی ایران*، انتشار پژوهش‌ها و تجربه‌های علمی در زمینه‌های باستان‌شناسی، تاریخ هنر و معماری است.
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Ward-Perkins, J. B., 1990, *Roman Imperial Architecture London*, Penguin Books.

ارجاع به مقالات مجله‌ها:

Trinkaus, E., 1982, "Artificial Cranial Deformation in the Shanidar 1 and 5 Neanderthals", *Current Anthropology* 23 (2): 198-199.

ارجاع به مجموعه مقالات:

Liverani, M., 2003, "The Rise and Fall of Media", Continuity of Empire (?): Assyria, Media, Persia, (Lanfranchi, G.B and others) eds. Padova, 1-12.

ارجاع به پایان‌نامه‌ها:

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فهرست مطالب

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جمهوری اسلامی ایران
وزارت علوم، تحقیقات و فناوری
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نشریه

پژوهش های باستان شناسی

با صاحب امتیازی دانشگاه بوعلی سینا بر اساس آیین‌نامه نشریات علمی مصوب ۱۳۹۸/۰۲/۰۲ در ارزیابی سال ۱۳۹۸، موفق به کسب رتبه الف شده است.

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Kernel Density Estimation (KDE) Approach in Landscape Archaeological Studies

(Case Study: The Distribution of Middle Paleolithic Open-air Sites in Miankouh Region; Chaharmahal and Bakhtiari Province, Iran)

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Abstract

Today, Kernel Density Estimation (KDE) is one of the most important methods used to illustrate the influence of most important factors (ecotopes) on the distribution of archaeological sites at the local landscape scale. Geographic Information System (GIS), as a core analytical tool, plays a key role in identifying task-specific locations. GIS, in combination with MATLAB toolboxes, topologically enhances our understanding of how environmental factors influenced the resource exploitation patterns of past societies. Focusing on the Middle Paleolithic (MP) statistical dataset, this paper underscores the analytical value of KDE in studying MP open-air sites and localities that were identified during three seasons of archaeological survey in the Miankouh region, located in western Chaharmahal and Bakhtiari (ChB) Province. An analysis of the available dataset (177 points with recorded latitude and longitude coordinates, XY) reveals two probable environmental factors that appear to have contributed to the formation of four major MP open-air site clusters across the Miankouh landscape. The highest concentration of sites occurs on river terraces near the Khersun and Bazoft rivers (Kernel 1), where suitable riverine chert raw materials were available for tool production in the Low Altitude Zone (LAZ). Another significant cluster (Kernel 2) is in the High-Altitude Zone (HAZ), around two natural seasonal pools and the Pootak spring.

Keywords: Kernel Density, Miankouh, Middle Paleolithic, Landscape, Spatial Analysis.

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Introduction

Landscape archaeology examines the spatial relationships of cultural materials (stone artefacts) to infer how landscapes were exploited in the past (Zvelebil *et al.,* 1992; Crumley and Marquardt, 1990). Cultural materials in the form of surface scatter findings in open-air environments (as opposed to sheltered areas such as caves) are often undervalued due to assumptions regarding their integrity and informational potential. This tendency is particularly common in arid and semi-arid landscapes, where sediment accumulation is slow and erosion is intense (Ames *et al.,* 2020).

Today, the analysis of such localities is increasingly associated with digital archaeology and its subfield, computational archaeology, as these disciplines facilitate the statistical analysis of cultural material data (see: Mara, 2022; Eiteljorg *et al.,* 2007; Winterbottom and Long, 2006). Among the most widely used digital tools in the humanities and especially in archaeology are GIS and MATLAB, which are employed for modelling socio-ecological and environmental landscapes at multiple spatial scales, as well as for analysing the spatial and temporal distribution of archaeological data (Hughes *et al.,* 2016: 159).

In terms of scale, Geographic Information System (GIS) is typically used to study the spatial relationships of a variety of archaeological elements, from the distribution of pottery and chipped stone artefacts at a single site, to the spatial distribution of archaeological evidence across broader geographic regions (Renfrew and Bahn, 2016: 94–98; Frachetti, 2006: 113).

Recent research contributes to our understanding of the formation processes and distribution patterns of surface scatter findings (i.e., open-air sites) as independent entities at the landscape scale. This is achieved by compiling diverse statistical data and incorporating them into GIS and MATLAB databases to generate spatial representations and digital maps. One of the core tools found in both platforms is the Kernel Density Estimation (KDE) function. In practice, this analytical tool estimates the density of observable data points (Silverman, 1998). As Węglarczyk (2018) notes, KDE allows for more nuanced analysis of probability distributions than traditional histograms. In spatial archaeology, KDE has been used for various purposes, including smoothing point data, creating continuous surfaces from discrete data, integrating point data with other raster datasets, estimating probability distributions, interpolating missing values, and detecting spatial clusters or "hot spots" (Krisp and Špatenková, 2010: 396).

The present study applies two of the most flexible data-driven analytical platforms GIS and MATLAB to model the probable spatial patterning of Middle Paleolithic (MP) open-air sites in the Miankouh region, one of the most mountainous zones in the Zagros range.

Research Importance and objectives

The spatial analysis approach explicitly addresses the use of space in the past. Such analyses are typically conducted at two principal scales: the site scale and the landscape or large-area scale (see: Bintliff, 2000; Zvelebil *et al.,* 1992; Dunnell and Dancey, 1983). Both approaches aim to identify patterns in the spatial distribution of archaeological materials and, ultimately, to reconstruct patterns of human behaviour at a site or within a locality. However, when these analyses are integrated across broader spatial extents using top-down perspectives, they are referred to as inter-site or landscape-oriented analyses (Gaydarska, 2015). With regard to KDE, knowledge of the spatial distribution of stone artefacts across a given region allows researchers to explicitly delineate clusters based on density values observed within specific environmental zones (Dunnell and Dancey, 1983: 273).

Regarding its analytical importance, one could assert that, when juxtaposed with other archaeological data analysis techniques, KDE delivers improved interpretive possibilities by smoothing point data and creating high-resolution, integrated spatial representations of site distributions in the format of density maps. This type of analytical tool represents an informal method of data point clustering which, unlike other techniques, does not impose predefined structural assumptions onto the dataset (Baxter *et al.,* 1997; Beardah and Baxter, 1996a). Another key capability of KDE lies in its ability to assess the degree of overlap between different distributions, thereby facilitating the evaluation of (dis)similarities among archaeological assemblages (De Ceuster and Degryse, 2020).

The primary aim of this study is to introduce KDE as an analytical method for interpreting archaeological evidence at a scale beyond the individual site specifically, at the broader scale (landscape level) in the Miankouh region.

Questions and Hypotheses

What is the role of the Kernel Density Estimation (KDE) tool in intra-site and landscape-scale archaeological research? Furthermore, if kernel densities of sites are observed, what factors have influenced such distributions across the landscape?

Our first hypothesis proposes that the identification of zones with high site concentrations through KDE serves as a foundation for exploring the underlying causes of clustering and localized intensities of past human activities.

Our second hypothesis, informed by research on the Middle Paleolithic (MP) Period, suggests that certain environmental variables particularly ecological ecotopes [1], including the distribution of water resources and accessible stone raw materials have significantly influenced the spatial distribution of sites within the landscape.

Research Background

There are three main orientations in previous research on the KDE. The first category focuses on the theoretical background, literature, and terminology surrounding the formation and conceptual development of KDE (see: Silverman, 1998). The second category deals with the mathematical foundations and technical procedures for building kernel density models using statistical functions (see: Baxter *et al.,* 2000; Baxter and Cool, 2010; Krisp and Špatenková, 2010). The third category compares KDE with other statistical-graphical methods, emphasizing the strengths and limitations of each in identifying horizontal spatial patterns within archaeological datasets (see: Sánchez-Romero *et al.,* 2021; Baxter *et al.,* 1997). The limited application of KDE in archaeological research has often been attributed to a lack of access to the required software or to insufficient familiarity with the method among archaeologists.

In comparison with histograms, Beardah and Baxter (1996a) highlighted KDE's ability to analyse bivariate (X, Y) and even tri-/multivariate (X, Y, Z) datasets rather than being restricted to univariate data. KDE eliminates dependency on the arbitrary selection of the starting point for intervals and produces smoother visual outputs that are better suited for comparative analyses. KDE effectively visualises entire datasets within a single image, facilitating easier interpretation and comparison (Baxter *et al.,* 1997: 347). Although the application of KDE in Paleolithic archaeology can be traced back to the 1950s (see: Binford, 1978), it was not until the late 20th century that KDE was extensively described as a formal statistical method, particularly in quantitative research (Silverman, 1998). Today, it is used across a wide range of disciplines, including archaeology, climatology, banking, economics, genetics, hydrology, and physiology (Sheather, 2004). In the context of Paleolithic studies, KDE has mainly been applied at the site scale to analyse various categories of cultural materials, such

as lithic artefacts (Clark, 2017; Neruda, 2015; Pettitt, 1997), stable lead isotope data (Baxter *et al.,* 2000), animal bone remains (Spagnolo *et al.,* 2020; Blasco *et al.,* 2016), or combinations of multiple datasets (Real *et al.,* 2018; Villaverde *et al.,* 2017; Oron and Goren-Inbar, 2014).

A prominent example of KDE applied at both site (intra-site) and landscape (inter-site) scales is the Paleolithic survey conducted by Olszewski et al. (2005) in the High Desert of Abydos, Egypt. There, spatial analysis of the density and average weight of cores, complete and broken flakes, and tool types was used to investigate topographic patterns of accumulation (Olszewski *et al.,* 2005: 293–294). In the Central Levant, near Damascus (Syria), KDE was applied to study Middle Paleolithic site functions, where proximity to water resources was shown to be the key factor influencing kernel densities and the concentration of stone artefacts across the semi-arid landscape (Conard *et al.,* 2010: 142). Perhaps the most illustrative KDE example comes from Quneitra in the Levant, where Oron and Goren-Inbar (2014) used it to examine the spatial distribution and density of lithic and faunal remains on an open-air excavated surface.

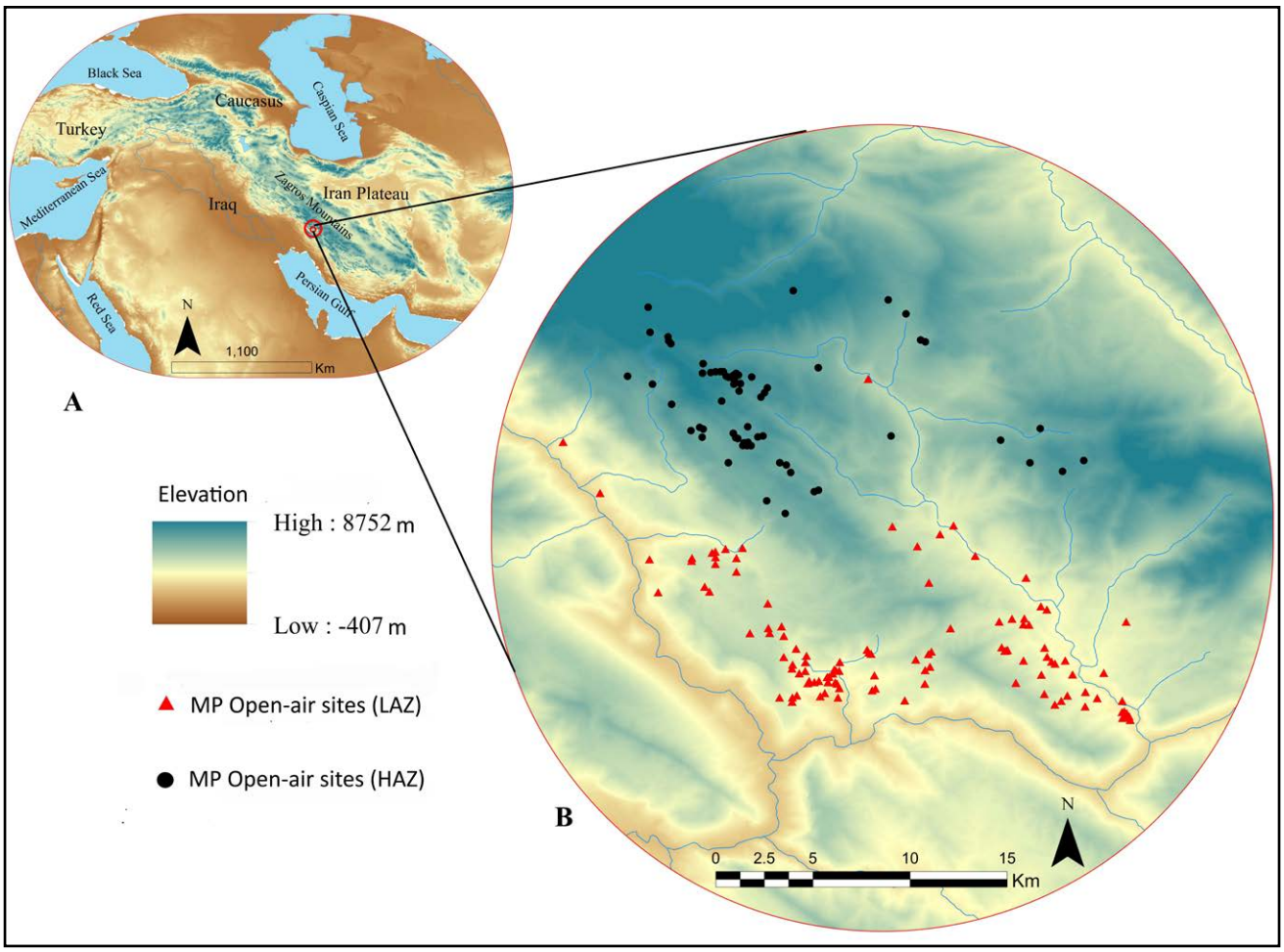
In Europe, Romagnoli and Vaquero (2016) conducted a taphonomic analysis of 11 distinct lithic clusters at the Abric Romaní rock shelter in Capellades, Spain, attributing the distribution patterns to variations in social activity intensity such as group size and occupation duration. Similarly, spatial analysis of lithic and bone remains at the Abrigo de la Quebrada rock shelter near Chelva, Spain, revealed repeated seasonal occupations with intense on-site processing (Villaverde *et al.,* 2017). Clark (2017) investigated seven Middle Paleolithic open-air sites in France to identify behavioural patterns corresponding to zones of high, medium, and low lithic density and to determine the formation processes that produced these distributions.

Recent years have seen a resurgence of interest in spatial patterning in Paleolithic contexts, especially in horizontal clustering of anthropogenic materials identified through GIS-based tools. Current trends in spatial distribution analysis in archaeology increasingly rely on techniques that detect major concentrations of artefacts, including those from the Hotspot family such as Hotspots by Quadrats, K-means, and KDE (see: Sánchez-Romero *et al.,* 2021 and references therein; Coil *et al.,* 2020; Giusti *et al.,* 2018; Blasco *et al.,* 2016).

The study Area

The data presented in the current paper originates from a series of Middle

Paleolithic (MP) open-air sites recorded during field surveys conducted in the Miankouh district of Ardal County, Chaharmahal and Bakhtiari (ChB) Province, within the Zagros Mountains. The survey covered an area comprising two ecological zones, which resulted in two distinct environmental settings spanning approximately 680 square kilometres (Khosrowzadeh, 2011; 2010; 2009) (Fig. 1). These two zones are primarily distinguished by differences in elevation, with the lower zone referred to here as the Low-Altitude Zone (LAZ) and the higher as the High-Altitude Zone (HAZ).



▲**Fig. 1. (A) The position of the Ardal County in ChB Province, Southwest Iran and (B) The position of MP open-air sites of the Miankouh region (Authors, 2023).**

Both environments were defined through field observation and subsequently confirmed through a review of relevant literature and the use of digital modelling tools. Across the surface of both ecozones, a low density of lithic artefacts ranging from 1 to 36 pieces was recorded at each MP open-air site. The study area yielded a wide range of cultural materials, including lithic artefacts from the MP, Upper Paleolithic (UP), and Epipaleolithic (EP) periods, as well as a substantial quantity of pottery

sherds from the Neolithic, Chalcolithic, Medieval, and Late Islamic periods. Focusing specifically on the MP component, 177 open-air sites were recorded in the form of XY coordinate points, comprising a total of 1,454 stone artefacts that were analysed in this study (see details in: Bahraminia *et al.,* 2022).

Materials and Methods

A total of 177 open-air Middle Paleolithic (MP) sites were identified across two distinct ecological zones the LAZ and HAZ) covering approximately 680 square kilometers for KDE analysis. The KDE pattern is determined by the input values and search radius, which vary according to the analytical scale and the size of the statistical population. Within the GIS environment (ArcMap 10.6.1), XY-coordinated point data were inputted using the KDE tool in the software's toolbox section (Fig. 2a). Subsequently, the kernel density of sites was calculated based on the specified search radius and visualized as an output map. The selection of the search radius is data-dependent and influenced by site spatial distribution, directly affecting the accuracy and representativeness of the density results (Sánchez-Romero *et al.,* 2021: 317). To further interpret the kernel density of sites and assess environmental influences on their distribution patterns, a complementary graphical representation was generated using the KDE function in MATLAB R2013a (Fig. 2b). This approach aims to enhance the visual and analytical clarity of the GIS-derived outputs.

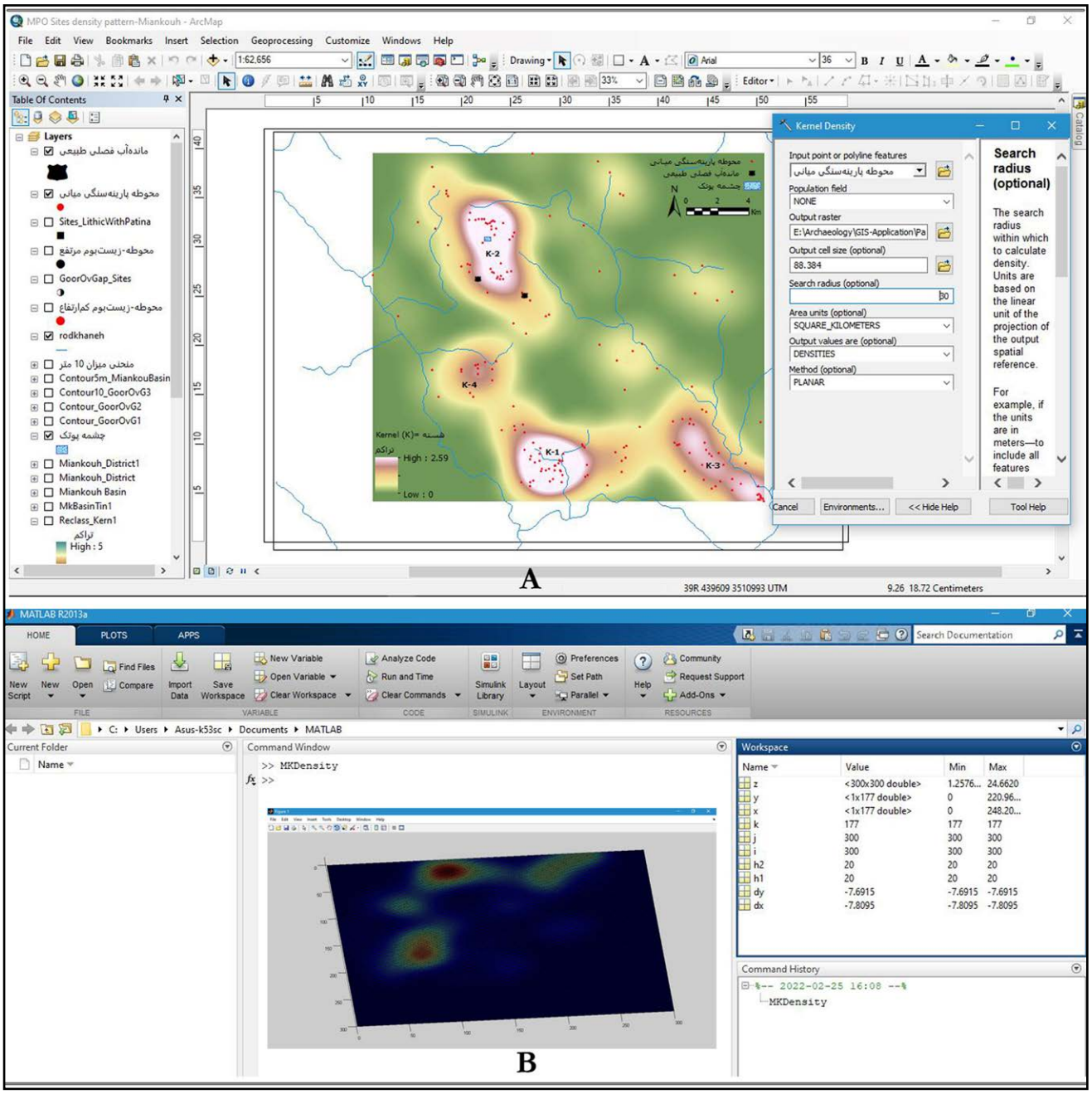
The KDE Mathematical Function

As previously noted, 177 coordinate points corresponding to Middle Paleolithic (MP) open-air sites in the Miankouh region (Khosrowzadeh, 2009; 2010; 2011) were selected for analysis. A search radius of 30 km was applied, determined by the spatial extent of the study area (680 km², encompassing both the LAZ and HAZ), within which the statistical population was evaluated.

The bivariate KDE's mathematical function, central to this study, is expressed by the following formula for estimating K:

$$\hat{f}(x,y) = \frac{1}{nh_1h_2}\sum_{i=1}^{n} k\left(\frac{x-X_i}{h_1}, \frac{y-Y_i}{h_2}\right)$$

(Beardah and Baxter, 1996b) where 177 points are statistical population (n), h1 is the bandwidth of X axis, and h2 is the bandwidth of Y axis. Bandwidth value or smoothing parameter based on the extent of the



region is 20 rad/time unit for each axis. This complex of orders produces a continuous raster map that is classified based on the colored pixels of the material density on this map (Sánchez-Romero *et al.,* 2021; Giusti *et al.,* 2018).

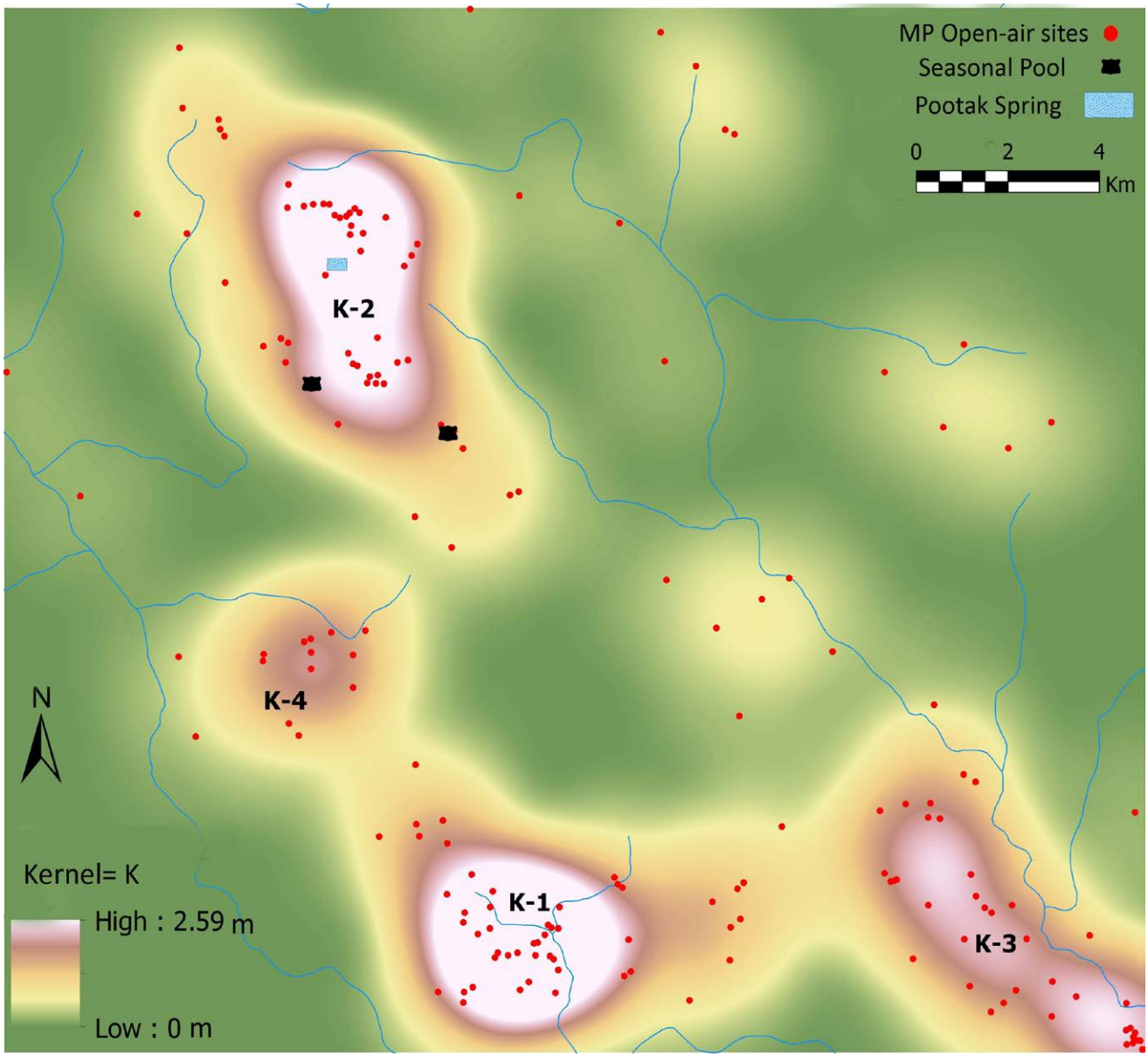
▲ Fig. 2: General view of GIS (A) and MATLAB (B) work environment (Authors, 2023).

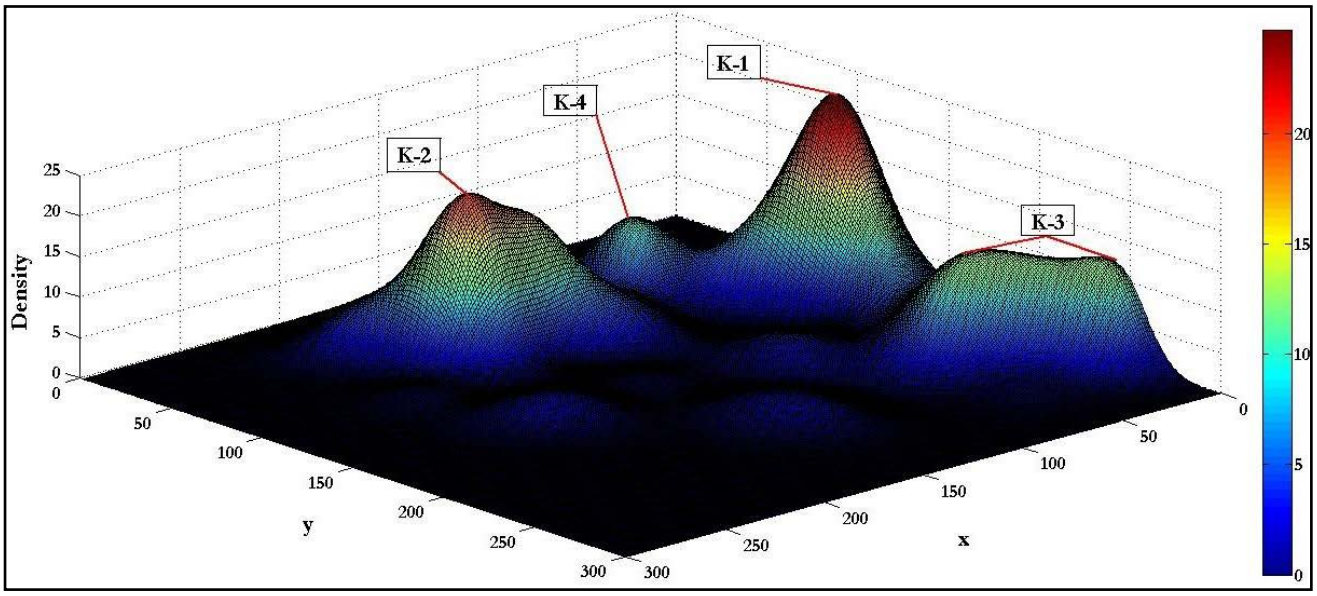
Discussion

As a result, output of the data indicates that, in general, four density kernels of sites are recognizable according to search radius and using a

combination of colors in the form raster/graphical schema (Fig. 3 & 4). Highest concentration of the MP open-air sites (Kernel 1 in Fig. 3 & 4) were seen on the terraces overlooking to Khersun and Bazoft rivers in the LAZ where were found a high frequency of well-rounded pebble chert-based stone raw materials for making artefacts. In this zone, there is also a density with a lower frequency of sites (Kernel 3-4 in Fig. 3 and 4) than kernel 1 on several terraces and slopes overlooking the Sarkhun valley where the valley leads to its narrowest point. Under the influence of three ecotones of Goor Ov Gap, Goor Ov Kuchir, and Pootak spring, the second concentration of sites (kernel 2) in the whole Miankouh are clearly formed near to/or in a close distance of these water resources in the HAZ. Almost

Fig. 3: A raster scheme for the main four kernel density of MP open-air sites in both ecozones of the Miankouh region (by ARC Map), (Authors, 2023). ▼





▲ **Fig. 4. A 3D graphical pick-shaped scheme from the main four kernel density of MP open-air sites in both ecozones of the Miankouh region (by MATLAB). (Authors, 2023).**

a similar density of sites can be seen in the Dehdasht terrace district in the narrowest part of the Sarkhun river valley (Fig 3-4: K-3). Here too, like Serenjak and Goud lalow slopes, the slopes of the Pachatoun and Mazdaki Valley, the highest frequency of river bed rounded stone raw materials can be seen.

Conclusion

Most research on the KDE analytical approach in spatial archaeology has primarily focused on the spatial distribution of cultural materials (such as lithic assemblages and faunal and floral remains) within single sites mainly caves in order to determine the function and duration of site occupation (see: Clark, 2017; Villaverde *et al.*, 2017). For instance, at Quneitra in the Levant, evidence suggests that specific parts of the site were used for particular activities such as knapping, carcass processing, and marrow extraction (Oron and Goren-Inbar, 2014: 201). Clark (2017: 1321) concluded that areas of high artefact density may reflect either multiple occupations or the activity of numerous knappers (see also: Real *et al.*, 2018: 202). Olszewski et al. (2005: 299), drawing on Van Peer's settlement models, particularly for the Nubian Stone Industry Complex, interpreted the MP sites in the Abydos Desert as locations designated for "specific activities." A similar behavioural pattern has also been identified at Kulna Cave (Layer 7a, Micoquian period) in the Czech Republic, where Neanderthals appear to have structured this winter base camp into spatial zones dedicated to specific tasks, possibly including meat processing (Neruda, 2015: 74). In the Central Levant (Syria), in a manner somewhat similar to the Miankouh

region, the extensive use of the semi-arid landscape seems to have been directly influenced by natural factors such as variations in precipitation, proximity to permanent water sources as well as by cultural factors like the availability of water transportation methods (Conard *et al.,* 2010: 142).

At the present, we have no absolute data or stratified contexts to identify the function of our MP open-air sites also, reasons for the accumulation of them in four points of the landscape. But on the basis of techno-typological analysis of lithic artefacts, spatial distribution of surface findings, the low frequency of the stone artefacts, and also the absence of cave sites in this region all give us the impression that the MP open-air sites of Miankouh had a very temporary and ephemeral functions such as places for chasing hunting or daily excursions for food sources extraction by hunter-gatherer societies (see details in: Bahraminia *et al.,* 2022). Using the inter-site approach, a method that aims to find relationship between several different sites at the landscape-scale, as opposed to the intra-site approach, which focuses on analyzing a single site (to review the characteristics of each approach, see: Bintliff, 2000; Zvelebil *et al.,* 1992; Dunnell and Dancey, 1983), and by focusing on KDE approach, in general, two important factors have participated in more concentration of the MP open-air sites in 4 Kernels which include: 1- rivers (Khersun and Bazoft) by providing a portion of chert-based stone raw materials for making tools in the LAZ and, 2- the natural seasonal pools/lakes and Pootak permanent spring in highlands of the HAZ.

Endnote

[1] The smallest units of a vast geographical landscape in terms of ecology that can be mapped and classified. In Miankouh, water resources, and natural beds (rocky outcrops/nodules) are sources of raw materials for tool-making represent the most important components of the active ecotopes in the area (for landscape studies and active ecotopes, see: Dash and Dash, 2009; Zonneveld, 1995).

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Observation Contribution

All authors contributed equally to the writing of the article.

Conflict of Interest

The Authors, while observing publication ethics in referencing, declare the absence of conflict of interest.

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چکیده

امروزه رویکرد مبتنی‌بر «تخمین یا برآورد تراکم هسته» در تصویرسازی پدیده‌های تأثیرگذار (اکوتوپ‌های اکولوژیکی) بر توزیع فضایی محوطه‌ها در بستر چشم‌اندازهای جغرافیایی از اهمیت بالایی برخوردار است. ابزار مستندنگاری و تحلیلی GIS به‌عنوان یکی از ابزارهای شناسایی محل‌های فعالیت‌های مشخص در کنار خروجی‌های برآمده از نرم‌افزار MATLAB در هرچه ملموس کردن نقش عوامل محیطی در الگوی بهره‌وری از محیط در باستان‌شناسی فضایی- چشم‌انداز نقش دارند. این پژوهش با جامعه‌ای آماری از دورهٔ پارینه‌سنگی میانی از ارتفاعات غرب چهارمحال‌وبختیاری (منطقهٔ میانکوه) شامل ۱۷۷ محوطه که در طول سه فصل بررسی پیمایشی در فاصلهٔ سال‌های ۹۰-۱۳۸۸ شناسایی شده‌اند، به‌گوشه‌ای از اهمیت تخمین/ برآورد تراکم هسته در مطالعهٔ محوطه‌ها/ محل‌ها با فراوانی مواد فرهنگی می‌پردازد. تحلیلی از ۱۷۷ نقطهٔ با مختصات XY نشان می‌دهد که دو عامل رودخانهٔ دائمی با منابع چرت در زیست‌بوم کم‌ارتفاع، و دو مانده‌آب یا حوضچهٔ طبیعی فصلی و چشمه پوتَک در زیست‌بوم مرتفع از برخی عوامل احتمالی توزیع محوطه‌ها/ محل‌ها در میانکوه بوده‌اند. نتایج ارزیابی‌ها نشان می‌دهد که به‌طورکلی چهار هستهٔ تراکم محوطه‌ها در طول چشم‌انداز قابل مشاهده است؛ متراکم‌ترین نقطهٔ توزیع محوطه‌ها در زیست‌بوم کم‌ارتفاع دیده شده است، جایی‌که تعداد زیادی از محوطه‌ها (هستهٔ اول) در فاصله‌ای نزدیک از رودخانه دائمی بازُفت و خِرسون در میان دامنه‌ها و تپه‌ماهورهای مشرف به این دو رودخانه با پراکندگی فراوان قلوه‌سنگ‌های چرتی مناسب ساخت ابزار و در محل‌های با آبراهه‌ها و آبکندهای فراوان شکل گرفته‌اند. هستهٔ دوم تراکم محوطه‌ها در زیست‌بوم مرتفع شکل گرفته است. در اینجا محوطه‌ها در کنار دو حوضچهٔ فصلی طبیعی و چشمهٔ دائمی پوتک تمرکز یافته‌اند. هستهٔ سوم در محدودهٔ تراس دهدشت در تنگ‌ترین بخش درهٔ رودخانهٔ سرخون قابل‌مشاهده است. کمترین تراکم محوطه‌ها (هستهٔ چهارم) روی تپه‌ماهورهای تَل‌اُو شکل گرفته‌اند که کاملاً مشرف‌بر رودخانهٔ بازفت هستند.

کلیدواژگان: تراکم هسته، میانکوه، پارینه‌سنگی میانی، چشم‌انداز تحلیل‌فضایی.

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Typology, Evolution, and Replacement of Ground Stone Tools as Indicators of Subsistence Changes Among the Inhabitants of the Komishani Site, Behshahr

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Abstract

During the second excavation season at the Komishani site in the summer of 2023, 27 ground stone tools were recovered. These include grinding slab, upper grinding stone, mortars, pestles, hand stones, and hoes. The purpose of this study is to classify and describe these ground stone tools to provide insights regarding the evolution and replacement processes of ground stone tools, and to shed light on the selection and change of livelihood strategies of the site's inhabitants. The terminology, classification, and typology used are borrowed from researchers in this field, focusing on categorization and avoiding multiple names for subcategories that emerged due to different shapes and cross-sections of a single ground stone tool type. Ultimately, an evolutionary perspective on ground stone tools (their change, transformation, and replacement over time) has been adopted. At the Komishani site, the replacement, coexistence, and functional shift of ground stone tools indicate the use of pestles in the lower layers for pounding and crushing plant materials, as well as processing fish and hunted birds. Gradually, in the upper strata, pestles and mortars were replaced by grinding slabs and hand stones, which were used for milling and processing various foodstuffs. Hunter-gatherer societies gradually transitioned to cultivation and the expansion of agriculture, a development also evident in the increasing size and complexity of ground stone tools.

Keywords: Ground Stone Tools, Neolithic Period, Komishani Cave, Food Production, Agriculture.

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Introduction

Ground stone tools are a subcategory of stone artifacts, generally defined as any piece of stone that is either manufactured through abrasion, polishing, or percussion, or used to grind, abrade, polish, or strike materials (Adams, 2002: 2). They are often associated with agriculture and the Neolithic Period and can provide valuable insights into a range of cultural and economic developments. Studies have shown that such tools existed even prior to the advent of agriculture, particularly in the processing of wild cereals (Ebeling & Rowan, 2004: 108). However, within the broader discourse on the origins of agriculture, the prolonged process of human tooth-size reduction beginning in the Upper Paleolithic is often overlooked. This phenomenon can plausibly be linked to the increasing use of grinding tools, which enabled the preparation of softer and more digestible plant-based foods. From around 100,000 years ago to the end of the Pleistocene, human tooth size decreased by approximately one percent every 2,000 years; however, after 10,000 BCE, this rate of reduction nearly doubled (Hodder, 2018: 1–4).

The classification and typology of ground stone tools are often based on morphology inferring function from shape and the residual form left by use, rather than the tool's original configuration. For this purpose, in addition to physical attributes, wear patterns, use traces, and impact marks are also considered. In the Zagros region and at sites east of the Fertile Crescent, such as Jarmo and M'lefaat, ground stone tools have been studied primarily at the site level, often using non-standardized or inconsistent terminology (see: Braidwood & Howe, 1960; Moholy-Nagy, 1983). However, Wright's regional typological approach has become more widely applied across the Levant and greater Southwest Asia. This method organizes tools into categories, types, and subtypes by systematically listing their physical features and classification criteria, including size, shape, and raw material (Kozłowski & Aurenche, 2005; Wright, 1992).

However, the use of various and sometimes inconsistent terms for naming and identifying tools remains an unresolved issue, and archaeologists have proposed multiple solutions to address this problem (Adams, 2002; Hole *et al.,* 1969). For instance, the terms "quern" and "hand mill" have proven problematic, as both technically refer to a paired set of stones functioning together. The dictionary definition of "quern" is: "an old form of hand mill for grinding grain, the upper stone usually pierced and turned on a pin in the lower stone by means of a stick thrust into a notch in the edge"

(Hole *et al.,* 1969:170). However, determining function based solely on morphology presents challenges.

In ethnoarchaeological studies, while demonstrating the classification of ground stone tools to members of the Hopi Tribe, one elder, upon seeing a deep mortar, explained that it had been used as a watering trough for eagles tied to the roof during seasonal ceremonies. Another example was identified as a tool used to prepare meat for elderly individuals who had lost their teeth, and a hand stone was recognized by a local informant as having been used for hide processing and hair removal, though this individual could not clearly articulate the difference between hand stones used for grain processing and those used for hides. All of these tools shared similar or even identical morphological features, yet they were easily distinguishable based on ethnographic context (Adams, 2010:131–132). Edge-wear analysis has been a primary method for differentiating between grain-processing hand stones and hide-processing ones (Adams, 1989). However, Mona Wright's experimental studies on edge-wear have demonstrated that determining the degree of wear on prehistoric ground stone tools is problematic, since their original weight and thickness prior to use are unknown, and no standard criteria exist for reconstructing their original shape (Wright, 1993: 353).

In recent research aimed at identifying the use and function of ground stone tools, greater emphasis has been placed on laboratory-based and chemical residue analyses. These include starch grain recovery methods, in which the tool surface is washed with distilled water, centrifuged, and analysed for microscopic residues such as starch granules (see: Rowan & Ebeling, 2008; Martinez *et al.,* 2020; Revedin *et al.,* 2022). In the authors' view, during the early Neolithic Period at the Komishani site, human populations were economically and symbolically self-sufficient and relatively independent from surrounding communities. These groups likely adopted similar, yet locally adapted, responses to environmental and climatic changes. However, this apparent similarity despite underlying cultural or functional differences should not be used as the sole basis for comparative analysis. For instance, Neolithization was a heterogeneous and temporally variable phenomenon that affected human communities in fragmented and non-linear ways. As such, the use of rigid, linear comparative models is inadequate, except when applied to morphological classification and basic cross-site comparisons. It is more effective to begin with a clear, site-specific description of ground stone tools, simplify

typological categories, and use such classifications as a foundation for broader regional syntheses. Where feasible, chemical and microscopic analyses should complement this approach. In the 2023 excavation season at the Komishani site, 27 ground stone tools were recovered, including a grinding slab, upper grinding stone, mortars, pestles, hoes, and hand stones. This article presents their preliminary typological classification and description. While ground stone tools are often multi-functional, to avoid ambiguity and excessive naming, each tool has been assigned a single functional category. They are grouped into five major types, each accompanied by photographs, basic attributes (weight and dimensions), and, where applicable, information on the stratigraphic layer from which they were recovered.

Research Background

In the late 19th century, it was assumed that the first tools used by so-called "uncivilized" peoples were chipped stone tools, and that ground stone tools developed later alongside the expansion of agriculture (McGuire, 1893). However, subsequent studies have shown that the earliest stone artifacts associated with hominin remains were often unmodified or minimally shaped cobbles, frequently referred to as pitted anvils (e.g., De Beaune, 2004; Leakey, 1971; Leakey, 1976; Leakey, 1994). Hammerstones are commonly associated with these pitted anvils, which feature small depressions typically 8 to 11 mm deep and 25 to 45 mm in diameter found at sites in Tanzania, Ethiopia, and across the Oldowan and Acheulean contexts (De Beaune, 2004: 140). In a broader sense, mortars, pestles, grinding stones, and hand stones can be viewed as a technological continuation of these early pounding tools, emerging in later periods and reflecting a form of tool evolution.

Chimpanzees are known to use hammerstones to remove bark and break open fruits and hard seeds, suggesting that the act of striking objects was not unfamiliar to early hominins. The motion involved in producing a sharp edge is not radically different from simple percussive strikes the same actions used to split bones, crush vertebrae, or pound prey (Joulian, 1996: 187). However, it was only humans who advanced beyond these basic percussive actions to develop more complex techniques such as controlled pounding and grinding. While the behaviours of chimpanzees and pre-Acheulean hominins may not differ significantly in terms of the physical action, the cognitive dimension particularly the control of impact

force and angle is crucial. The moment a member of Homo, or one of its immediate ancestors, applied a pounder previously used only for breaking organic matter to produce a flake with a cutting edge, marked a cognitive and technological departure from its predecessors (De Beaune, 2004: 142). The awareness and intentional manipulation of the angle of impact represent a significant cognitive shift. For years, this act and its resulting products have been seen as defining characteristics of a particular Homo lineage: the tool-making humans (Ambrose, 2001).

In the Middle Paleolithic, the presence of plant remains as charcoal is attributed to Kebara Mousterian Cave (60 to 50 thousand years BP), which contains numerous charred remains of seeds and fruits, including wild legumes and hazelnuts (Lev *et al.,* 2005). This indicates human involvement with plants and the breaking of hard seeds in earlier periods, leading to concentrated agriculture and the expansion of ground stones. Through an evolutionary perspective, the change and transformation of ground stones from a striking tool to a grinding tool can be better understood.

In several Upper Paleolithic sites in the Levant (dating between 45,000 and 22,000 years ago), grinding slabs and portable hand stones emerge as new tool types. Subsequently, in the Kebaran culture (22,000 to 14,500 BP), large mortars and elongated pestles were found which, due to their considerable size, were non-portable. In the following Geometric Kebaran phase (14,500 to 12,500 BP), a smaller number of grinding slabs, hand stones, mortars, and pestles similar to those of the Kebaran but more compact and portable were recovered (Hodder, 2018: 3). During the Early Natufian Period (12,800 to 11,500 BP), the presence of ground stone tools increased, with mortars and pestles being the most common types. In the Late Natufian (11,500 to 10,300 BP), there is a slight increase in the use of grinding slabs. By the Pre-Pottery Neolithic, grinding slabs significantly outnumber mortars and pestles, and appear in both portable and non-portable forms (Wright, 1991: 91). In Iran, the classification of ground stone tools has received comparatively less attention, with most publications limited to their mention in site reports. Among the few sites where ground stone tools have been classified are Tol-i Bakun (Langsdorff & McCown, 1942), the Dehluran Plain (Hole *et al.,* 1969; Hole, 1987), Chogha Mish (Delougaz & Kantor, 1996: 249–284), East Chia Sabz (Darabi, 2016), Chogha Golan (Conard & Zeidi, 2013), and Tol-e Chega Sofla (Dahdouh, 2024). Ground stone tools have also been reported from sites such as Tepe Mahtaj of Behbahan, Ahranjan, Qara Tepe, Haji Firuz,

Jani Tepe, Tepe Abdul Hussein, and Tepe San-e Chakhmaq West (Matthews & Fazeli Nashli, 2022).

Theoretical Framework

In the study of ground stone, two approaches are used: pre-production and post-production. Pre-production deals with the issue of technology (Miller, 2016: 57-71), and post-production includes all manufactured ground stone and the final shape of the initial design for which production began. To address ground stone, they can first be divided into two categories: non-portable and portable (See: Jayez 2023) and then classified and typologized based on their shape. The terminology, classification, and typology used are borrowed from researchers in this field (Hole, 1987; Wright, 1991), focusing on categorization and avoiding the use of different names for subcategories that have emerged according to the different shapes and cross-sections of a single type of ground stone. Finally, a method inspired by an evolutionary perspective on ground stone (their change, transformation, and replacement over time) and a simplified adaptation of Adams' classification method (Adams, 2002) is used, which initially studies the morphology of ground stone. It should be noted that similar examples from other sites have also been referenced.

Komishani Site

Komishani is located along the Neka–Behshahr road, approximately 10 km west of Behshahr, at geographical coordinates 36.401281° N, 53.215511° E, on a terrace facing Komishan Cave and in proximity to the Huto and Kamarband caves, at an elevation of 45 m asl. Komishan Cave was first identified in the 1980s (1360s SH) during construction activities. In 2017 (1396 SH), due to road expansion and development, the outer terrace adjacent to Komishan Cave was disturbed. As a result, four stratigraphic trenches were excavated in various parts of the cave and the surrounding terrace. Trenches 1 and 2 were opened on the terrace opposite Komishan Cave (now referred to as the Komishani site), trench 3 was located on the southern side and upper slope above the cave, and trench 4 was placed on the northern side of the cave (Fazeli Nashli, 2023). During the first excavation season, artifacts including stone vessels, pounders, and mortars, along with numerous sickle blades exhibiting lustrous sheen (sickle gloss), were recovered, highlighting the archaeological significance of the site. However, due to the limited size of the initial trenches, larger-scale

excavations were deemed necessary. Consequently, in 2023 (1402 SH), a second excavation season was undertaken to address broader research questions related to the Early Neolithic in the region.

In this second season (Fazeli Nashli, 2023), trench 5 was established on the outer terrace near the cave, measuring 5×7 meters, for horizontal excavation and to better understand the in-situ stratigraphy. Trench 6 was positioned on the terrace edge adjacent to the road, approximately 6 meters from trenches 1 and 2, and 35 meters from the cave entrance. This trench, with dimensions of 2×4 meters, was designated for stratigraphic analysis (Fazeli Nashli *et al.,* 2024).

Fig. 1: Aerial photo of Komishani and the location of trenches 5 and 6 (Fazeli Nashli, 2023). ▶

Komishani Ground Stones

In the second excavation season at the Komishani site, a total of 27 ground stone tools were recovered. In the lower stratigraphic layers, the selection of raw material, along with the finishing, symmetry, and surface polishing of the tools, is particularly noteworthy, suggesting a high level of skill and considerable time invested in their manufacture. In contrast, tools from the upper layers lack these features. Their standardized forms and larger dimensions suggest an emphasis on efficiency and functionality in production. The recovered ground stone tools have been classified into five categories: grinding slab and upper grinding stone, mortars, pestles, hand stones, and unclassified types. These are introduced, categorized, and described in detail below.

Findings from each trench are presented separately under headings such as Trench 5 (horizontal) and Trench 6 (stratigraphic/vertical). Their

physical and material attributes including stone type, weight, length, width, thickness, and color are documented in accompanying tables. All artifacts are photographed, and representative examples from each category have been selected, illustrated, and presented (Fazeli Nashli, 2023).

Grinding Stones (Grinding Slabs and Upper Grinding Stones)

The act of grinding involves the use of two complementary stone elements: a lower stationary stone and an upper mobile stone. The lower stone is typically heavy and remains fixed to provide stability during use. The upper stone, which is movable, is shaped to fit the surface of the lower stone and is light enough to be operated with both hands. The friction between the contact surfaces of these two stones results in the grinding of raw materials. When the upper and lower grinding stones are morphologically compatible and function as a pair, archaeologists use the terms "mano" (upper) and "metate" (lower) to describe them (Hole *et al.,* 1969: 170). However, when the upper grinding stone lacks a formal relationship with the lower surface, it is classified as a hand stone (Adams, 2002: 142–143).

Both grinding stones recovered from the Komishani site were found in Trench 6. The upper grinding stone (No. 1 in Fig. 2) is broken, with only a fragment preserved. Due to its light weight, it is identified as an upper grinding stone. It features a dorsal protrusion that facilitates grip, and abrasion marks are visible on its ventral surface. It was found in a disturbed layer, suggesting it may have been displaced from its original context. The lower grinding stone (No. 2 in Fig. 2), given its heaviness and limited portability, is identified as a grinding slab. The upper surface displays multiple overlapping wear striations, creating a relatively even grinding surface. Several edge fractures are present, possibly resulting from its secondary use as an anvil or stone platform for pounding activities.

The notable aspect of this artifact is its abandoned and inverted position within the recovered layer, where it had been placed alongside several natural stones to fill a space. This context indicates secondary use or disposal following primary use. Among the funerary objects in this layer, a bronze earring and a silver anklet were recovered, suggesting the deposit belongs to a later period. However, the unused and inverted state of the grinding slab suggests the end of its original function and possible re-use, implying it may originate from an earlier period. The possibility of intergenerational transmission and the long use-life of ground stone tools should not be

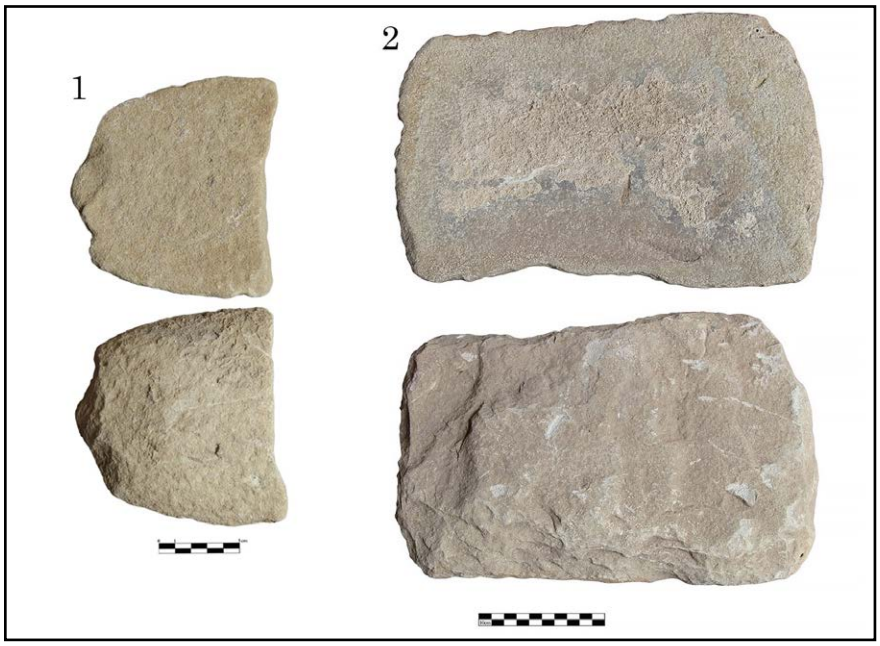


Fig. 2: Upper grinding stone and grinding slab recovered from the Komishani site (Authors, 2023). ▶

Table 1: Descriptive characteristics of the upper grinding stone and grinding slab from Komishani (Authors, 2023). ▶

Number	Trench	Material	Weight	Length	Width	Thickness	Munsell Stone Color
1	6	Sandstone	750	10.2	12.1	4	10YR 6/2 Pale Yellowish Brown
2	6	Sandstone	7.500	37.5	26	5	10YR 6/2 Pale Yellowish Brown

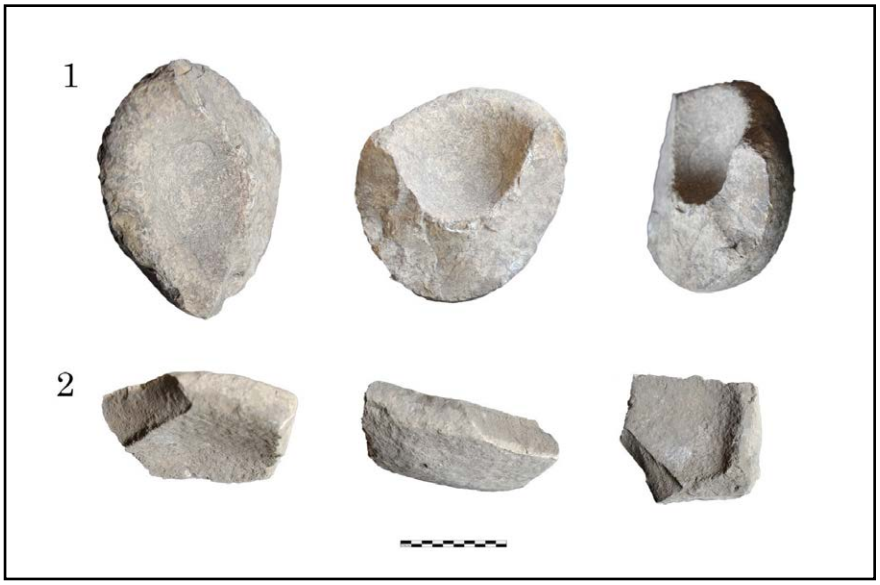
overlooked. Its broad surface is consistent with the processing of larger quantities of material. It is important to note that the size of ground stone tools serves as a useful indicator of subsistence strategies (Adams, 2002: 64). Based on established classifications, this specimen is best identified as a flat grinding slab, as it lacks concavities in cross-section and does not exhibit a saddle-shaped or basin-shaped profile. Comparable examples have been documented at sites associated with subsistence activities (see: Hole *et al.,* 1969; Hole, 1977; Delougaz & Kantor, 1996).

Mortar

Mortars are formed by hollowing out stone to create a concavity. Materials are placed inside and used in combination with a pestle for crushing, stirring, or pounding. They vary in size and depth, with simple variations related to their stability. Nomenclature is typically based on the diameter and depth of the opening, and distinctions are also made between portable and non-portable types, such as bedrock mortars. The most reliable method for distinguishing mortars from stone vessels or bowls is by assessing the degree of wear on the rim surface (Adams, 2002: 127–130).

During the Epipaleolithic, the production and use of bedrock mortars were common in open-air, communal settings outside residential areas. With the onset of the Neolithic Period, their use shifted into more private, domestic spaces (Jayez, 2023: 152). Mortars are frequently recovered from Neolithic sites; for instance, one was found at East Chia Sabz in Dehluran, where they are confined to Neolithic layers. In some cases, such as Ali Kosh and Chogha Golan, ochre residues have been identified within mortar basins (Darabi, 2016: 12).

Two mortars recovered from Trench 6 at the Komishani site include: (1) a mortar (No. 1 in Fig. 4), broken approximately in half, with a depth of 8 cm and a mouth diameter of 10 cm, found near a layer containing a kiln; and (2) a mortar fragment (No. 2 in Fig. 4) with a mouth diameter of 11 cm. Due to its relatively heavy weight and the fact that it originates from the upper rim, it is considered part of a large mortar. It was recovered from a context where numerous broken stones and ground stone tools had been repurposed to form a platform for placing animal horns. In this case, the spatial arrangement suggests that the intentional breakage of the objects should be considered.



◄ Fig. 3: Mortars recovered from the Komishani (Authors, 2023).

Number	Trench	Material	Weight	Length	Width	Thickness	Munsell Stone Color
1	6	Limestone	2.300	14.5	14.5	8	5Y 8/4 Grayish Brown
2	6	Limestone	3	16	19	7.5	10YR 8/2 Very Pale Orange

◄ Table 2: Descriptive characteristics of mortars from the Komishani (Authors, 2023).

Pestles

Pestles are movable upper stones, typically elongated, and often exhibit

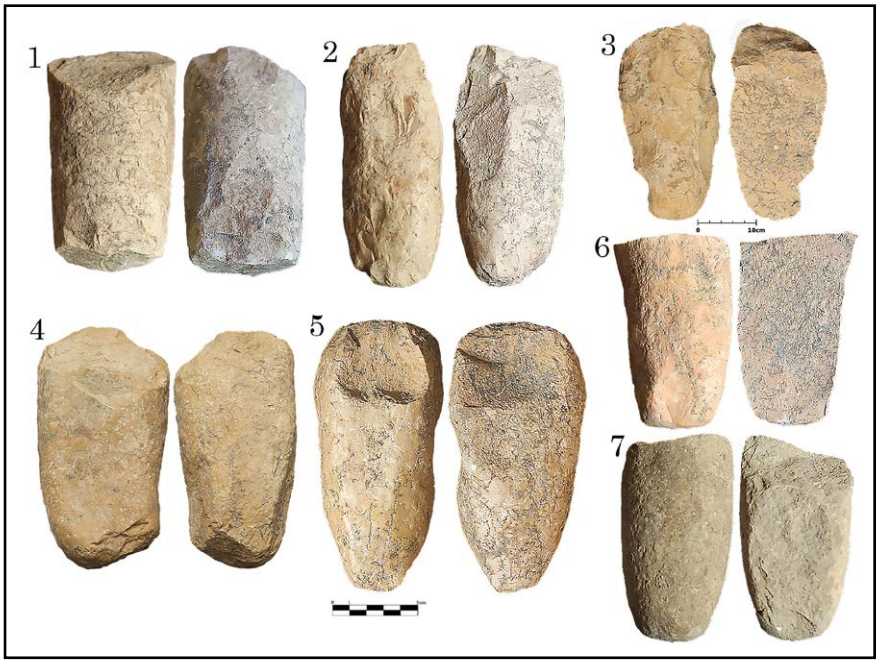
battered ends with circular, oval, or occasionally irregular working surfaces. In cross-section, they are convex, rounded, or flat, and are categorized accordingly (Wright, 1992: 69). They are used for pulverizing, crushing, and grinding, and display variation in both shape and size. Most are selected from naturally suitable river pebbles and used with little to no modification, while others are deliberately shaped into specific forms, sometimes featuring finger grips or notches for handling. Larger and heavier pestles are employed for pounding and breaking, while smaller and lighter examples are used for finer crushing, grinding, and stirring tasks.

Wear patterns on pestles used in mortars appear at the ends and along the lateral surfaces that contact the mortar basin. These traces include impact fractures, surface removals, and abrasion. Conversely, wear on pestles used on flat surfaces such as slabs or ground surfaces is concentrated on the flatter end. Some pestles also exhibit secondary functions: they may be employed in multi-stage processing sequences, such as using the same tool to mash fish and grind cereals, or to crush plant pods within a mortar before refining them into flour on a grinding slab (Adams, 2002: 138–140). Pestles are among the most ubiquitous ground stone tools in the Near East and are found across virtually all excavated sites in the region. At Chogha Golan, one pestle contained traces of natural bitumen; at East Chia Sabz, seven pestles were documented (Darabi, 2016: 14), and at Tol-e Chega Sofla, 25 specimens were recovered (Dahdouh, 2024: 145).

The pestles from the Komishani site were all recovered from Trench 6, primarily from context 6064. This layer yielded abundant animal remains, particularly fish jaws and teeth, as well as bird foot bones suggesting bird hunting and fishing activities. Pestles in this context may have been used for processing, pounding, and crushing bones. Notably, their morphological characteristics deviate somewhat from typical examples. For instance, pestle no. 5 exhibits precisely symmetrical removals on both its dorsal and ventral surfaces, resulting in pebble-like depressions. These features may reflect the aesthetic preferences of their makers, or alternatively, they could be accidental removals created to produce a thinner edge for an alternative function.

In Figure 5, specimens 1 through 5 were all recovered from this same context. Particular care appears to have been taken in selecting raw materials, and a notable symmetry is evident in their shaping. The polish observed on their surfaces may either reflect aesthetic choices or, possibly, a functional necessity: due to the presence of foraminifera fossils

(micro-aquatic marine organisms) that make the stone surface abrasive, users may have polished the pestles to create smoother working surfaces. This attention to material selection and morphological refinement suggests a high level of craftsmanship. Both the handles and ends show signs of impact and indicate multi-functional usage. Some ends were likely used on flat surfaces such as slabs or hard-packed ground while others were employed on curved or concave surfaces resembling mortars.



◄ **Fig. 4: Pestles recovered from the Komishani site (Authors, 2023).**

Number	Trench	Material	Weight	Length	Width	Thickness	Munsell Stone Color
1	6	Limestone with Foraminifera fossils	750	11.9	7	6.6	10 YR 8/2 Very pale orange
2	6	Limestone with Foraminifera fossils	425	13.1	7.3	5.1	10 YR 7/4 Grayish Orange
3	6	Limestone with Foraminifera fossils	500	16.5	7.9	3.3	10 YR 7/4 Grayish Orange
4	6	Limestone with Foraminifera fossils	750	13.5	7.3	5.5	10 YR 7/4 Grayish Orange
5	6	Limestone with Foraminifera	800	15	7.3	5.50	10 YR 7/4 Grayish Orange
6	6	Light Limestone	420	11.5	7.2	3.1	10 R 7/4 Moderate Orange Pink
7	6	Calcareous Sandstone	600	12.2	6.7	5.1	5 YR 7/2 Grayish Orange Pink

◄ **Table 3: Descriptive characteristics of pestles from Komishani site (Authors, 2023).**

In the image above, the surface of pestle handle No. 5 is shown under 65x magnification using a digital microscope. On the right are images of the use-worn and impact surfaces, where breakage and chipping occurred at the end of the handle. Below, a foraminifera fossil embedded in the stone material is visible. Since the wear and impact traces were clearly observable to the naked eye, similar imaging was not conducted for the other specimens.

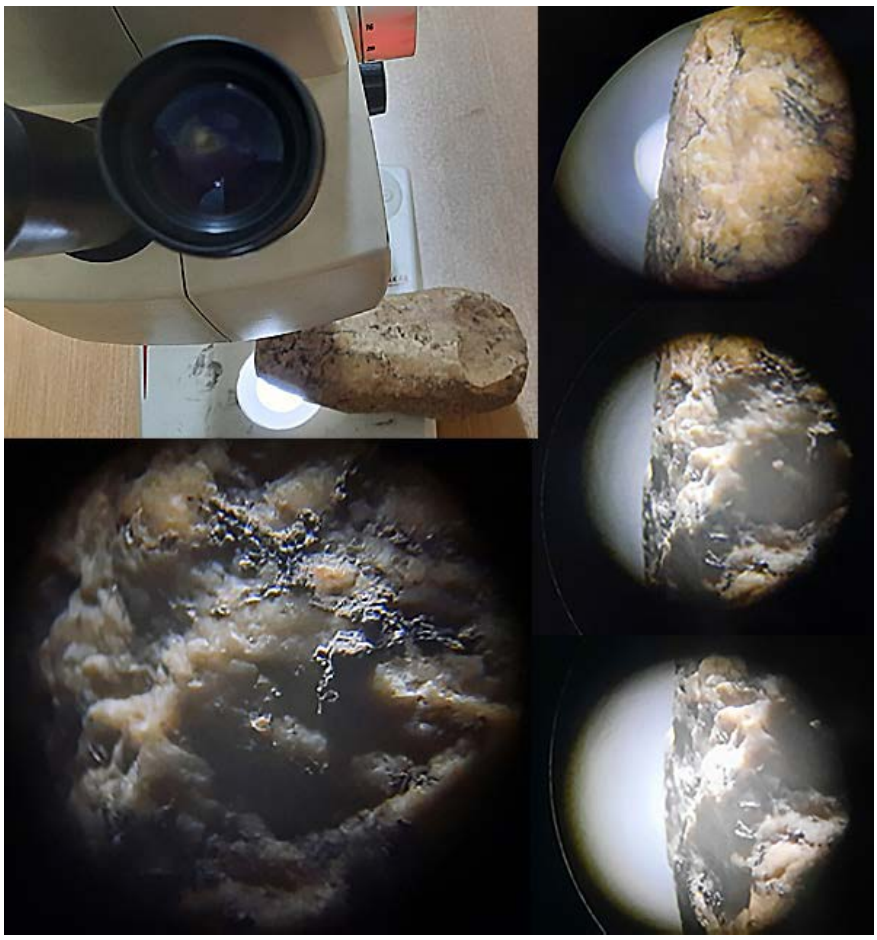


Fig. 5: Microscopic images of pestle handle no. 5 (Authors, 2023). ▶

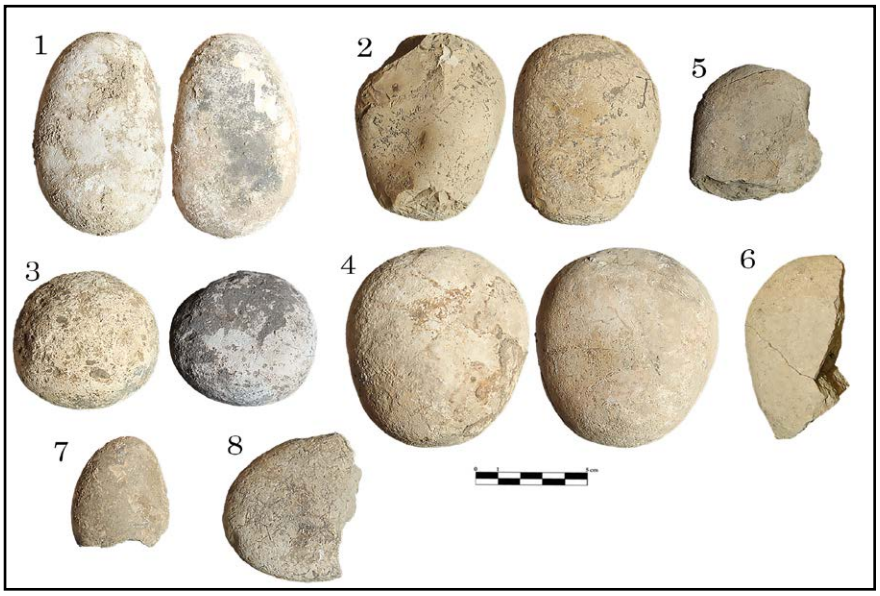
Hand stones

Small stones are used for processing pigments or for mixing materials on a palette stone and lower stones. Typically, they are small, smooth river stones, approximately 5 to 20 cm in length, and some bear finger grooves that make them easier to hold. Their texture ranges from smooth to coarse. Any hand stone associated with a lower grinding stone (mano) is referred to as an upper grinding stone (metate), and if there is no evidence of such association, it is termed a hand stone. The analysis of their distribution over time and space is well established (Adams, 2002: 143).

They are often found at agricultural sites; one cylindrical example was found at East Chia Sabz. This type of tool appears in the Neolithic layers (after the Bos Morde phase) of the Dehluran Plain but became common in the Sefid phase at Tepe Chogha Sefid, where its use reached its peak. At Tepe Sabz, they were also recovered in association with grinding stones (Darabi, 2016: 17). At Chogha Golan, several specimens ranging from 6 to 18 cm in length were found, some of which had been used for processing

pigments (Conard & Zeidi, 2013: 371). Examples from Tepe Mahtaj (Darabi *et al.*, 2017) and 15 samples from Tol-e Chega Sofla have also been reported (Dahdouh, 2024: 142).

In the excavation of the Komishani site, eight hand stone samples were recovered; all but two (samples 2 and 8) came from Trench 5. Sample 2, in addition to its worn surface, exhibits chips from impact and pounding on both ends and was found alongside pestles, suggesting its potential multi-purpose use as both a hand stone and a pestle for pounding.



◄ **Fig. 6: Hand stones recovered from the Komishani (Authors, 2023).**

◄ **Table 4: Descriptive characteristics of hand stones from Komishani (Authors, 2023).**

Number	Trench	Material	Weight	Length	Width	Thickness	Munsell Stone Color
1	5	Light Limestone	1.250	15.5	8.5	7	10 YR 8/2 Very pale orange
2	6	Limestone with Foraminifera fossils	450	10	7	5	10 YR 8/2 Very pale orange
3	5	Calcareous Sandstone	350	7.4	6.8	5	10 YR 8/2 Very pale orange
4	5	Calcareous Sandstone	600	10	8	6	5 YR 5/2 Pale Brown
5	5	Light Limestone	510	9	7	4	10 YR 8/2 Very pale orange
6	5	Light Limestone	550	12	6.2	5.5	10 YR 8/2 Very pale orange
7	5	Sandstone	150	7.1	5.3	3	5 YR 4/1 Brownish Gray
8	6	Limestone with Foraminifera fossils	400	7.7	10	3.7	10 YR 8/2 Very pale orange

Hoe

Hoes are thick and robust tools, characterized by cuts along their edges, and some possess grooves for attaching a handle. They were used for shallow soil digging, weeding, or creating trenches to divert water. The

thinness of some blades was produced by flaking (Adams, 2002: 178). Several examples have been recovered from Tall-e Chega Sofla (Dahdouh, 2024: 144). At the Komishani site, four hoe samples were recovered. Except for one specimen (No. 2), all were found in Trench 5. Metamorphic stones are stronger than sedimentary stones, and the use of such material in the manufacture of hoes is noteworthy. Hoe no. 1 was recovered from the bottom of a smuggling pit adjacent to Trench 5, while the others were found in in-situ layers directly associated with digging pits and preparing the soil surface. They exhibit removals at their ends to make them thinner and more closely resemble stone axes.

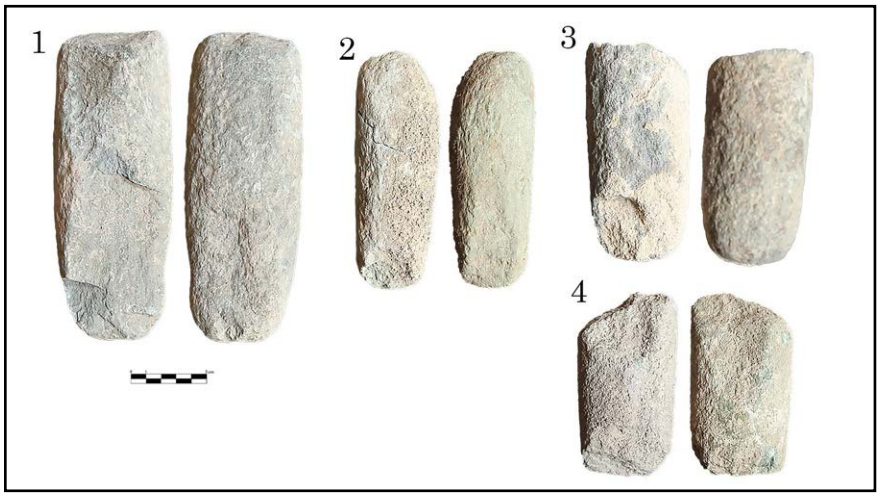


Fig. 7: Hoes from Komishani site, photo by (Authors, 2023). ▶

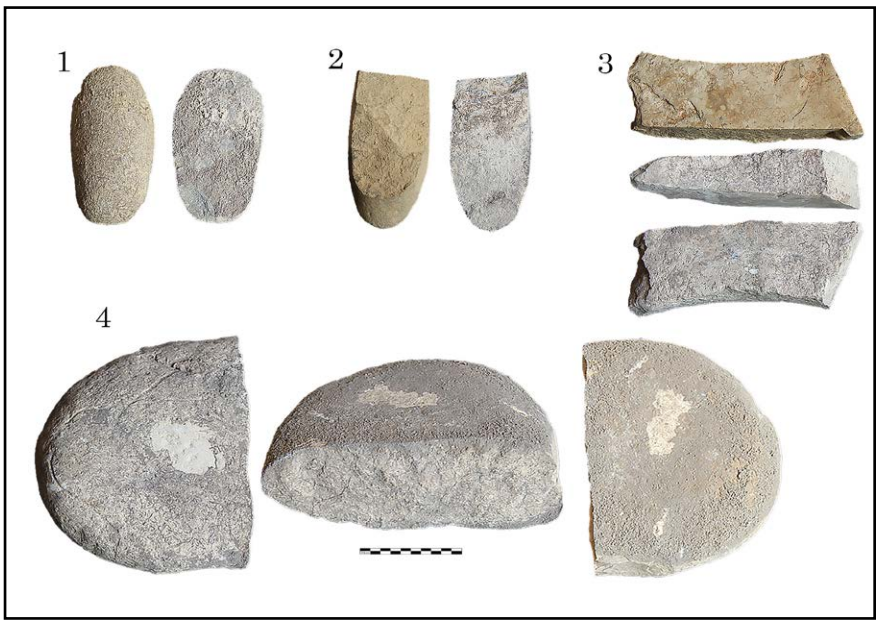
Table 5: Descriptive characteristics of hoes from Komishani site (Authors, 2023). ▶

Number	Trench	Material	Weight	Length	Width	Thickness	Munsell Stone Color
1	5	Metamorphic stone	1.250	20	74	5.2	5G 5/2 Grayish Green
2	6	Metamorphic stone	350	12.6	4.5	4.5	5G 5/2 Grayish Green
3	5	Metamorphic stone	750	12.4	74	52	5GY 4/1 Dark Greenish Gray
4	5	Sandstone	500	11	60	4.4	5G 5/2 Grayish Green

Unknown Ground Stone Tools

This category includes stones whose exact nature and function cannot be definitively determined. For this reason, they have been classified and presented separately. Four ground stones with unknown functions were recorded from the Komishani site, with samples 1 and 2 found in Trench 5, and samples 3 and 4 found in Trench 6. Pieces 2 and 3 in the image have no known parallels; however, their shapes increase the likelihood that they serve a specific function. Piece 2 has a molded impression, and piece 3 has a polished, shiny surface. Piece 1 is likely a broken fragment of a hand stone, and piece 4, considering its weight and the abrasion on one side, could be a broken fragment of a grinding slab. A notable point is its ability to remain stable when standing on the fractured side. It was recovered from

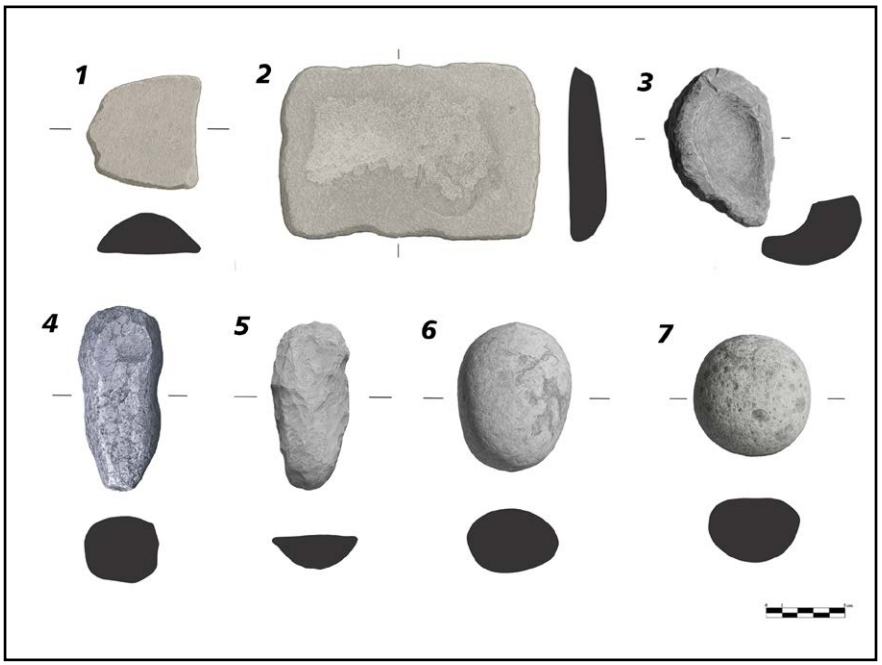
a layer where numerous stones were used to create a platform for placing horns.



◄ Fig. 8: Unknown ground stone from Komishani (Authors, 2023).

Number	Trench	Material	Weight	Length	Width	Thickness	Munsell Stone Color
1	5	Sandstone	250	12.2	6.1	2.8	5YR 5/2 Pale Brown
2	5	Limestone	200	9.7	4.8	30	10 YR 6/2 Pale Yellowish Brown
3	6	Limestone with Foraminifera fossils	1.100	21	8	4.4	10 YR 7/4 Grayish Orange
4	6	Limestone with Foraminifera fossils	4.100	16	20	8	10 YR 7/4 Grayish Orange

◄ Table 6: Descriptive characteristics of unknown ground stone from Komishani (Authors, 2023).



◄ Fig. 9: Some ground stone specimens from Komishani; 1. Upper grinding stone 2. Grinding slab 3. Mortar 4-5. Pestle 6-7. Hand stone), (Drawing by: Amir Mahmudabadi).

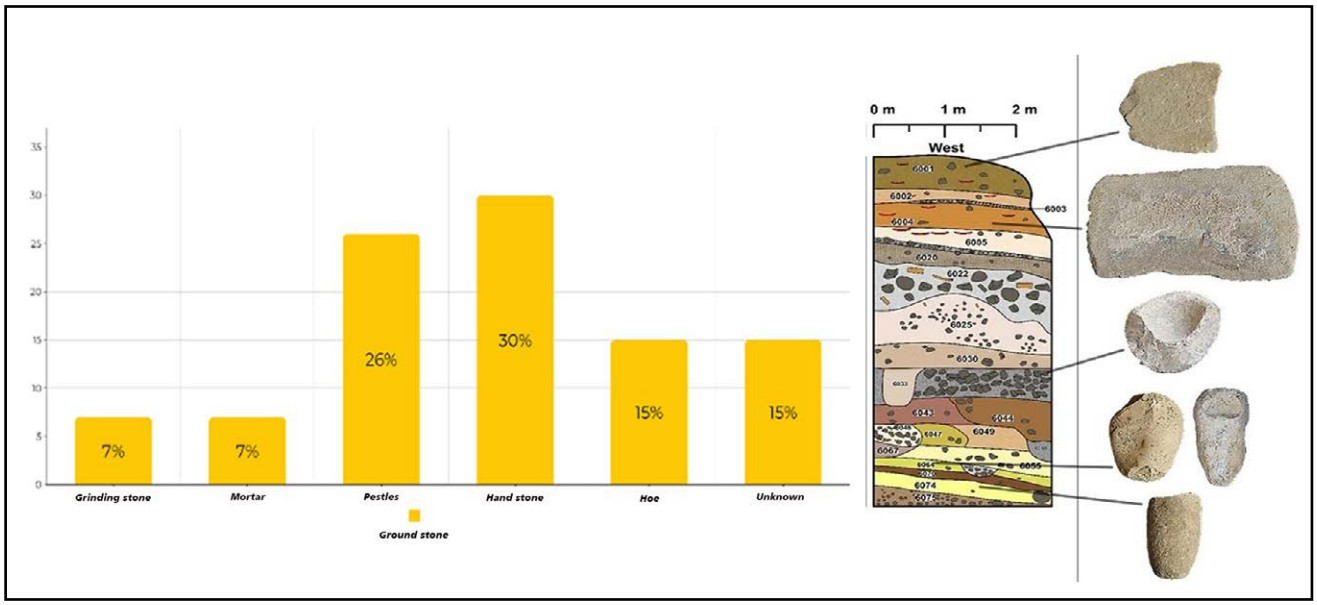
Discussion

A distinction can be made between the portability of ground stone tools and the mobility of the individuals who used them. In highly mobile hunter-gatherer groups, smaller and more portable tools were used, or ground stone technology was entrusted to the collective (unconscious) memory (Wright, 1994: 247). Therefore, there is no reason to assume that, because ground stone tools were not easily portable, the people who used them were immobile and sedentary (Adams, 1993: 341). In the Late Upper Palaeolithic Period, many grinding stones were not easily portable. The use of ground stone tools, hearths, energy expenditure for tools and their movement, and bringing plants to grinding tools rather than vice versa especially concerning items like hearths, ovens, and grinding stones that were less mobile was more probable. In this cycle, ground stone tools functioned as focal points, encouraging repeated occupation of the same location. The multipurpose nature and immobility of some objects created fixed points around which humans gathered; otherwise, the immobility of ground stone tools alone does not lead to sedentarism (Hodder, 2018: 10). The entanglement of plant use in the Middle East demonstrates how grinding stones and hearths created a cultural tradition centred on the home and dwelling (Fuller *et al.,* 2016). This entanglement of things can also be traced in the interaction and mutual influence of plants and ground stone tools on each other. In the process of domesticating wild plants, where the hard husk is often lost the characteristics that pounding and grinding aim to simplify similar to the reduction in human tooth size mentioned earlier, show the reciprocal effects of things on each other.

The arduous nature of processing wild cereals has been underestimated. Wild cereals offer a higher energy yield because they are naturally well-preserved in their husks for storage. However, their processing is more difficult, so humans focused on tools and technology to facilitate processing (Wright, 1994: 257). The evolutionary trajectory of ground stone can be simultaneously traced in a dialectic between the domestication of wild plants and the transformation and typology of ground stone tools. Although the precise chronological breaking point of plant domestication or the transformation and replacement of ground stone tools is undefinable, in the stages of pre-extensive agricultural production, if there was a continuity of closer relationships between humans and plants, discerning the exact moment when plant domestication occurred is very difficult, and what truly exists is a process of increasing intensity of plant use (Cauvin, 2001: 109).

This point is also evident in the use and intensification of ground stone, from pounders to grinding tools, from multi-purpose pestles used in other contexts to hand stones and grinding slabs specifically used for grinding cereals. These cases indicate a transitional trend in livelihood strategies: the intensity of fish catching and bird hunting gradually decreased in the lower layers, and in the upper layers, the focus shifted to plant processing and the expansion of agriculture. It should be noted that all but one (Fig. 6) of the hand stones and hoes were recovered from Trench 5, indicating agricultural development in this trench. After the publication of studies on animal bones and plant remains recovered from the site, and placing them alongside the changes in tool morphology, more reliable lines can be drawn for their evolutionary sequence. In older phases, the presence of multi-purpose pestles alongside fish catching and bird hunting is noteworthy, as they gradually gave way to hand stones. Acorns and pine nuts did not require processing before storage; rather, most time was spent grinding them. However, fish and seafood, which are more nutritious, cannot be stored and need to be smoked or dried, or consumed immediately after being caught, as raw fish spoils (Graeber & Wengrow, 2022: 268). In comparison to other ground stone tools, there appears to be a significant relationship between the extent of hand stone and grinding slab use and, on the other hand, the level of agriculture and food production (Darabi, 2016: 17). The inverse movement in the layers indicates this. Most hand stones (Fig. 6) were recovered from the horizontal trench, which is directly related to the expansion of agriculture. The presence of architectural structures, the recovery of ovens, and related spaces all indicate activities related to food production. However, in the vertical trench, from the lowermost layers, we observe the presence of multi-purpose pestles, and considering their wear surface, it can be assumed that they were not only used in mortars but also on a flat surface or for processing fish and pounding hunted birds. The possibility of their use by hunter-gatherer groups is high, and it can be considered a pre-agricultural stage that gradually gave way to mortars and grinding slabs.

The practice of breaking ground stone tools at the Komishani site appears to represent the final stage in their production and use cycle. Most of the broken pieces were recovered from in situ layers and were not subjected to the damage caused by ploughing or other external agents. This phenomenon is observable even in the lowest layers. Few intact tools remain, and the rest show signs of being halved and intentionally



▲ **Fig. 9: Diagram of the ground stone of the Komisani and their location in Trench 6 (Authors, 2023).**

broken, which reduces the likelihood of accidental breakage. Perhaps they were used for secondary purposes, such as hammer stones, after breaking. Seventeen out of the twenty-seven introduced pieces are broken, some of which were used in the construction of structures. At Tepe Mahtaj, most of the recovered ground stone tools are also broken and seem to have been used for building stone structures, indicating their secondary use (Darabi, 2017: 19).

The statistical ratio of ground stone tools also indicates a greater use of hand stones, which are directly related to grinding cereals. These were mostly found in the horizontal trench, alongside ovens and heated areas, indicating agricultural development, and serve as a replacement for the pestles in the lower layers, whose use by hunter-gatherer groups is highly probable, as they are both portable in terms of weight and multi-purpose in application. Mortars and grinding slabs also occur in equal proportions, with the only notable difference being the replacement of grinding slabs in the upper layers by mortars. In the Pre-Pottery Neolithic Period, ground stone tools increased in both number and variety. Before agriculture, the use of mortars was common, while grinding slabs became prevalent in the Early Neolithic, indicating a shift from foods prepared by pounding towards foods prepared by grinding. However, the assumption that mortars were used for processing nuts and acorns and grinding slabs for processing grains remains to be proven (Ebeling & Rowan, 2004: 108). As mentioned in the introduction, certainty regarding the efficacy and function of ground stone tools is only possible through laboratory studies and the examination

of micro-residues remaining on their surfaces. Nevertheless, at the Komishani site, a progression from pounding to grinding can be observed, as the pestles of the lower layers were replaced by the grinding slabs and hand stones of the upper layers.

Conclusion

The emergence of ground stone tools at the Komishani site begins with pestles, which gradually give way to the proliferation of hand stones, while mortars are replaced by grinding slabs. This pattern indicates the expansion of agriculture in the upper layers of the site. Hand stones and grinding slabs are often associated with the grinding of cereals (plant seeds). However, a notable feature of the ground stone tools at this site is the type of stone used, which contains foraminifera fossils. The inhabitants of the site must have collected these from the seashore, demonstrating both their careful selection of raw materials and their high skill in producing ground stone tools. The lightness and portability of these tools increase the likelihood of their use by hunter-gatherer groups. In the same phase, the abundance of fish and bird bones is noteworthy, and, by considering these factors together, one can identify human societies transitioning from multi-subsistence strategies such as bird hunting, fish catching, and crushing hard seeds into agricultural communities. It is possible that the evolution of ground stone tools began with hunter-gatherer groups and continued into sedentary societies, with this change and exchange representing a response to livelihood needs, shifts in subsistence strategies and choices, and being dependent on climatic changes and events.

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Authors' Contribution

This article is the result of a project in which all Authors were present and actively participated. Also, in order to write the article Amir Mahmoodabadi 40%, Hassan Fazeli Nasli 30%, Mojtaba Safari 20%, and Xinying Zhou 10%.

Conflict of Interest

The authors, while observing publication ethics in referencing, declare the absence of conflict of interest

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گونه‌شناسی، تطور و جایگزینی ادوات‌سنگی در تغییرات معیشتی ساکنان محوطهٔ کمیشانی

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چکیده

محوطهٔ کمیشانی در کنار جادهٔ نکا به بهشهر و در فاصلهٔ ۱۰ کیلومتری غرب شهرستان بهشهر، به مختصات جغرافیایی ۳۶۴۰۱۲۸۱ N ۵۳۲۱۵۵۱۱,E در تراس روبه‌روی غار کمیشان و در نزدیکی غارهای هوتو و کمربند در ارتفاع ۴۵ متری از سطح دریا واقع شده است. در فصل دوم کاوش در محوطهٔ کمیشانی درمجموع ۲۷ عدد ادوات سنگی به‌دست آمد که طبق گونه‌شناسی شامل: تخت‌سنگ آسیا، سنگ-آسیارویی، هاون، دستهٔ هاون، سنگ‌دستی و خیش می‌شوند. طبقه‌بندی و گونه‌شناسی ادوات‌سنگی اغلب مبتنی‌بر ریخت‌شناسی بوده؛ طبقه‌بندی و ریخت‌شناسی را تنها می‌توان به معنای تعلل برروی ریزه‌کاری‌ها و عوامل محرک در آغاز چیزها دانست و نه فرجام آن‌ها، کارکرد و تأثیر متقابل آن‌ها بر دیگر چیزها که به آن‌ها معنا و تعین می‌بخشد. در محوطهٔ کمیشانی تغییر، جایگزینی و هم‌نشینی ادوات‌سنگی نشانگر استفاده از دستهٔ هاون‌ها در لایه‌های تحتانی برای کوبیدن، خُرد کردن و پرداخت ماهی‌های صید شده و پرندگان شکار شده در کنار گیاهان است که رفته‌رفته در لایه‌های فوقانی دسته هاون‌ها و هاون‌ها جای خود را به تخت‌سنگ‌آسیا و سنگ‌دستی‌ها داده‌اند که برای آسیا کردن و پرداخت مواد غذایی می‌باشند. جوامعی شکارگر-گردآورنده در کنار مدیریت گیاهان که رفته‌رفته به کشت، تولید و گسترش کشاورزی می‌رسند و توسعهٔ کشاورزی در بزرگ‌تر شدن ابعاد ادوات‌سنگی نیز آشکار است. نگاه به ادوات‌سنگی همیشه پیوندخورده به کشاورزی و در پس‌زمینهٔ آن بررسی شده است؛ اما مطالعات اخیر نشان‌دهندهٔ پیدایش آن در دوره‌های پیشین‌تر و تأثیرات آن در رژیم غذایی، سکونت، سنت پدید آمدن خانه و تأثیر متقابل آن برروی گیاهان و حتی تسریع‌تر شدن کوچکی دندان آسیا انسانی می‌باشد. در متن حاضر در کنار طبقه‌بندی و توصیف اولیه، سعی‌شده است؛ روند تطور و جایگزینی ادوات‌سنگی در محوطهٔ کمیشانی که در ارتباط با انتخاب و تغییر شیوهٔ معیشت ساکنان این محوطه است، نشان داده شود.

کلیدواژگان: ادوات سنگی، نوسنگی، محوطهٔ کمیشانی، تولید غذا، کشاورزی.

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Dalma or Non-Dalma: Evaluation of the Ceramic Assemblages Attributed to the Dalma Culture

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Abstract

During the past two decades, a dozen excavations have been conducted in the primary geographical region of the Dalma Culture and its surrounding areas of the Zagros. Some archaeologists have assigned the ceramic assemblages recovered from these investigations to the Dalma Period based on ceramic types comparable to the classic Dalma ceramic tradition, such as Dalma Impressed, Dalma Monochrome, and Red-Slipped Ware. Several of these assemblages exhibit a combination of cultural materials originating from two or three neighboring regions. In distinguishing between genuine Dalma ceramics and those containing elements merely resembling the classic Dalma ceramic tradition, it is essential to employ the defining characteristics of the Dalma ceramic tradition as a baseline for establishing the relative chronology of these assemblages. Numerous ceramic assemblages from sites both within and along the periphery of the Dalma territory have been attributed to this period, including Kalnan, Soha Chai, Talvar II, Tazeh Kand, Qela Gap, Kul Tappeh, and Idir. The assemblages from these sites can be examined in detail to identify localized traits. It is likewise possible to distinguish ceramics "attributed to the Dalma tradition" from the "classic Dalma tradition," thereby clarifying some of the characteristics and boundaries of this ceramic tradition. In this article, we examine the ceramic assemblages, and, in certain cases, other aspects of the sites attributed to the Dalma Culture, and compare them with key reference sites such as Dalma Tappeh, Godin, Seh Gabi B, and Nadali Beig. The results indicate that some sites attributed to the Dalma Culture actually belong to later periods, such as Gabrestan I and Godin VII, whose ceramic assemblages contain attributes only distantly related to those of a genuine Dalma assemblage.

Keywords: Dalma Ceramic Tradition, Dalma Monochrome, Dalma Impressed, Godin VII Period, Absolute Chronology.

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Introduction

Prehistoric cultures in archaeology are primarily defined through their ceramic assemblages. The extent of prehistoric cultures can be determined by the geographical distribution of these assemblages. In addition, ceramic assemblages usually provide evidence of cultural interactions between different regions. In studying prehistoric cultures through their ceramic assemblages, one should consider the possibility that cultural materials in the buffer zones of cultural boundaries may contain ceramics from two or even three neighboring regions. We aim to discuss one of Iran's most widespread prehistoric cultures, the Dalma Culture, and critically evaluate ceramic assemblages from several sites attributed to this culture. To this end, our discussion is based on ceramic analyses and, in some cases, on absolute chronology.

The Dalma Culture and Its Place in the Prehistoric Sequence of the Central and Northern Zagros

According to some researchers, the Dalma Culture was primarily an unconventional ceramic phenomenon or "ceramic tradition" that developed in the rugged landscapes of the high Zagros during the first half of the 5th millennium BCE (Henrickson & Vitali, 1987: 37). It is important to note that this perspective is based on the fact that the culture is best known for its distinctive ceramic assemblages. Excavations at Dalma Tappeh, located south of Lake Urmia, led to the identification and definition of the Dalma ceramic tradition in the 1960s (Young, 1963; Hamlin, 1975). Subsequent excavations at Godin Tappeh and Seh Gabi B, along with re-evaluations of ceramic collections from Siahbid and Chogha Maran in the Central Zagros, revealed similar assemblages, which highlighted this newly identified culture in terms of its ceramic tradition (Young & Levine, 1974; Henrickson, 1985; Levine & McDonald, 1977). Extending over 400 km, from the southern shores of Lake Urmia to the southern parts of the Central Zagros, the Dalma Culture represents one of Iran's most extensive prehistoric cultural entities. The most distinctive aspect of this culture is its ceramic assemblages, which demonstrate a remarkable uniformity across its territory. Some researchers have attempted to explain this cultural uniformity on anthropological grounds (Henrickson & Vitali, 1987: 37; Hole, 1987: 48; Henrickson, 1983; 1989: 380).

C. Hamlin, who published an article on Burney's and Young's excavations at the type site Tappeh Dalma, has categorized the ceramic assemblage into

four main ceramic types: Dalma Monochrome, Dalma Impressed (surface-manipulated), Red-slipped, and Plain Ware. The chronological placement of the Dalma period in the prehistoric sequence of the southern Lake Urmia region is identified as the Early Chalcolithic, or "Hasanlu IX." It succeeded the Late Neolithic or Hajji Firuz phase ("Hasanlu X") and preceded the Late Chalcolithic or Pisdeli phase ("Hasanlu VIII") (Voigt & Dyson, 1992). Although it has been claimed that Lavin Tappeh provides evidence of continuity between these periods (Hejabri Nobari *et al.*, 2012), in the absence of convincing evidence, such as the pottery sequence at Lavin, it is challenging to accept this viewpoint. Therefore, based on ceramic typologies, there is as yet no clear cultural continuity between the Late Neolithic ("Hasanlu X"), Early Chalcolithic ("Hasanlu IX"), and Late Chalcolithic ("Hasanlu VIII").

Following the identification and initial characterization of the Dalma ceramic tradition at the type site, Tepe Dalma, several ceramic assemblages were uncovered through excavations in the Central Zagros region. Despite minor differences, these assemblages displayed significant similarities to those from the southern Lake Urmia Basin. Owing to their remarkable ceramic similarities, these assemblages were also attributed to the Dalma Culture or Ceramic Dalma Tradition in both the Kangavar and Mahidasht sequences (Young & Levine, 1974). In the Kangavar sequence, Dalma ceramics were recovered from excavations at Godin (Trench XYZ) and Seh Gabi Mound B. In the Mahidasht sequence, Dalma ceramics have been identified at Siahbid and Chogha Maran (Henrickson, 1983; Levine & McDonald, 1977; Young & Levine, 1974).

There are differences in the ceramic assemblages of the Dalma Culture in the Kangavar sequence of the Central Zagros compared to those from the southern Lake Urmia Basin. While, as mentioned before, Dalma ceramics consist of four main types in the Lake Urmia Basin, this ceramic tradition in the Kangavar sequence includes eight ceramic types. In addition to those defined at the type site, these are: 1. Dalma Bichrome, 2. Dalma Streaky, 3. Black-on-Buff (BOB), and 4. Dalma Ubaid/Untempered (DUP) (Henrickson, 1983; 1985; Levine & Young, 1987).

Following the Early Chalcolithic, also known as the Shahn Abad Phase, this phase was succeeded by Middle Chalcolithic II, also known as the Seh Gabi Phase. In the Kangavar sequence, a critical issue remains unresolved regarding the stratigraphic and chronological relationship between the Early Chalcolithic (Shahn Abad) and Middle Chalcolithic I (Dalma) (Young & Levine, 1975). To date, no site has been excavated that reveals the nature

of the transition between these two periods in ceramic development. These two phases were associated with two separate mounds at Seh Gabi, Mound C (Shahn Abad) and Mound B (Dalma), and no cultural continuity is evident in their ceramic assemblages. However, the relationship between Middle Chalcolithic I (Dalma Phase) and Middle Chalcolithic II (Seh Gabi Phase) in the Kangavar sequence is much more straightforward. Deposits of the Seh Gabi Phase immediately overlay the Dalma deposits in Trench XYZ (layers 43–48) and the upper layers of Seh Gabi Mound B (layers 1–4) without cultural interruption (Henrickson, 1983; Henrickson, 1985). In their ceramic assemblages, Red-Slipped Ware—a variant of Impressed Ware—and Black-on-Buff (BOB) demonstrate continuity between the Dalma and Seh Gabi phases (Young & Levine, 1974; Henrickson, 1983; Henrickson, 1985). Notably, materials associated with the Seh Gabi Phase and those associated with the Dalma Phase remain unpublished at Godin. Our understanding of these two phases is therefore based primarily on the materials from Seh Gabi Mound B.

In the Mahidasht sequence of the Kermanshah region, the Dalma Phase has been defined by four ceramic types: 1. Black-on-Buff (BOB), 2. Dalma Ubaid/Untempered (DUP), 3. Red-Slipped Ware, and 4. Impressed Ware. Dalma Streaky, Dalma Bichrome, and, most importantly, Dalma Monochrome have not been reported from Mahidasht sites (Henrickson, 1983; Henrickson, 1985; Renette *et al.,* 2023).

The limited occurrence of Dalma Bichrome ware in two sub-areas of the Central Zagros—Kangavar and Sonqor—at sites such as Tappeh Seh Gabi B, Tappeh Nad Ali Beig, and Tappeh Khodaei underscores notable intra-regional variations in the Dalma ceramic assemblages (Bahranipoor, 2018; Khatib Shahid *et al.,* 2012; Henrickson, 1983: 200; Levine & Young, 1987: 21). The presence of distinctive ceramic types such as Black-on-Buff (BOB) and Dalma Ubaid/Untempered (DUP) within Dalma contexts at sites such as Godin, Seh Gabi B (Young & Levine, 1974; Henrickson 1983; 1985: 69), Nad Ali Beig (Bahranipoor, 2023), Chogha Maran, and Siahbid (McDonald, 1979; Renette *et al.,* 2023) in the Kangavar and Mahidasht sequences, as well as possibly in the intermediate valleys between these two regions, provides strong evidence of this ceramic tradition's diffusion from the Ubaid culture of the Mesopotamian lowlands into the Central Zagros (Bahranipoor 2023). Most researchers attribute the widespread distribution of these ceramic types, especially in Mahidasht, Kangavar, and the Seymareh Valley, to the influence of the Great Khorasan Road, a major

cultural and trade route through the Central Zagros region (Hole, 1987: 48; Henrickson, 1983: 739; Henrickson & Vitali, 1987: 44; Abdi, 2002).

In addition to the notable intra-regional differences in the Dalma ceramic tradition, recent studies indicate that this tradition is neither uniform nor homogeneous on a sub-regional scale. This heterogeneity may stem from stylistic variations and influences from local ceramic traditions. For instance, while Nad Ali Beig's ceramic assemblage displays close similarities with those of Godin and Seh Gabi B in the Central Zagros region, it also exhibits local distinctions, comparable to the way Lavin Tappeh's ceramic assemblage differs from that of Tappeh Dalma in the southern Lake Urmia region (Bahranipoor, 2021).

Chronology of the Dalma Period

The chronology of the Dalma period has been a matter of debate for several decades. Before the excavation of Tappeh Nad Ali Beig, our knowledge of the Dalma period's chronology was based primarily on absolute dating derived from excavations conducted in the 1960s and 1970s. These absolute dates were based on a single sample from Tappeh Dalma (Hamlin, 1975, Table 2), one sample from Seh Gabi Mound B in the Kangavar Valley (Henrickson, 1983: Table 71), and two samples from Dalma deposits at Siahbid in the Mahidasht Plain (Henrickson, 1985; Henrickson, 1983: Table 71). These dates are unreliable due to their wide range (approximately 400–500 years) and the use of outdated dating techniques (Marshall, 2012: 246-247). The absolute date for Seh Gabi B (Layer 6) indicates a range of 4410–4565 BCE (1σ) (Voigt & Dyson, 1992: Table 2). Researchers have proposed various timeframes for the Dalma period based on these ambiguous dates. Henrickson, for example, initially proposed a range of 4100–3700 BCE, then revised it to 4000–5100 BCE, and ultimately proposed 4800–5000 BCE (Henrickson, 1985: 50; Henrickson, 1989: 369; Henrickson, 1992: 287).

Recently, the Dalma deposits at Tappeh Qeshlagh near Bijar have been dated to 5000 ± 250 BCE and 5000 ± 350 BCE using the thermoluminescence method (Sharifi & Motarjem, 2018: Fig. 4). However, because of the broad time range (between 500 and 600 years), these data are also considered unreliable. Furthermore, absolute dates have been reported for deposits attributed to Dalma at Soha Chai (Rahimi Sorkhani & Eslami, 2018), Kalnan (Saed Moucheshii *et al.*, 2011), and Layer VIII of Kul Tappeh (Abedi, 2016: Table 2). However, these dates are problematic

due to the weak and uncertain attribution of their pottery assemblages to the Dalma ceramic tradition (see below for further details). In contrast, the chronology of the Dalma period has recently been partially clarified based on 15 radiocarbon dates from the Nad Ali Beig sequence in the Central Zagros, which constitute the first reliable dates for a part of the Dalma cultural sequence in the region (Bahranipoor, 2023). Although the settlement at Nad Ali Beig does not cover the beginning and end of the Dalma period, the start of the Dalma pottery tradition can be estimated at around 5200/5100 BCE, with its end around 4600 BCE (e.g. Renette, 2022: 40; Bahranipoor, 2023: 613; Hole, 1987, Table 2).

The Problem: Dalma or Non-Dalma

When the Dalma Culture or Dalma Ceramic Tradition was first identified at the type site Tappeh Dalma and then recognized in the Kangavar area, most researchers were astonished by the apparent uniformity among the ceramic assemblages of this culture. Nevertheless, it was also apparent that the Central Zagros assemblages differed from those of the Urmia Lake Basin in having four additional ceramic types, i.e., BOB, DUP, Streaky, and Bichrome variants (e.g., Henrickson, 1983; Levine & Young, 1987). Recently, more detailed ceramic analyses from newly excavated sites in western Iran have suggested that despite the apparent uniformity among the different ceramic assemblages of this culture, there are distinct local traits as well, allowing the subdivision of the Dalma Culture territory into several sub-regions (Bahranipoor, 2021). In the following, we provide some considerations essential for identifying whether a given ceramic assemblage belongs to the Dalma Culture. We will discuss different ceramic types of the Dalma Culture from different perspectives to establish a baseline for evaluating ceramic assemblages attributed to this tradition. First, we begin with the most diagnostic variant of the Dalma ceramic assemblage: Dalma Monochrome.

Dalma Monochrome is the most critical component of Dalma assemblages because of its distinctive painted designs. The painted designs of Dalma Monochrome differ markedly from those of the preceding and succeeding phases in both the Central and Northern Zagros. Detailed ceramic analyses have shown that this variant can be divided into two versions based on the complexity of painted designs (Henrickson, 1983; Bahranipoor, 2022). The earlier version is painted with simple linear motifs, while the later version bears more elaborate geometric designs. Contrary

to some ceramic types of Dalma assemblages, such as Dalma Impressed and Red-Slipped Ware, which have a much longer temporal existence in ceramic assemblages of different periods (see below), Dalma Monochrome is restricted in time to the Dalma period, i.e., ca. 5200/5100–4600 BCE. Also, unlike some other types of Dalma ceramic assemblages, such as Black-on-Buff and Bichrome, which are confined spatially to parts of the Central Zagros, Dalma Monochrome is the typical variant of the Dalma Culture, occurring at sites throughout its territory in both the Central and Northern Zagros.

Dalma Impressed is a ubiquitous variant of the Dalma ceramic tradition, which often occurs together with Dalma Monochrome in typical Dalma sites, such as layers 57–60 of Trench XYZ at Godin, layers 5–7 of Mound B at Seh Gabi, Phase II of Nad Ali Beig, Tappeh Dalma, Tappeh Lavin, Tappeh Baghi, Layer V of Qeshlagh, and Layer V of Namshir (Fallahian & Nozhati, 2016; Bahranipoor, 2023; Henrickson, 1983; Nobari Hejebri *et al.,* 2012; Sharifi & Motarjem, 2018; Zamani Dadaneh *et al.,* 2021). However, there are two points to consider about this variant: first, it appears late in the Dalma cultural sequence, and second, it persists—although in a modified form—into subsequent post-Dalma contexts in Central and Northern Zagros, such as the "Godin IX" and "Hasanlu VIII" phases (Young & Levine, 1974; Levine & Young, 1987; Henrickson, 1983; Renette & Mohammadi Ghasrian, 2020).

In the Dalma Tappeh sequence, Hamlin already observed that Impressed Ware occurs in low frequencies in the earliest levels of the site, suggesting its initial appearance (Hamlin, 1975: 111). In the Kangavar sequence, Henrickson also noted that Dalma Impressed appears later than Dalma Monochrome and Dalma Red-Slipped wares (Henrickson, 1983: 203). Recent findings from Nadali Beig have provided more concrete evidence of the late appearance of Dalma Impressed in the site's sequence. In this case, the early Phase 1 ceramics are represented exclusively by Dalma Monochrome, Dalma Red-Slipped, Dalma Streaky, Dalma Plain, and BOB/DUP variants, while the later Phase 2 marks the first occurrence of Dalma Impressed and Dalma Bichrome alongside the Phase 1 variants (Bahranipoor, 2023). Thus, the latter two variants represent later developments in the ceramic assemblage of Dalma culture, as evidenced at Nadali Beig. Based on the Nadali Beig absolute dates, Dalma Impressed appears around 4900 BCE, while the Phase 1 variants appear as early as c. 5000 BCE (Bahranipoor, 2023).

The second problem with Impressed Ware as a relatively unreliable marker for identifying a given ceramic assemblage as Dalma is its long duration. This ceramic type continues into the post-Dalma contexts of the "Godin IX" and "Hasanlu VIII" phases in the Kangavar region and the Urmia Lake Basin, respectively (Young & Levine, 1974: 7; Levine & Young, 1987: 21; Henrickson, 1983; 1985: 70; Renette & Mohammadi Ghasrian, 2020: 114). It should be noted that because of its persistence in post-Dalma contexts, Impressed Ware has a more extensive distribution than the genuine Dalma Impressed variant. For instance, occasional sherds with impressed patterns have been reported from archaeological contexts at sites such as Farukhabad in the Deh Loran Plain (Wright, 1981), Arisman in the Central Plateau (Helwing *et al.,* 2011), Cham Ghouleh (Moghaddam *et al.,* 2016), and Cheshmeh Rajab in the Seymareh Valley (Mohajernezhad & Soraghi, 2016), as well as some sites in the south of the Malayer Plain (Sarikhani *et al.,* 2017) and the north of Hamedan (Bakhtiari & Saremi, 2013). These ceramics exhibit technical differences from the classic Dalma Impressed type. A critical point regarding Dalma Impressed is the technical and decorative distinction between this type in genuine Dalma assemblages and the impressed ceramics of later phases in the Central and Northern Zagros. Dalma Impressed is a buff-ware variant with a medium to fine straw-tempered texture. The ceramic is finer and better-fired than the Seh Gabi Impressed type, and it is often coated with a thick slip in brown, dark red, or buff tones. The impressed motifs on typical Dalma Impressed are deeply incised, densely arranged, and applied exclusively to the exterior surface using various decorative techniques (see: Bahranipoor, 2018; Hamlin, 1975; Young & Levine, 1974; Levine & Young, 1987; Henrickson, 1983). The most common form of genuine Dalma Impressed is a short-necked or neckless jar (Bahranipoor, 2018; Henrickson, 1983: 197; Levine & Young, 1987: 21; Henrickson & Vitali, 1987: 38; Bahranipoor, 2023). In contrast, the Impressed ceramics of the later Seh Gabi and Pisdeli periods are coarse, unslipped wares. They are often decorated with shallow, scattered finger impressions, and sometimes with fingertip impressions and herringbone motifs, on the vessel surface—particularly on the bases of large vessels such as basins, trays, and storage jars (Young & Levine, 1974; Levine & Young, 1987: 21; Henrickson, 1983: 38; Renette & Mohammadi Ghasrian, 2020; Online: http://www.penn.museum/collection/.php).

As a component of the Dalma ceramic assemblage, the Red-Slipped

Ware has a complicated status because of its notable longevity. It first appeared at sites such as Guran in the seventh millennium BCE (Mortensen, 2014) and persisted as a major element in ceramic assemblages of subsequent periods up to the 4th millennium BCE (Henrickson, 1983: 185; see also: Bahranipoor, 2023: 149). This ceramic type is found in the pre-Dalma levels of the XYZ Trench at Godin (prior to Godin XI), as well as in the Dalma, Seh Gabi, Pisdeli, Godin VIII or Taherabad, and Godin VII/VI layers, where it occurs alongside other ceramic types and remains one of the dominant variants in ceramic assemblages throughout these periods (Roustaei & Azadi, 2017; Mortensen, 2014; McDonald, 1979; Voigt & Dyson, 1992; Henrickson, 1983; Young & Levine, 1974; Renette & Mohammadi Ghasrian, 2020). Hence, this ceramic type does not serve as a reliable marker for distinguishing Dalma assemblages or establishing their relative chronology, since it was present from at least the late 7th millennium BCE to the early 4th millennium BCE.

While Dalma Streaky and Dalma Bichrome seem to be local developments that occur only in specific Central Zagros contexts, both BOB and DUP can be considered consequences of increasing westward interaction with lowland Mesopotamia through the Mahidasht. "As Henrickson and Vitali (1987: 39) pointed out, stylistically and technically, both BOB and DUP are not part of the classic highland Dalma assemblage; instead, they bear a clear resemblance to the lowland Mesopotamian Ubaid ceramic tradition". They are relatively thin, highly fired, unslipped ceramics with fine mineral and chaff temper. The Mesopotamian origin of these wares is supported by their much higher frequencies in ceramic assemblages of the western part of the Central Zagros (Mahidasht), which is in fact the gateway to the Iranian Plateau from lowland Mesopotamia along a natural communication corridor known as the High Road or the Great Khorasan Road (e.g., Henrickson, 1983; Gopnik & Rothman, 2011; Renette *et al.* 2021a). The diffusion of Ubaid-related buff wares along the High Road into the Central Zagros can be seen as part of a northward expansion of the black-on-buff ceramic tradition from southern Mesopotamia into the Zagros highlands. This type of ware was introduced into the Deh Luran Plain in southwest Iran in the second half of the 6th millennium BCE, where it is represented by the Chogha Mami Transitional phase, related to the Samarra culture (Hole, 1977), in the Central Zagros in the late 6th millennium BCE (Bahranipoor, 2023), and in the Northwest Region from the mid-5th millennium onwards (Voigt & Dyson, 1992: 175). These lowland-related buff ceramics should

not be regarded as an integrated component of the classic Dalma ceramic assemblages because they appear only at a few Dalma sites, mostly along the High Road in the Central Zagros, such as Godin, Seh Gabi, and Nad Ali Beig.

Regarding the above discussion, we can now establish clear criteria for assessing ceramic assemblages ascribed to the Dalma Culture. Accordingly, the Impressed ceramic alone in a ceramic assemblage does not necessarily indicate its attribution to the Dalma Period, as it represents only part of the genuine Dalma sequence. We argue that a given ceramic assemblage can only be classified as Dalma if both Impressed and Dalma Monochrome wares coexist. The BOB/DUP variant occurs only at sites along the Great Khorasan Road in the Central Zagros and may be considered an "alien" element of Mesopotamian origin. For instance, it does not occur in the classic assemblage of Tappeh Dalma in the northern Zagros. Dalma Streaky and Dalma Bichrome, which have the lowest frequencies in classic Dalma assemblages, are also local variants occurring at Central Zagros sites. Therefore, like BOB/DUP, they cannot be considered essential elements of a classic Dalma assemblage. One important point is worth noting: a given classic ceramic assemblage can be ascribed to the Dalma tradition only when the Red-Slipped and Plain variants constitute the majority of that assemblage (Bahranipoor, 2023). Recently, Renette emphasized that a Dalma archaeological assemblage should consist of at least 90% classic Dalma ceramics and associated aspects of Dalma material culture (Renette 2022: 144).[1]

Research Question and Hypothesis: Field studies conducted at several sites in the Central and Northern Zagros and their adjacent areas over the past two decades have led to the discovery of ceramic assemblages that, due to the presence of components resembling those of the Dalma ceramic tradition, have been attributed to this tradition. These assemblages usually reflect a combination of cultural materials from two or three neighbouring regions. Geographically, these "Dalma-attributed sites," including Kalnan (Saed Moucheshii *et al.,* 2011), Soha Chai (Aali, 2006), Talvar 11 (Valipour *et al.,* 2010), Tazeh Kand (Balmaki, 2017), Qela Gap (Abdollahi *et al.,* 2013), Kul Tappeh (Abedi, 2016), and Idir (Hessari & Akbari, 2005), are located in the Zanjan-Qazvin corridor, the Bijar-Qorveh corridor, the eastern and southern margins of the Central Zagros, and the northern Urmia Lake Basin (Fig. 1). By conducting detailed analyses of the ceramic assemblages from these sites, we aim to identify local components and highlight differences

between these assemblages and the classic Dalma ceramic tradition.

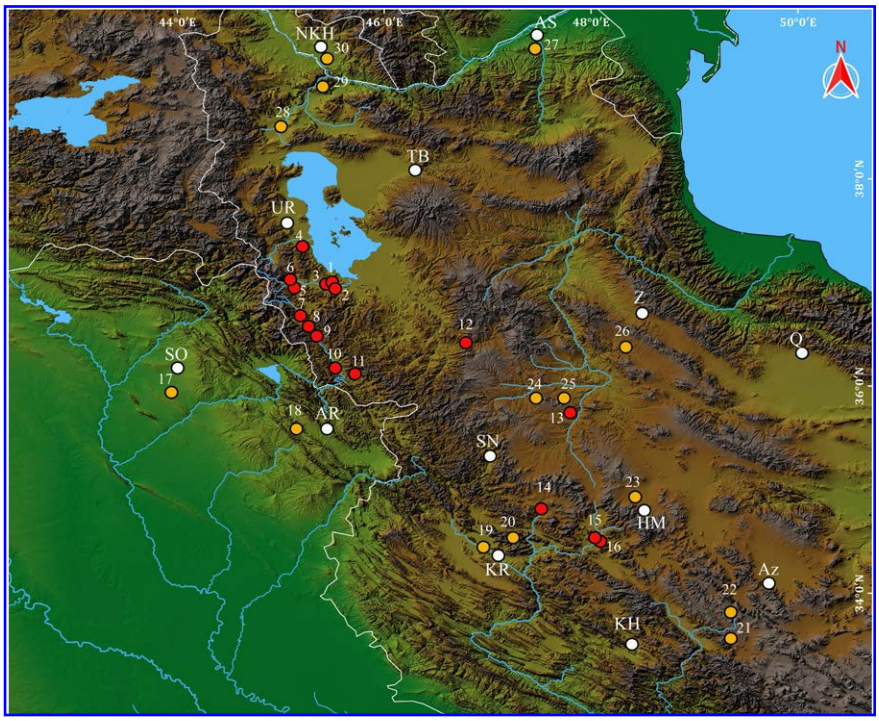
The most significant aspects of the Dalma ceramic tradition in these assemblages are Impressed ceramics, painted ceramics, and Red-Slipped ceramics. As mentioned earlier, Red-Slipped and Impressed ceramics have a long chronological span in the Dalma ceramic tradition, appearing both before and after the Dalma period (Henrickson, 1983: 191; Young & Levine, 1974: 7; Levine & Young, 1987: 21). Recent studies indicate that ceramics with impressed decoration persist until the Godin VII period, where they have been combined with features from other cultures to create a distinctive ceramic tradition (Saed Moucheshii *et al.,* 2011; Aali, 2006; Valipour *et al.,* 2010). This study aims to clarify the chronological status of these assemblages based on comparative ceramic analyses and newly available radiocarbon dates for the Dalma period.

Research Methods: This research selected the ceramic assemblages from key sites of the Dalma Culture—Dalma Tappeh, Godin (the XYZ Trench), Seh Gabi Mound B, and Nad Ali Beig—as the basis for ceramic comparisons. Using the presence of two ceramic variants, Dalma Monochrome and Dalma Impressed, in assemblages as the most reliable criterion for attributing a given ceramic assemblage to the Dalma culture, the present study evaluates the assemblages of sites ascribed to this prehistoric culture. Through this comparative analysis, the study seeks to establish a relative chronological framework for ceramic assemblages attributed to Dalma and to define the cultural boundaries of the Dalma ceramic tradition.

The Sites Attributed to the Dalma Culture in Northern and Central Zagros

Over the last two decades, several excavated sites in the Central Zagros and northwest region have been attributed to the Dalma period because they produced ceramic assemblages with variants supposedly resembling the classic Dalma ceramic. However, based on new insights into the classic Dalma ceramic (Bahranipoor, 2021) and the chronology of this period (Bahranipoor, 2023), we argue that the following sites do not represent Dalma culture; rather, they contain some ceramic elements only remotely similar to the genuine Dalma ceramic.

Tappeh Kalnan: The multi-period site of Tappeh Kalnan, located 16 km south of Bijar, was excavated in 2010 using two-step trenches (Fig. 1) (Trenches 1 and 2) (Saed Moucheshi *et al.,* 2011: 33). Only Trench 1,



◀ **Fig. 1: Location of the Dalma and non-Dalma excavated sites in the Central and the North Zagros: 1. Hasanlu; 2. Pisdeli; 3. Dalma; 4. Seavan; 5. Chapar Abad; 6. Kohneh Sufiyan; 7. Lavin; 8. Ubaid; 9. Gerdi Sheytan; 10. Baghi; 11. Namshir; 12. Kani Mikaeil Cave; 13. Qeshlagh; 14. Nad Ali Beig; 15. Seh Gabi B; 16. Godin; 17. Surezha; 18. Kani Shaie; 19. Chogha Maran; 20. Siahbid; 21. Qela Gap; 22. Sarsakhti; 23. Taze Kand; 24. Kalnan; 25. Talvare 11; 26. Soha Chai; 27. Idir; 28. Dava Göz; 29. Kul Tappeh; 30. Nakhchivan Tappeh (base map: M. Alirezazadeh, 2025).**

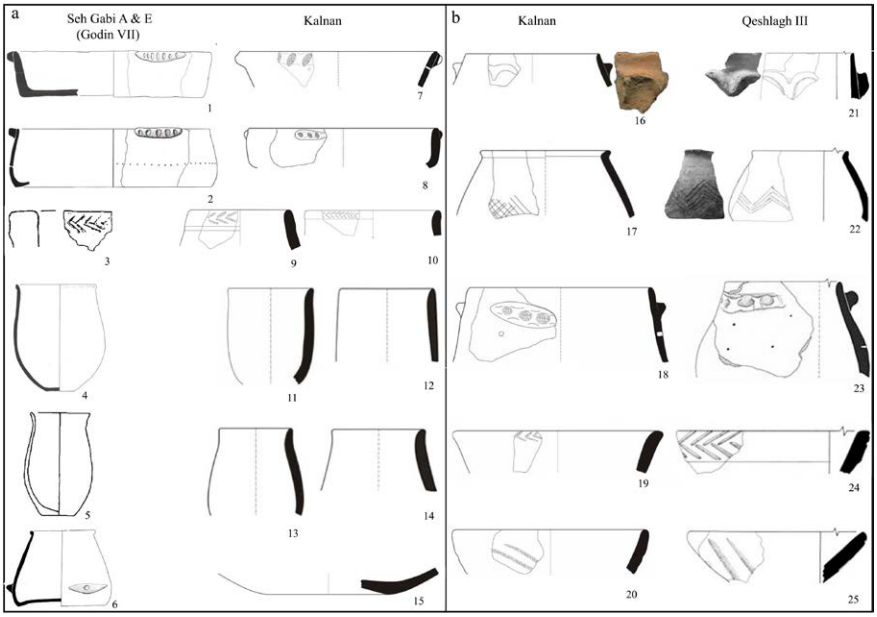
at a depth of 384 cm, revealed virgin soil. In this trench, the excavated sequence was divided into 11 layers from top to bottom, with Layer 1 attributed to the Seh Gabi period and Layers 2 through 11 to the Dalma period (Saed Moucheshi *et al.,* 2011). The Dalma-attributed ceramics of Kalnan are dominated by Plain Ware of various colours, including red, brown, cream, and orange. The most abundant type is Red-Slipped Ware, representing 18–73% of the assemblage. In addition to Red-Slipped Ware, the only other ceramic type attributed to the Dalma period is finger-impressed ceramics, recovered in limited quantities from the first three layers (Levels 12–10) (Ibid: 38–40). Therefore, the attribution of the Kalnan assemblage to the Dalma ceramic tradition is primarily based on these two types: Red-Slipped and finger-impressed wares. Other hallmark Dalma ceramic types, particularly Dalma Monochrome, are absent from the site. Ceramics decorated with incised linear and herringbone patterns are the most common variants in the layers attributed to Dalma at Kalnan. Some of these decorations are combined with appliqué decorations, such as ram's heads (Saed Moucheshi *et al.,* 2011, Figs. 18–19) (Fig. 2). These decorations differ significantly from the typical Dalma ceramic assemblages known from the type site Tappeh Dalma and the Central Zagros sites of Godin, Seh Gabi, and Nad Ali Beig.

The analysis of Impressed ceramics from Kalnan reveals that, in

addition to their very low frequency in the assemblage, they do not match the classic Dalma Impressed Ware observed at Tappeh Dalma, Seh Gabi B (Layers 7–5), Godin (XYZ Trench), and Nad Ali Beig (Phase II). The key distinctions between Kalnan's impressed ceramics and classic Dalma Impressed are as follows: absence of a thick slip coating, lower density of the ceramic paste, shallower finger impressions, and a more scattered distribution of decorative motifs in Kalnan (cf., Young & Levine, 1974: 7; Henrickson, 1983: 196; Bahranipoor, 2018). Dalma Impressed is a variety of buff ware with medium-to-fine straw temper, well made and better fired than the Impressed Ware of Seh Gabi and Pisdeli. These ceramics are typically coated with a thick slip in brown, dark red, or buff colours (Bahranipoor, 2018; Henrickson, 1983: 197; Levine & Young, 1987: 21; Henrickson & Vitali, 1987: 38; Online: http://www.penn.museum/collection/.php).

According to our interpretation, the Kalnan ceramic assemblage is more comparable to, and therefore contemporaneous with, the Godin VII phase. The reasons for this attribution are as follows: 1. the predominance of plain ceramics, particularly those with Red Slip; 2. the similarity in vessel forms, including open-mouth bowls, basins commonly referred to as S-shaped vessels, jars with impressed finger decorations, cord decorations, and appliqué herringbone motifs; 3. the presence of moulded zigzag, herringbone, or wavy motifs on some vessel rims; and 4. the occurrence of concave bases (Levine & Young, 1987; Young & Levine, 1974; Gopnik & Rothman, 2011; Bahranipoor, 2023; Renette & Mohammadi Ghasrian, 2020; Zamani Dadaneh *et al.,* 2021: 22) (Fig. 1a). It is noteworthy that local elements and, to some extent, influences from the Zanjan–Qazvin Corridor cultures are also evident in this assemblage. These include cream, brown, and gray ceramics, incised decorations, and stylized goat appliqué motifs (Alibeigi *et al.,* 2014; Saed Moucheshi *et al.,* 2010, Figs. 8, 18–20; Rahimi Sorkhani & Eslami, 2018; Majidzadeh, 2008; Fazeli Nashli, 2007, Figs. 67, 76–77, 84), (Figs. 1b & 4b).

In addition to the significant differences between the ceramic assemblages of Kalnan and those of the key sites of the Dalma period, another critical issue is the absolute chronology of the site. Three radiocarbon dates are available from the Dalma-attributed deposits at this site (Layers 2, 6, and 8), (Saed Moucheshi *et al.*, 2010, Table 1). These dates suggest a period spanning 4042–3660 BCE, which falls outside the newly established time range for the Dalma period, i.e., ca. 5200/5100–4600 BCE (see above). It



◀**Fig. 2: a. The resemblance between Kalnan and Godin VII ceramic assemblages from Seh Gabi (Mounds A & E) (Levine & Young, 1987: Fig.16; Young & Levine 1974: Fig. 13; Saed Moucheshi *et al.*, 2011: Figs. 9, 12; Saed Moucheshi, 2011: Figs. 45-4, 29-4); b. The resemblance between Kalnan and Godin VII ceramic assemblages from Qeshlagh III (Saed Moucheshi, 2011: Figs. 29-4, 30-4, 40-4, 31-4, 37-4; Sharifi, 2020: Figs. 34-5, 43-5, 106-5, 107-5).**

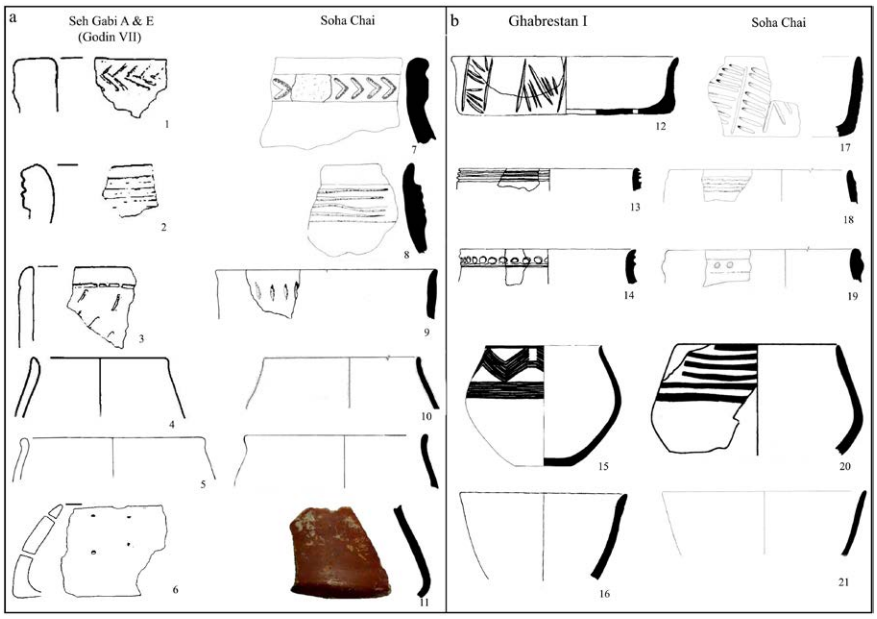
can thus be confidently stated that the chronological position of Kalnan, based on its ceramic assemblage and absolute dates, aligns more closely with the Godin VII phase or the Late Chalcolithic period than with the Dalma period.

Soha Chai: Soha Chai is a single-period site in the Sajjasrud Valley, southwest of Zanjan City, in the Ijrud region (Fig. 1) (Rahimi Sorkhani & Eslami, 2018). Six trenches were excavated during two seasons of salvage excavation, revealing two architectural phases. Based on the ceramic assemblages recovered from these phases, both are attributed to the Dalma period (Aali, 2006). The ceramic assemblage of the site has been divided into three main categories: Dalma, non-Dalma, and local (Rahimi Sorkhani & Eslami, 2018: 22–23). According to Rahimi Sorkhani and Eslami (2018: 222), there are four types of Dalma ceramics: Dalma Monochrome, Dalma Red-Slipped, Plain Ware, and Dalma Surface-Manipulated. With 53% of the total assemblage (360 out of 680 sherds), Red-Slipped Ware is the most frequent ceramic type. The second most prevalent type is Surface-Manipulated ceramics, with 219 sherds (32%). These include a variety of decorative techniques, such as incised, applied, relief, and impressed patterns, with incised patterns being the most common (Zifar *et al.*, 2017, Fig. 3). What has been considered Dalma Monochrome represents 69 sherds (10%), all recovered exclusively from inside the mudbricks (Rahimi Sorkhani *et al.*, 2016: 57). Other minor ceramic types identified in the assemblage include Black-on-Buff, Black-on-Red, and Red-on-Buff, each

with less than 2% frequency (1–5 sherds) (Rahimi Sorkhani *et al.,* 2016: 58; Rahimi Sorkhani & Eslami, 2018: 222).

As mentioned above, Soha Chai's predominant decorated ceramic variant is Surface-Manipulated Ware, with incised patterns comprising 19.9% of the total assemblage (Aali, 2006; Rahimi Sorkhani, 2008). The primary motifs include short oblique, vertical, and horizontal incised patterns, with less frequent crescent motifs and individual or multiple incised herringbone motifs below the rim (Aali, 2006) (Figs. 3a & 3b). These decorative elements, particularly the short oblique and vertical incised patterns, are reminiscent of those on ceramics from Ghabristan I (Majidzadeh, 2008: Fig. 8: 6) (Fig. 3b). At neighboring sites, such as Talvar 11 (Zifar, 2012; Valipour *et al.,* 2010), Kalnan (Saed Moucheshi *et al.,* 2010), Qeshlagh III (Sharifi, 2020; Sharifi & Motarjim, 2018), and Ghabristan, individual or multiple incised herringbone motifs have also been documented (Figs. 3a, 3b & 4b). Additionally, several specimens in this category are decorated with impressed motifs, which is why this assemblage is attributed to the Dalma culture. Notably, this variant, which is technically Impressed Ware, constitutes only 1.8% of the Surface-Manipulated variant at Soha Chai. These decorations include finger, needle, and punch impressions executed very shallowly. Several technical and decorative differences distinguish Soha Chai's Impressed Ware from classic Dalma Impressed Ware, including the low frequency of this type, the absence of thick slips, scattered motifs on the surface, and the shallow depth of the impressed designs in the Soha Chai specimens.

The second type of ceramic attributed to the Dalma tradition at Soha Chai is painted ceramic, which is both technically and decoratively distinct from Dalma Monochrome. The painted ceramics of Soha Chai are characterized by red to brown surfaces with linear geometric motifs in red or brown (Aali, 2006; Rahimi Sorkhani *et al.,* 2016: 57–58). Analysis of the motifs indicates that the primary design structure consists of simple linear patterns applied sparingly to the rims of vessels, without emphasis on detail. These motifs include thin parallel lines arranged vertically, diagonally, or horizontally (Figs. 3 & 4b). In contrast, in the classic Dalma ceramic tradition, potters utilized negative or solid motifs across the ceramic surface. The combination and repetition of solid geometric designs in Dalma ceramics, along with the use of background patterns, produced a much more intricate and diverse set of motifs than those observed at Soha Chai (Bahranipoor, 2021; Hamlin, 1975; Young, 1963; Henrickson, 1983).



◄**Fig. 3: a. The resemblance between Godin VII and Soha Chai ceramics (Young, 1969: Fig. 6; Young & Levine 1974: Fig. 13; Levine & Young, 1987: Fig.16; Aali, 2007: Figs. TF.L2.N142, TF.L.10N, TF.L2.135, TF.L2. N96, TF.L10.14; Rahimi Sorkhani & Eslami, 2018: Fig. 4); b. The resemblance between the Soha Chai and Qabrestan I ceramic decorations (Aali, 2006: Figs. TE.L8.N20, TF.L6.N11, TF.L2.N88, TF.L2.N218, TF.L2. N31; Majidzadeh, 2008: Figs. 8, 9).**

Moreover, the ceramic assemblage attributed to the Dalma tradition at Soha Chai differs from classic Dalma ceramics in its simultaneous use of both painted and incised decoration on a single vessel, a practice uncommon in genuine Dalma ceramics. Typically, the classic Dalma Monochrome ceramic featured dark brown, red, or purple motifs applied on untreated surfaces or on cream, dark red, and occasionally purple slips (Bahranipoor, 2021; Young, 1963; Young & Levine, 1974: 4; Levine & Young, 1987: 21; Henrickson, 1992: 287). In contrast, at Soha Chai, the exterior slip and motifs range exclusively across a spectrum from red to brown on burnished surfaces (Aali, 2006). One characteristic feature of the classic Dalma Monochrome was the use of contrasting colors, both in the slip and in the motifs, producing a striking visual contrast (Young, 1963; Bahranipoor, 2021). Additionally, the paste of the painted ceramics from Soha Chai varies in color from reddish-brown to buff-brown, whereas the paste of the classic Dalma Monochrome is typically buff or light red (Bahranipoor, 2018; Aali, 2006; Young, 1963; Bahranipoor, 2023; Renette & Mohammadi Ghasrian, 2020: 125; Zamani Dadaneh *et al.,* 2021: 22) (Figs. 3b & 4b3).

The Soha Chai ceramic assemblage also shows notable differences in vessel forms compared to classic Dalma ceramics. These distinctions are observed in carinated globular pots, open-mouth deep bowls, basins with outward-flaring sides, closed-mouth pots, and concave bases in the Soha Chai assemblage (Aali, 2006: 573 TE.L8.N20, TE.L2.N5, TF.L6.

N11, TF.L2.135 & TF.L2.N235; TF.L2.N235). These forms more closely resemble the ceramic assemblages of Ghabristan I in the Central Plateau (Majidzadeh, 2008: Figs. 8:6, 9: 3–4) and Godin VII in the Central Zagros (Young & Levine, 1974: Fig. 13: 15) than the classic Dalma ceramic repertoire.

Thus, the technical and decorative differences in Soha Chai ceramics indicate that the site's assemblage does not conform to the classic Dalma tradition (cf. Zamani Dadaneh *et al.*, 2021: 22; Renette & Mohammadi Ghasrian, 2020: 125; Bahranipoor, 2023). The absence of the two signature ceramic types of the Dalma tradition—Dalma Monochrome and Dalma Impressed—combined with the prevalence of moulded cord decoration, band appliqué along the rims, incised herringbone, and grooved patterns below the rim, as well as distinct vessel forms, suggests that the chronological context of the Soha Chai assemblage is closer to that of "Godin VII" and "Ghabristan I." It is also noteworthy that, due to Soha Chai's location between the cultural zones of the Central Zagros and the Central Plateau (Figs. 3a, 3b & 4b), its ceramic assemblage reflects influences from both regions alongside local styles. Analysis of the Soha Chai ceramics reveals cultural interactions with the Central Zagros (Godin VII phase) and the Central Plateau (Ghabristan I phase). For instance, the presence of painted ceramics, gray or black burnished wares, incised patterns, carinated globular pots, and concave bases parallels the ceramic tradition of Ghabristan I (Majidzadeh, 2008, Fig. 9: 3; Fazeli Nashli, 2007: Figs. 62, 64–65, 67, 76–77, 84; Rahimi Sorkhani & Eslami, 2018, Fig. 5: BW) (Figs. 3a & 3b). This evidence underscores the significance of Soha Chai as an intermediate site connecting the Central Plateau to the east, the Northern Zagros to the north, and the Central Zagros to the south, highlighting the site's distinctive material culture, which reflects influences from surrounding cultural zones.

In addition to its ceramic assemblage, Soha Chai's key issue is its absolute chronology. The Dalma-attributed deposits at this site have yielded eight radiocarbon dates (Rahimi Sorkhani & Eslami, 2018: 219). These dates indicate a range of 4269–3968 BCE. As previously discussed regarding Kalnan, based on multiple dates from Nad Ali Beig and the conclusions of other researchers, the Dalma period likely falls in the late 6th millennium BCE to, at most, the mid-5th millennium BCE (Bahranipoor, 2021: Table 1; Bahranipoor, 2023; Renette, 2022; Henrickson, 1992: 287; Hole, 1987; Voigt & Dyson, 1992: Fig. 2). It is clear that Soha Chai's dates fall outside

this range. The dates from Soha Chai strongly suggest that its assemblage is more closely associated with Ghabristan I and Godin VII. Furthermore, Soha Chai's absolute dates align closely with those of Ghabristan I (Pollard *et al.,* 2012: Table 17; Renette & Mohammadi Ghasrian, 2020: Table 1; Bahranipoor, 2023).

Talvar 11: The site of Talvar 11, located 11 km south of the Talvar Dam near Bijar, was the subject of a rescue excavation during a single field season (Valipour *et al.,* 2010: 49) (Fig. 1). Three trenches (I, II, and III) and six sondages were excavated. The trenches reached virgin soil at depths ranging from 35 to 280 cm. Trench I yielded the oldest cultural deposits, 30 cm thick, attributed to the Dalma period (Valipour *et al.,* 2010: 40). The Trench I sequence was divided into three layers from top to bottom, with Layer 3 attributed to the Dalma tradition. According to the excavator, the Dalma ceramic assemblage from Talvar 11 comprises Plain Buff Ware, Gray Ware, Red-Slipped Ware, ceramics with incised patterns, ceramics with appliqué decorations, and a small number of painted wares (Valipour *et al.,* 2010: 53; Zifar *et al.,* 2017).

The examination of the ceramic assemblage from Layer 3 of Trench I at Talvar 11 reveals that the most abundant ceramic type is Red-Slipped Ware, while painted ware is the least common, comprising less than 1.1% of the assemblage (Valipour *et al.*, 2010: 53; Zifar, 2012). A significant difference between the Talvar 11 assemblage and classic Dalma ceramics is the complete absence of Impressed ceramics, a diagnostic variant of the Dalma tradition. Instead, the defining features of the ceramic tradition at this site—namely linear and herringbone incised decoration—closely resemble other assemblages within the Zanjan–Takestan Corridor, such as Kalnan, Qeshlagh III (Sharifi, 2020), and Soha Chai (Aali, 2006), where similar features and stylized ram's head appliqué decorations are also found (Figs. 4a & 4b).

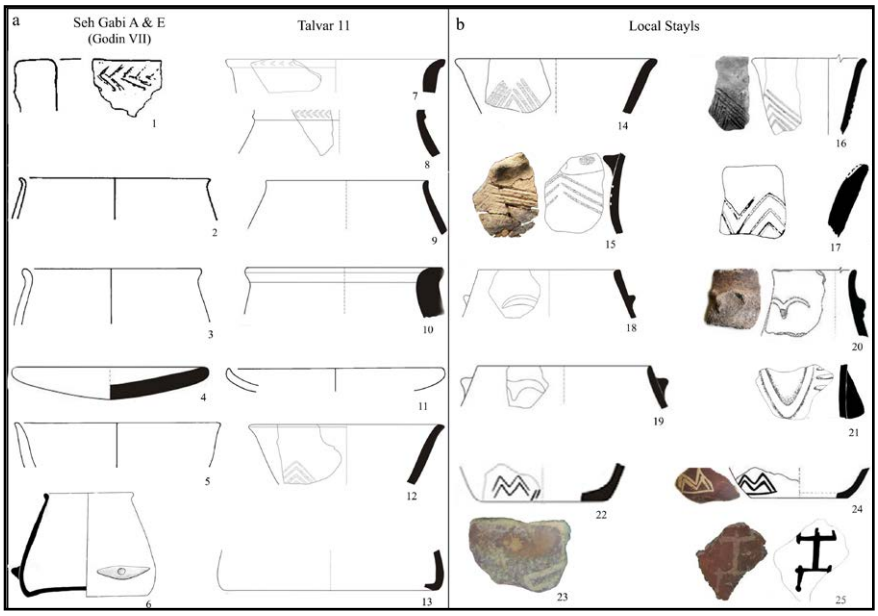
The painted ceramics of Talvar 11 are characterized by dark red to brown slips with geometric motifs in cream (Zifar, 2012). The decorative patterns follow the same style observed at Soha Chai, featuring simple linear designs with minimal elaboration. These include narrow vertical and horizontal bands, scattered double zigzags, and a single representation of a goat with elongated, curved horns. From a technical and decorative perspective, particularly regarding the hanging double zigzag motifs, the Talvar 11 ceramics closely resemble those of Qeshlagh III (Sharifi, 2020: Fig. 5-28) and are somewhat comparable to those of Soha Chai (Rahimi

Sorkhani *et al.,* 2016: Fig. 3) and Kalnan (Saed Moucheshi, 2011) (Fig. 4b: 22–25). Considering the similarities in ceramic decoration among these sites, it appears that this type of ceramic represents a local intra-regional variant. We suggest, with caution, that the antecedent of this ceramic type may be traced to the Dalma ceramic tradition at Qeshlagh, specifically to sub-phase C of "Level V," with continuity observable up to Level III at the site, because the predominance of red and brown slips combined with cream-colored motifs renders these ceramics partially similar to the Dalma Monochrome ceramics of Qeshlagh (Sharifi, 2020: Figs. 184–202; Motarjem & Sharifi, 2018: 90).

It is important to note that the depiction of the goat motif on the ceramics of Talvar 11, emphasizing the elongated and curved horns, is executed with exceptional skill. This motif differs from the exclusively geometric designs typical of the classic Dalma tradition.

The most common vessel forms in the Talvar 11 assemblage are basins, spherical open-mouth bowls, and closed-mouth jars (Zifar, 2012). These forms contrast sharply with the dominant forms of the classic Dalma tradition, such as short-necked pots and globular bowls. Notably, the rims of some Talvar 11 vessels feature multiple incised herringbone motifs, horizontal grooves, and stylized ram's head appliqué decorations used as handles (Valipour *et al.,* 2010: 69; Zifar, 2012). These features closely resemble the ceramic assemblages of Qeshlagh III (Sharifi, 2020: Fig. 5-34), Kalnan (Saed Moucheshi *et al.,* 2011: Figs. 18–19), and Soha Chai (Aali, 2006) (Figs. 4a & 4b).

Consequently, due to the absence of two primary elements of the classic Dalma tradition—Dalma Monochrome and Dalma Impressed—the Talvar 11 ceramic assemblage cannot be attributed to Dalma culture. Instead, based on archaeological evidence, including the abundance of Red-Slipped Ware, Gray Ware, similarities in vessel forms, the presence of incised zigzag and herringbone decorations on the rims of some vessels, and concave bases, the Talvar 11 ceramics are more comparable to the ceramic traditions of Godin VII and, to some extent, Ghabristan I (Levine & Young, 1987, Fig.16; Young & Levine, 1974, Fig.13; Majidzadeh, 2008, Fig. 8; Fazeli Nashli, 2007, Figs. 76–77, 84, 67; Gopnik & Rothman, 2011). Thus, the Talvar 11 ceramic assemblage appears to reflect the intersection of two cultural zones: the Central Zagros and the Central Plateau, particularly the Qazvin Plain, alongside local intra-regional traditions. The influence of the Central Plateau is



◀**Fig. 4: a. The resemblance between Talvaar 11 and Godin VII ceramic assemblages from Seh Gabi (Mounds A and E) (Young, 1969: Fig. 6; Young & Levine 1974: Fig. 13; Levine & Young, 1987: Fig.16; Zifar, 2010: Figs. 8-5, 9-5, 14-5, 16-5); b. The resemblance of local style decorations between Taalvar 11 (Nos. 14, 18, 22) (Zifar, 2012: Figs. 10-5, 17-5; Valipour *et al.*, 2010: Fig. 1), Kalnan (Nos. 16. 20, 24) (Saed Moucheshi, 2011: Figs 45-4, 30-4, 36-4), Qeshlagh III (Nos. 15, 19, 23) (Sharifi, 2020: Figs. 108-5, 34-5, 28-5), and Soha Chai (Nos. 17, 21, 25) (Rahimi Sorkhani *et al.*, 2016: Fig. 4; Aali, 2006: Figs. TF.L6.N8, TF.L10.N3).**

evident in the presence of Gray Ware and ceramics with incised patterns within this assemblage.

Based on the close similarities between Talvar 11, Soha Chai, and Kalnan ceramic assemblages, and the radiocarbon dates from the latter two sites, it can be concluded that the ceramics at Talvar 11 chronologically fall between the late fifth millennium BCE and the first half of the fourth millennium BCE, contemporaneous with Godin VII rather than Godin X (Dalma) (Bahranipoor, 2023).

Tappeh Tazeh Kand: The site is located near Bahar in Hamadan Province and geographically lies between the Central Zagros and the Central Plateau (Fig. 1). Five trenches were excavated at the site, but only Trench 1 reached virgin soil. The oldest cultural deposits in these trenches have been attributed to the Dalma period (Balmaki, 2017: 76). The Tazeh Kand ceramic assemblage includes Red-Slipped Ware, Black-on-Buff Ware, and Impressed Ware.

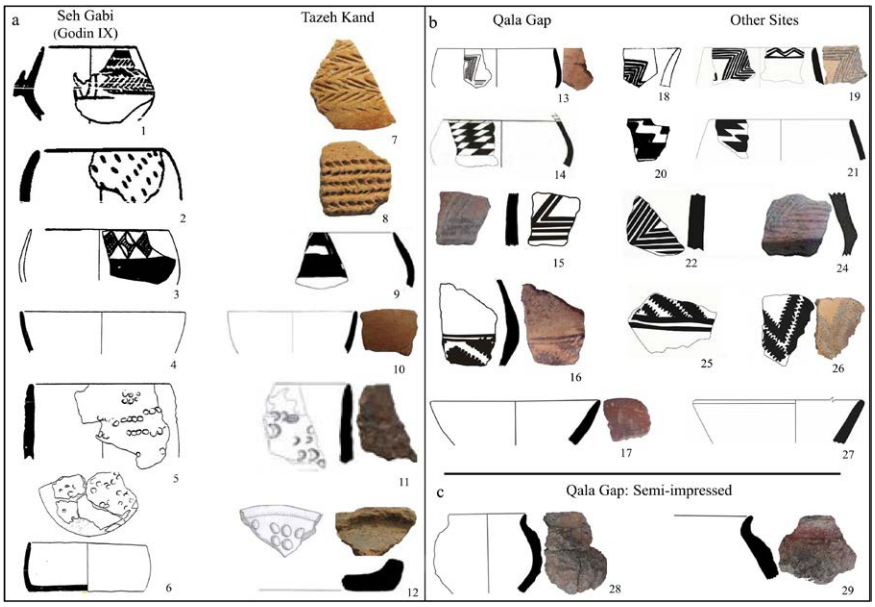
The most frequent ceramic type at Tazeh Kand is Red-Slipped Ware, followed by Impressed Ware. The latter's presence appears to have led the excavator to ascribe the site to the Dalma period. These ceramics are decorated with finger impressions, horizontal rows of multi-stranded incised herringbone motifs, and needle impressions, with finger impressions being the most common decorative technique (Balmaki, 2013: Fig. 5; Balmaki, 2017) (Fig. 5a: 70-8, 11-12). Despite this, significant differences exist between the Impressed ceramics of Tazeh Kand and the classic Dalma Impressed Ware. These distinctions are evident in the shallowness and

scattered distribution of the impressed motifs on the vessel surfaces, the absence of various impressed decoration techniques, and differences in vessel forms. The finger impression patterns in the Tazeh Kand assemblage are found on shallow trays with short walls, open-mouth straight-sided bowls, and pots (Fig. 5a: 11-12). In contrast, the distinctive features of this decorative technique in classic Dalma Impressed Ware include the use of multiple methods, densely packed motifs, deep impressions, high-quality ceramics, refined craftsmanship, a variety of slip colors (red, brown, and buff), and a range of specific vessel forms. These are typically found in short-necked, closed-mouth globular pots or out-flaring open-mouth bowls (Bahranipoor, 2018; Henrickson, 1983: 197; Levine & Young, 1987: 21). Some researchers, particularly Henrickson, emphasize that the main characteristics of Dalma Impressed Ware are fine fabric, multiple slip colors, and the use of various impressed decorative techniques (Henrickson & Vitali, 1987: 38; Henrickson, 1983: 197; Levine & Young, 1987: 21).

The absence of Dalma Monochrome ceramics further distinguishes the Tazeh Kand assemblage from classic Dalma assemblages. The only painted ceramic in this assemblage is fine Black-on-Buff (BOB) Ware (Balmaki, 2017), in contrast to Seh Gabi Mound B and Nad Ali Beig, which yielded Dalma Monochrome, DUP, and Dalma Bichrome as well (Fig. 5a: 9). Another significant difference is the presence of incised and needle patterns, which are absent in classic Dalma assemblages but are more characteristic of the Seh Gabi Ware or "Godin IX" ceramic tradition. Such motifs—particularly rows of fine herringbone and needle patterns, and trays with shallow finger impressions—were frequent in the Seh Gabi or Godin IX phase (Henrickson, 1983: Fig. 54: 1-3; Young & Levine, 1974: 7) (Fig. 5a: 1-2 & 7-8).

Qela Gap: The site is a high, multi-period mound (25 m) located 12 km northwest of Azna, which underwent stratigraphic excavations in 2009 (Abdollahi & Sardari, 2013: 119) (Fig. 1). Three trenches (A, B, and C) were excavated down to virgin soil, and the stratigraphy was divided into seven periods, Qela Gap 1–7, from top to bottom. Excavators attributed layers 19–21 from Trench C to the Dalma culture, referring to this phase as "Qela Gap 5" (Abdollahi & Sardari, 2012: 79; Abdollahi *et al.,* 2013, Table 1).

The ceramic assemblage attributed to Dalma at Qela Gap includes Plain Buff Ware, Red-Slipped Ware, Black Ware, Painted Ware, and Impressed Ware (Abdollahi & Sardari, 2011: 79). The Qela Gap painted ceramics



◀ **Fig. 5: a. The resemblance between the Godin IX (Seh Gabi) phase ceramics and the Tazeh Kand assemblage (Henrickson, 1983, Figs. 53, 54, 93, 70; Balmaki, 2017, Figs. 6, 7, 9); b. The resemblance between the vessel forms and decorations of Qela Gap ceramics (Nos. 13-17) (Abdolahi & Sardari Zarchi, 2012: Fig. 7 & Fig. 9), Khargoar Robat, Seymareh Valley (Nos. 18, 20, 24) (Goff, 1971, Fig. 2; Bahrami & Fazeli Nashli, 2016. Fig. 7), Qal'ye Sarsakhti (Nos. 19, 22, 25, 26, 27) (Shirzad & Kaka, 2017: Figs. 203, 218, 245), and a site in Qara Chai River Valley (No. 21) (Kaka et al., 2015, Fig. 6); c. Examples of Qela Gap Semi-Impressed Ware (Abdolahi & Sardari Zarchi, 2012: Fig. 7).**

are characterized by a sand-tempered fabric with a red background and exclusively geometric designs in brown to black (Abdollahi & Sardari, 2013: 79). Due to the use of sand as temper, these ceramics are very fine and fall into the category of hard wares as defined by Henrickson (Henrickson & Vitali, 1987: 37). This contrasts with the Dalma ceramic tradition, in which Henrickson categorized Dalma Monochrome as soft ware due to its high vegetal temper content (Henrickson, 1983: 200; Henrickson & Vitali, 1987: 37). Geometric motifs of the Painted Ware include vertical bands with cross-hatching, solid bands of denticulate triangles, and nested crenellations (Fig. 5b: 13–16). These patterns bear a significant resemblance to earlier Chalcolithic traditions and the fifth-millennium BCE cultures along the Central Zagros–Central Plateau corridor, particularly at sites such as Qal'eh-ye-Sarsakhti (Shirzad & Kaka, 2012; Abedi *et al.,* 2014a: Fig. 4), Koureh 1 in Silakhor Plain (Parviz, 2007), the northern Seymareh Valley sites (Koohdasht, Chia Siah, and Cheshmeh Rajab) (Mohajerinejad & Soraqi, 2015: Fig. 6; Goff, 1971: Fig. 2:11–17; 56), and the Khorramabad Valley sites (Sohail-Beigi & Bagh-e Now) (Bahrami & Fazeli Nashli, 2016: Fig. 4:9; Abdollahi & Sardari, 2013: 1:4 &1; Abdollahi & Sardari, 2011: Fig. 7:N:610; Abdollahi *et al.,* 2013) (Fig. 5b: 18–26).

The intricate motifs characteristic of classic Dalma Monochrome—such as zigzag, lozenge, and triangle patterns, and positive and negative painting techniques—are absent from this assemblage. Additionally, Qela Gap's painted ceramic vessels include carinated open-mouth bowls, shouldered jars with long necks, and trays (Abdollahi & Sardari, 2012: 1:4

& 1), forms not observed in the Dalma ceramic tradition. Carinated open-mouth bowls also occur at Qal'eh-ye-Sarsakhti (Shirzad & Kaka, 2012), Baba Mohammad, and Sinjabi in the northern Seymareh Valley (Goff, 1971: Fig. 2:23–31).

Another feature cited by the excavators for attributing the Qela Gap assemblage to the Dalma ceramic tradition is the presence of necked jars with semi-impressed patterns, likely of the finger-impression type. However, the impressed ceramics of Qela Gap bear no technical or decorative resemblance to those of the Central Zagros Dalma tradition. These differences include the relatively low frequency of impressed ceramics, the absence of a clay slip, the shallowness of finger impressions, the unclear nature of the patterns, and the specific vessel forms, particularly the necked jars (Abdollahi & Sardari, 2011: 138; Abdollahi & Sardari, 2013, Fig. 1:2) (Fig. 5c: 28–29).

Therefore, based on the above reasoning, the ceramic assemblage from layers 19–21 at Qela Gap does not technically or decoratively conform to the Dalma ceramic tradition. Among the significant distinctions are the absence of the two defining features of classic Dalma—Dalma Monochrome and true Dalma Impressed variants—the use of sand temper, the presence of black ceramics, carinated bowls, crenellation motifs, and decorative bands featuring solid and denticulated motifs.

The similarity in technical and decorative characteristics observed in ceramic assemblages from Qela Gap, Qal'eh-ye-Sarsakhti, Koureh 1 (Silakhor Plain), the Khorramabad Valley sites, and possibly the northern Seymareh Valley sites suggests that a localized ceramic tradition developed within these regions during the fifth millennium BCE.

Kul Tappeh: As the northernmost site attributed to the Dalma culture, Kul Tappeh is located near Hadishahr in West Azerbaijan province, close to the Iran–Azerbaijan border (Fig. 1). This 24-m-high, multi-period site was excavated during two seasons for stratigraphic purposes in 2010 and 2011 (Abedi *et al.,* 2014b: 33). Only two trenches (III and IV) reached virgin soil among the four trenches opened on the mound (Abedi, 2016a: 93). The earliest cultural deposits in both trenches, designated as Layer VIII, with a thickness of approximately 3 meters, have been attributed to the Dalma period (Ibid., Table 2).The allegedly Dalma ceramic assemblage from Kul Tappeh includes Red-Slipped Ware, ceramics with incised decorations (groove and comb patterns), Plain Ware, and Painted Ware (Abedi *et al.,* 2014b: 38), with the first two being the most frequent.

It appears that the presence of Painted Ware was the main criterion for attributing the Kul Tappeh assemblage to the Dalma culture. This variant occurs in various colors, including brown, pink, and reddish-yellow, but the most common is a red ground with black or brown paintings. In this assemblage, geometric motifs are dominant and commonly found on the outer rim of vessels, although stylized animal motifs have also been reported (Abedi *et al.,* 2014b: 38).

The most common motifs on Painted Ware from Kul Tappeh include parallel diagonal, horizontal, and vertical lines, typically drawn below the rim (Abedi *et al.,* 2014b: Fig. 9–10). Occasionally, these motifs are accompanied by banded or individual hatched lozenges and triangles, thin zigzag bands, as well as checkered and grid patterns (*Abedi et al.,* 2015: Fig. 5; Abedi *et al.,* 2014b: Fig. 8–9) (Fig. 6a: 7–12).

Although certain decorative elements, such as lozenges and zigzags, in the ceramic assemblage of Layer VIII at Kul Tappeh are shared with specimens from the southern Lake Urmia cultural zone, the overall decoration of Dalma ceramics from that region exhibits significant differences in motif combinations, application techniques, and attention to detail compared with the Kul Tappeh assemblage. Dalma ceramics from southern Lake Urmia are distinguished by the use of wide, solid band motifs, often covering most or even the entire vessel surface (Falahian & Nozheti, 2016; Hejebri Nobari *et al.,* 2012; Hamlin, 1975; Young, 1963), a characteristic absent in Painted Ware from Layer VIII at Kul Tappeh (Fig. 6a & 6b).

Dalma ceramics are characterized by hanging inverted triangles below the rim, nested herringbones, and combinations with other motifs, such as triangles, lozenges, and zigzags (Binandeh, 2011: Fig. 6; Hamlin, 1975, Fig. 4: D–F), none of which are observed in the Kul Tappeh assemblage. One defining feature of Dalma Monochrome is a decoration technique that emphasizes the relationship between the design and the light-colored vessel background, producing a negative design effect. Based on the relationship between the main motifs and the ceramic background, this method produces two distinct decorative patterns, a technique not found in Kul Tappeh's Painted Ware (Bahranipoor, 2018; Young, 1963; Hamlin, 1975; Henrickson, 1983; Levine & Young, 1987) (Fig. 6b).

Furthermore, in the southern Lake Urmia cultural zone, the outer slip of Dalma Monochrome is typically matte cream, white, or red and decorated with matte red, purple, brown, or black motifs (Hamlin, 1975; Hejebri

Nobari *et al.,* 2012). In contrast, the Kul Tappeh ceramics feature brown or black motifs on a burnished red background (Abedi *et al.,* 2014b). The Painted Ware from Kul Tappeh closely resembles the ceramics from Phase I of the Dava Göz site, or the so-called "Transitional Chalcolithic Phase" (Abedi, 2016b; Abedi *et al.,* 2015). The ceramic assemblage from Dava Göz, located approximately 60 km southwest of Kul Tappeh, is consistent with that from Layer VIII at Kul Tappeh. The most common ceramic types in Dava Göz Phase I include Red-Slipped and Incised (grooved or combed) Wares, while Painted Ware is less frequent. The Painted Ware of Dava Göz Phase I has a brown or red clay slip and is decorated with simple linear geometric designs in black or brown. These motifs include parallel diagonal, horizontal, and vertical lines, lozenges, hatched triangles, and checkered patterns. Additionally, stylized animal motifs reported in the

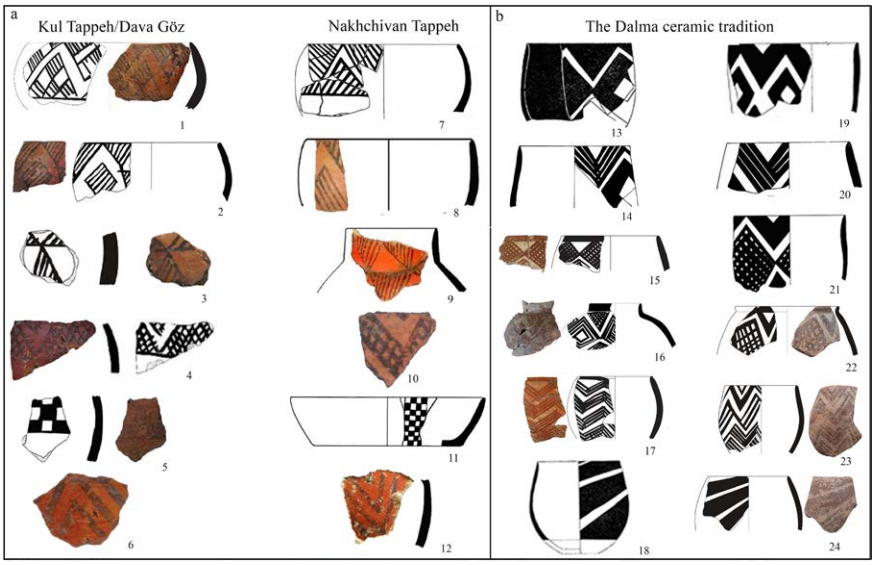


Fig. 6: a. The resemblance of painted motif between Dava Göz (Nos. 1, 6) (Abedi, 2017, Fig. 7), Kul Tappeh (Nos. 2-5) (Abedi et al., 2015, Fig. 5), and Nakhchivan (Nos. 7-12) (Bakhshaliyev, 2023, Figs. 9,11,12); b. A selection of classic Dalma ceramics from Dalma Tappeh (Nos. 13, 14, 18) (Hamlin, 1975, Figs. 5-7), Nadali Beig (Nos. 15-17) (Bahranipoor, 2023, Fig. 7), Lavin (Nos. 19-21) (Nobari Hojebri et al., 2012, Figs. 8-9), and Namshir (Nos. 22-24) (Saed Moucheshi et al., 2017, Fig. 13). ▶

Dava Göz assemblage resemble those found at Kul Tappeh (Ibid: 73) (Fig. 5a: 1 & 6).

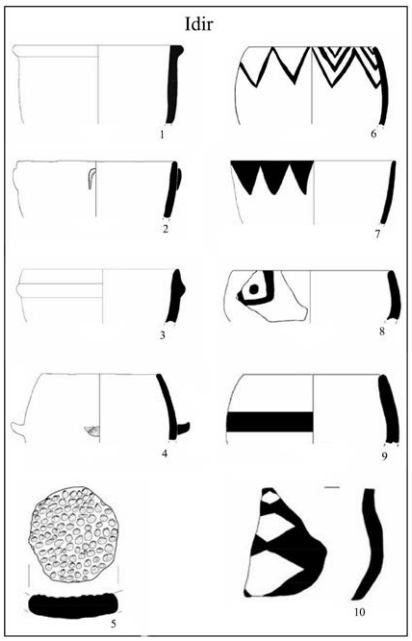
The most significant distinction between the ceramic assemblages of Kul Tappeh and Dava Göz and the classic Dalma ceramic tradition lies in the absence of the Dalma Impressed variant (Abedi, 2016b; Abedi, 2016a; Abedi *et al.,* 2015: 38). Instead, both assemblages are dominated by ceramics featuring comb- or groove-incised patterns, which constitute the most frequent type of decorated ceramics within these assemblages (Abedi *et al.,* 2014b: 38; Abedi, 2017: 73). In contrast, such incised decoration is notably absent across the broader Dalma cultural horizon, with the exception of Qeshlagh, which appears to reflect influences from cultural

interactions within the Zanjan–Takestan corridor (Bahranipoor, 2021: 120). Moreover, the painted ceramics of Kul Tappeh and Dava Göz exhibit marked similarities with those from the Nakhchivan region, particularly the site of Nakhchivan Tappeh (Bakhshaliyev, 2023) (Fig. 5a: 7–12).

Tappeh Idir: This site is located 16 km south of Aslan Duz, near the Iran-Azerbaijan border, and is another site attributed to the Dalma culture (Fig. 1). A stratigraphic trench was excavated down to virgin soil, revealing a sequence of 14 layers, from top to bottom, spanning five cultural periods (Hessari & Akbari, 2006). The excavator attributed layers 7 through 10 to the Dalma culture (Hessari, 2019: 28). The ceramic assemblage attributed to the Dalma culture at Idir includes Plain Ware, ceramics with applied and appliqué decorations, Painted Ware, and Impressed Ware (Ibid: 30). The predominant ceramic coatings are buff and light-brown clay slips. Idir's painted ceramics feature exclusively geometric motifs in red and black (Hessari, 2019: 30). The decorative elements of the painted ceramics from Idir include solid-colored triangles or nested zigzags below the rim, bands of positive and negative lozenges, wide horizontal bands, dotted patterns, and quadrilateral shapes (Hessari, 2019: Fig. 2).

Although the primary decorative elements in Idir ceramics, such as lozenges and zigzags, are shared with the Dalma Monochrome variant from the southern Lake Urmia basin, significant differences exist in the composition and repetition of these motifs between the two assemblages (Fig. 7: 6–7, 10). The overall decorative style of the Painted Ware from Idir is similar to that of the Dalma Tappeh assemblage, which utilizes zigzag patterns to create hanging triangles below the rim. However, in Idir, these designs are executed as narrow bands confined to the area below the rim (Hessari, 2019: Fig. 2) (Fig. 7: 6–7). The classic Dalma Monochrome, in contrast, is distinguished by its elaborate designs, covering the entire ceramic surface and often characterized by wide, solid band motifs (Fallahian & Nozhati, 2016; Hamlin, 1975; Hejebri Nobari *et al.,* 2012). The integration of vertical or horizontal band motifs with negative execution, characteristic of the Dalma ceramic tradition, is absent in the Idir assemblage, except for a single specimen (Fig. 7). Quadrilateral and dotted motifs also differentiate Idir's decorative style from the classic Dalma tradition (Fig. 7: 8).

Furthermore, the painted ceramics of the southern Lake Urmia Dalma tradition feature colors ranging from matte red to purple, brown, and black. In contrast, the painted motifs of Idir ceramics are restricted to black and



▲ **Fig. 7: The Dalma-attributed ceramics of Idir (Hessari, 2019: Fig. 2).**

brown tones. Another distinction between the Idir assemblage and the Dalma tradition is the prevalence of burnished surface treatment in the former. The surface of Idir ceramics is often highly burnished, creating a polished appearance. This surface treatment, particularly in the earlier phase at Idir (i.e., the Early Chalcolithic), may represent a localized regional characteristic.

Ceramics with appliqué and relief decorations are the most common type of decorated ceramics in the Idir assemblage, with button-shaped appliqué decorations being predominant (Hessari, 2019: 30). Based on the continuity of this decoration from the preceding period, it appears that this technique is linked to the local ceramic traditions of the region. Furthermore, such decorations are absent from the classic Dalma ceramics.

The Dalma-attributed deposits of Idir also produced a collection of ceramics with finger-impressed decorations, which are described only briefly (Hessari, 2019: Fig. 2: p) (Fig. 7: 5). Apart from the closed-mouth pots, the Idir ceramic assemblage exhibits notable differences in vessel forms compared to the classic Dalma ceramics (Fig. 7: 1–4). The most common forms in the Idir assemblage include spherical bowls and deep, open-mouth bowls with straight or outflaring walls. These vessels often feature a raised band below the rim or a protruding handle-like appendage, features also observed in the Early Chalcolithic ceramics of Idir. Such characteristics may indicate the continuity of a local tradition (Fig. 7).

Thus, based on the reasons outlined above, the ceramic assemblage from layers 10–7 of Idir, despite its minimal similarities to the Dalma ceramic tradition (such as closed-mouth pots, impressed decorations, and filled or negative lozenge motifs), is entirely distinct from the defining characteristics of Dalma ceramics. It is possible that the Idir ceramic assemblage belonged to contemporaneous ceramic traditions that were prevalent in the Mughan Plain and the southern Republic of Azerbaijan during the first half of the 5th millennium BCE. Even though very few elements of the Dalma ceramic tradition are present in this assemblage, it represents a distinct cultural tradition.

Conclusion

As discussed above, ceramic assemblages recovered from some excavated sites, mainly in the periphery of the Dalma culture's core area, have been attributed to the Dalma ceramic tradition based on the presence of components that are somewhat similar to those of the Dalma

ceramic tradition. Painted and impressed ceramics constitute the most prominent elements associated with Dalma-attributed assemblages. As mentioned above, ceramics with impressed decoration, due to their continued presence in the archaeological stratigraphic sequence during the post-Dalma periods, such as Seh Gabi and Pisdeli throughout the 5th millennium BCE, cannot be used alone as a reliable indicator for assigning a ceramic assemblage to Dalma culture without the presence of the signature Dalma Monochrome variant. The painted ceramics of the peripheral regions of the Dalma culture, characterized by black-on-red ceramics with geometric motifs, are only slightly similar to the classic Dalma Monochrome ceramics. In terms of motif type, execution method, vessel forms, and technical attributes, these ceramics cannot be considered equivalent to Dalma Monochrome. Due to this slight resemblance, this type of ceramic has sometimes been attributed to Dalma culture. It also co-occurs with other types, such as Red-Slipped or semi-impressed ceramics, within assemblages from the peripheral regions of Dalma culture. In light of these findings and the strongly localized distinctions reflected in the ceramic assemblages of the peripheral regions, it is possible to identify and differentiate components of the Dalma ceramic tradition from other local ceramic elements.

In light of this approach, the ceramic assemblages from Kalnan, Talvar 11, and Soha Chai cannot be confidently attributed to the Dalma ceramic tradition because they lack the two primary markers of that tradition: Dalma Monochrome and Dalma Impressed variants. However, given the clear intra-regional similarities among the ceramic assemblages from Kalnan, Qeshlagh III, Talvar 11, and Soha Chai, and the presence of components characteristic of Godin VII and Ghabristan I, their chronological position should be considered contemporaneous with "Godin VII" and "Ghabristan I." These ceramic assemblages reflect interactions between the Central Zagros, Bijar-Qorveh, and Zanjan-Takestan corridors. Furthermore, the absolute dates of Soha Chai and Kalnan fall within the temporal range of Ghabristan I and Godin VII. Considering the limited presence of impressed techniques (primarily shallow fingertip impressions) in the ceramic assemblages from Kalnan, Soha Chai, and Talvar 11, it can be inferred that this decorative method persisted in an altered and often degenerated form into the Godin VII period. The shared ceramic features between these sites and Godin VII include the abundance of plain ceramics, particularly Red-Slipped Ware, similarities in vessel forms (cups, basins, and "S-shaped"

vessels), the use of incised zigzag, herringbone, or molded wavy patterns on the rims of some vessels, and concave bases. The distinctly localized intra-regional characteristics of these assemblages include the presence of red- and brown-slipped ceramics with black and cream motifs, cream and gray ceramics, carinated globular pots, shallow punch decorations, abundant short incised lines arranged in groups or herringbone patterns, and appliqué motifs of ram's heads or "U-shaped" designs. These traits reflect significant interaction with the Bijar and Qazvin regions, particularly during Qeshlagh III and Ghabristan I.

The most frequent ceramic decorative technique in the Bijar-Qorveh and Zanjan-Takestan corridors is incised decoration, which has been reported at Talvar 11 (Valipour *et al.,* 2010, Fig. 1), Qeshlagh III (Sharifi, 2020), Soha Chai (Aali, 2006), Shizar (Valipour, 2006), Karvansara (Ali-Beigi *et al.,* 2014), and Ghabristan I (Majidzadeh, 2008: Fig. 8; Fazeli Nashli, 2007: Figs. 76–77, 84). Notably, this decorative technique has been documented west of Kalnan only at Namshir III (Saed Moucheshi *et al.,* 2017: Fig. 19). Consequently, we propose that this decorative technique was specific to the Zanjan-Takestan corridor, from which it subsequently spread to the Bijar-Qorveh region. The ceramic assemblage from Tazeh Kand, located at the easternmost end of the Central Zagros, does not conform to the Dalma ceramic tradition due to the absence of its primary markers—Dalma Monochrome and Dalma Impressed wares. Instead, the Tazeh Kand assemblage, characterized by fine buff-painted ware (BOB), an abundance of Red-Slipped ware, and decorative features such as scattered shallow finger impressions (particularly on the bases of basins), multiple rows of fine incised herringbone and needle-pattern motifs, and comparable vessel forms, more closely resembles the Seh Gabi ceramic tradition (Godin IX) rather than Dalma (Godin X). Regarding the ceramics with semi-impressed decorations from Qela Gap (Layers 19–21), located in the eastern Central Zagros, we suggest that the technical and decorative similarities between the ceramic assemblages of Qela Gap, Qal'eh-ye-Sarsakhti, and potentially the northern Seymareh Valley and Khorramabad Valley sites indicate the existence of a localized ceramic tradition incorporating elements borrowed from neighboring cultures—the Central Zagros and the Central Plateau—during the 5th millennium BCE. The limited presence of semi-impressed decorations in the Dalma-attributed layers of Qela Gap points to influence from the northern Seymareh Valley rather than the Central Zagros Dalma ceramic tradition.

A distinctive pattern is observed in the ceramic assemblages attributed to the Dalma tradition from the northern Lake Urmia region, specifically Kul Tappeh Layer VIII, Dava Göz Phase I, and Idir Layers 7–10. Given the similarities among the assemblages of these sites and their comparable absolute dates, it appears that they belong to a single ceramic tradition active in northern Lake Urmia during the fifth millennium BCE. What distinguishes Kul Tappeh VIII and Dava Göz I from the classic Dalma ceramic tradition is the absence of two critical markers of Dalma culture: Dalma Monochrome and Dalma Impressed, together with the prominent presence of comb- or groove-incised pattern ceramics—a feature not observed in classic Dalma assemblages. It appears that the attribution of these two assemblages to the Dalma tradition was primarily based on the presence of painted ceramics, which show significant technical and decorative differences from Dalma Monochrome ware. As discussed above, the resemblance between the ceramic assemblage of Nakhchivan Tappeh and the sites identified in the northern part of Lake Urmia to those of Dava Göz and Kul Tappeh supports the hypothesis that a distinct ceramic tradition existed in northern Lake Urmia, contemporaneous with the Dalma ceramic tradition in the southern Lake Urmia region.

Despite having very few similarities with the Dalma ceramic tradition (such as short-necked pots, ceramics with impressed patterns, and lozenge-shaped negative or solid motifs), the ceramic assemblages from Layers 7–10 of Idir are clearly distinct from the defining characteristics of the Dalma tradition. These differences are evident in the prevalence of appliqué decoration, including banded or button-like designs under the rim, the high burnishing of the ceramics, vessel forms, the simplicity of geometric motifs, and the techniques employed in their execution. Therefore, the ceramic assemblage from Layers 7–10 of Idir appears to represent a culture that incorporates features from the preceding Early Chalcolithic period, while including very few elements of the Dalma ceramic tradition, and most likely reflects a distinct local culture that existed in the Mughan Plain and southern Republic of Azerbaijan during the first half of the fifth millennium BCE. Finally, it should be noted that if the relative chronological position of the ceramic assemblages from Kalnan and Soha Chai is placed within the same timeframe as Godin VII and Ghabristan I, then, based on the absolute dates available for these two sites and Ghabristan I, it becomes possible to reconstruct at least part of the chronological sequence for Godin VII. Therefore, considering the absolute dates from Kalnan and Soha Chai,

along with the similarities between their ceramic assemblages and those of Godin VII and Ghabristan I, the Godin VII phase can be placed between 4200 and 3600 BCE. Accordingly, the ceramic assemblages of Kalnan and Soha Chai, based on these ceramic observations and absolute dates, can serve as a reference framework for dating the ceramic assemblages of Godin VII and Ghabristan I.

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Endnote

1. According to this reasoning, the sites of Siahbid and Chogha Maran in Mahidasht (Renette *et al.,* 2021a), Kani Shaei near Sulaymaniyah (Renette *et al.,* 2021b; Renette *et al.,* 2022), Surezha in the Erbil Plain (Stein, 2018: 43; Stein & Fisher, 2020: 142) in Iraqi Kurdistan, and the Hamrin region sites of southeastern Iraq (Jasim, 1985) cannot be considered representative of Dalma Culture. For instance, the most diagnostic variety of the Dalma assemblage—Dalma Monochrome Ware—does not occur in the ceramic assemblages of Siahbid, Chogha Maran, or the Hamrin region sites. In the case of Surezha and Kani Shaei, Dalma ceramic types, such as Dalma Monochrome and Dalma Impressed, comprise, as the excavators noted, only a "small proportion" of the total ceramic assemblages recovered from the levels ascribed to Dalma Culture (Alden *et al.,* 2021; Stein & Fisher, 2020: 141, Table 5; Renette *et al.,* 2022: 8; Renette *et al.,* 2021b: 129).

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۴۵ پژوهش‌های باستان‌شناسی ایران

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چکیده

در پژوهش‌های میدانیِ دو دههٔ اخیر در گسترهٔ جغرافیایی اصلی فرهنگ دالما و مناطق پیرامونی آن، مجموعه سفال‌هایی به‌دست آمده که به‌دلیل وجود مؤلفه‌هایی تقریباً مشابه با سنت سفالی دالما، آن‌ها را به دورهٔ دالما نسبت داده‌اند. بارزترین مؤلفه‌های سنت سفالی دالما در این مجموعه‌ها، سفال با نقش فشاری، سفال منقوشِ تک‌رنگ و سفال با پوشش قرمز است؛ درواقع مجموعه سفال‌های مناطق حاشیه‌ای بیانگر نوعی امتزاج مواد فرهنگی دو یا سه منطقهٔ فرهنگی همجوار است. با مبنا قراردادن شاخص‌های واقعی سنت سفالی دالما می‌توان به تفاوت‌های سنت سفالی دالما با مجموعه‌های سفالی مناطق بینابینی پی‌برد و جایگاه گاه‌شناسی نسبی این مجموعه‌ها را تا حدودی روشن‌تر کرد؛ ازجملهٔ این مناطق حاشیه‌ایِ فرهنگ دالما می‌توان به شمال دریاچهٔ ارومیه، کریدور زنجان-قزوین، کریدور بیجار-قروه و حاشیهٔ شرقی و جنوبیِ زاگرس‌مرکزی اشاره کرد. مجموعه‌های سفالی این مناطق حاشیه‌ای که به این دوره منسوب شده‌اند عبارت است از: کلنان، سهاچای، تالوار ۱۱، تازه‌کند، قلاگپ، کول‌تپه و ایدیر. با تحلیل‌های دقیق مجموعه‌های سفالیِ این مناطق می‌توان مؤلفه‌های بومی و تفاوت‌های مجموعه‌های حاشیه‌ای «منسوب به سنت سفالی دالما» را با «سنت کلاسیک دالما» شناسایی و سمت‌وسوهای فرهنگی و مرزبندی این سنت را تا حدودی مشخص کرد.

کلیدواژگان: سنت سفالی دالما، سفال منقوش تک‌رنگ، سفال با نقش فشاری، دورهٔ گودین VII و تاریخ مطلق.

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The Scale of Accounting: An Examination of High-Volume Numerical Records in Proto-Elamite Tablets from Susa hosted in Iran National Museum

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Abstract

This article presents an in-depth analysis of four Proto-Elamite tablets, housed in the Iran National Museum, specifically chosen for their demonstrably high-volume numerical entries. The selection of these tablets offers a unique opportunity to investigate the scale of commodity accounting within the proto-urban center of Susa, a pivotal site in the study of early complex community. The research delves into the intricate numerical signs and systems employed by Proto-Elamite scribes to record these substantial quantities, with a particular focus on the application and interplay of the Sexagesimal (S), Decimal (D), Bisexagesimal (B and B#), and Capacity (C, C#, and C") systems. The analysis reveals a sophisticated administrative apparatus that was not only capable of managing but also meticulously recording significant quantities of goods. These goods encompassed a wide range of resources crucial to the functioning of the proto-urban center, including various types of grains, which formed the basis of the region's agricultural economy, the accounting of human laborers, who constituted a vital part of the workforce, and potentially rations, indicating a system of distribution and resource allocation. The presence of such high-volume data within these tablets provides invaluable insights into the economic complexity of Susa during this period. It underscores the scale of resource management, the existence of well-organized distribution networks, and the potential reach of trade connections that extended beyond the immediate vicinity of Susa. While the Proto-Elamite numerical signs exhibit a distinct visual style when compared to their Mesopotamian counterparts, reflecting a unique cultural and scribal tradition, the overarching emphasis on large-scale quantification highlights a shared concern for efficient and accurate accounting practices. This focus on meticulous record-keeping was essential for the management of surplus production, the organization of labor, and the maintenance of economic stability within the developing center. This study emphasizes the significance of undertaking a detailed analysis of the numerical data contained within these four tablets. By doing so, it becomes possible to reconstruct, at least in part, the scale of commodity counting and its profound implications for Proto-Elamite economic and administrative practices.

Keywords: Proto Elamite, Susa, Administration, High- Volume tablets, Commercial Hub.

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Introduction

The Proto-Elamite period, blossoming in Susa during the late fourth millennium BCE (Yousefi *et al.,* 2025), left behind a significant corpus of clay tablets inscribed with a unique, largely undeciphered scripts[1] (Le Burn& Vallat, 1978; Vallat,1971; Vallat, 1973; Vallat, 1985). Among these, tablets exhibiting high-volume numerical entries offer invaluable insights into the administrative and economic practices of this early complex society (Etemadifar & Yousefi, 2024). As demonstrated by the numerical signs depicted, their administrative system employed a sophisticated approach to quantitative record-keeping, utilizing a suite of specialized systems tailored to diverse commodities (Desset, 2016). The sexagesimal system (S), mirroring later Babylonian practices, facilitated the enumeration of inanimate objects, showcasing their capacity for handling large numerical values (Friberg, 1994;2019; Damerow, 2006). In contrast, the decimal system (D) was reserved for animate beings, specifically domesticated animals and human laborers, reflecting a distinct method for quantifying living resources (Friberg, 1978; 1999). Furthermore, the bisexagesimal systems (B and B#), dedicated to grain products and potential rationing, and the capacity systems (C, C#, and C"), used for measuring grain, underscore the importance of precise agricultural accounting (Scheil, 1923; Friberg, 2019).

The existence of these diverse numerical systems, coupled with the presence of signs denoting high numerical values (e.g., "3,600," "600" in the sexagesimal system), (e.g., "10,000," "1000" in the decimal system) and (e.g., "1200" "120" in the bisexagesimal system) points to a highly organized administrative structure and a developed economy capable of managing substantial resources. Such large-scale accounting implies complex administrative operations, including the distribution of goods, the organization of labor forces, and the tracking of agricultural yields, vital for a complex economical center like Susa. Given Susa's strategic location, it likely functioned as a pivotal commercial hub, facilitating the exchange of goods between the sedentary agricultural societies of southern Iran and the pastoral nomads of the Iranian highlands (Yousefi *et al.,* 2025). As Alden (1982) and Potts (1999) discuss, the Proto-Elamite tablets, particularly those with high-volume numerical data, provide critical evidence of such trade, with the diverse numerical systems reflecting the varied commodities exchanged and the standardized units and large numerical values suggesting organized trade networks and administrative oversight.

This article posits that a comprehensive analysis of the high-volume numerical data contained within four selected Proto-Elamite tablets from Susa hosted in Iran National Museum will yield critical insights into the scale and complexity of their administrative and economic practices. The sheer volume of numerical data inscribed on these tablets presents a unique challenge, requiring meticulous analysis and innovative methodological approaches. The methodology involves a quantitative analysis of the numerical signs and their associated values, focusing on the four selected tablets. We will explore the implications of these numerical records for understanding Proto-Elamite administrative and economic practices, specifically focusing on the scale of resource management and distribution.

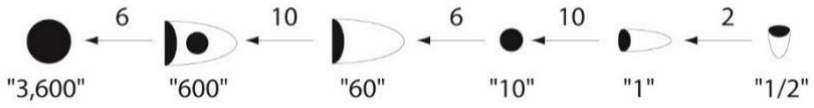
Deciphering the Proto-Elamite Numerical System

The Proto-Elamite numerical system, as evidenced by the corpus of numerical signs found on tablets primarily from Susa, presents a complex and multi-faceted structure (Dahl, 2005; Hessari & Yousefi, 2023). This part aims to provide a comprehensive analysis of this system to elucidate its intricacies and implications for understanding Proto-Elamite administrative and economic practices. The numerical signs, as depicted in the below images, reveal a sophisticated approach to quantification, with multiple systems employed for diverse commodities. The Proto-Elamite scribes did not utilize a singular numerical framework. Instead, they employed a suite of distinct systems, each tailored to specific categories of counted items (Desset, 2016; Englund, 1998). This differentiation suggests a highly organized administrative structure and a nuanced understanding of quantification.

Sexagesimal System (S)

Advancements in decipherment have significantly clarified the role of the sexagesimal system (S) in Proto-Cuneiform and Proto-Elamite accounting (Friberg, 1978; Nissen, 1986; Nissen *et al.,* 1990; 1993; Englund, 1998; 2004; 2011). This system, as depicted in the Figure 1, was primarily employed for counting discrete inanimate objects, encompassing a wide range of commodities (Nissen *et al.,* 1991; Damerow, 2006). The numerical signs reveal a sophisticated capacity for handling large quantities, with values such as “3,600,” and “600,” indicating a complex administrative framework capable of managing substantial resource flows. This bears a resemblance to the later Babylonian sexagesimal system, suggesting a potential shared origin or influence, although crucial differences highlight

the independent development of Proto-Elamite numerical practices (Friberg, 1978). The objects counted using the sexagesimal system (S) likely included a variety of bulk commodities and manufactured goods as grains and other agricultural products defined as large quantities of stored or distributed grain, as distinct from the capacity measurements in system C, could be recorded using this system (Friberg, 1978; Nissen, 1986; Nissen *et al.,* 1993). Given the importance of textile production in early urban centers, fabrics or finished garments could have been quantified using these units (Friberg, 1978). Metal tools, pottery, or other manufactured items might have been recorded in large numbers, particularly if they were being distributed or stored centrally (Nissen *et al.,* 1993). Quantities of raw materials such as wood, stone, or metal might have been tallied using the sexagesimal system, especially if they were being traded or distributed. The signs themselves, as visualized in the image, represent distinct numerical values. Understanding their meaning is crucial for interpreting the tablets. For example, the sign representing "3,600" implies a high level of administrative organization capable of tracking very large quantities of specific commodities. The presence of the fraction "1/2" also indicates a high level of sophistication (Desset, 2016). It's important to note that while the sexagesimal system shares a numerical base with the Mesopotamian systems, the specific forms of the signs and the ways they were used may have differed. This suggests that while there may have been a common origin or influence, the Proto-Elamite scribes adapted and developed their own unique numerical practices to meet the specific administrative and economic needs of their society (Friberg, 1999; Desset, 2016).



◀**Fig. 1: Sexagesimal Numerical System (S), (After: Desset, 2016).**

Decimal System (D)

The decimal system (D), employed by Proto-Elamite scribes for enumerating animate objects, specifically domesticated animals and human laborers, stands out as a significant characteristic of their numerical practices (Friberg, 1978). This system, featuring signs representing values like "10,000," "1,000," "100," "10," and "1," indicates a clear conceptual separation between living and non-living resources, a distinction that is not consistently observed in contemporaneous Mesopotamian accounting (Fig. 2). The consistent application of this decimal system across Proto-Elamite communities suggests a standardized administrative practice, reflecting

a degree of societal organization and a focused management of living resources. The meticulous recording of livestock numbers, using decimal notation, implies a systematic approach to animal husbandry, potentially linked to herding, taxation or distribution. Notably, the presence of signs representing “10,000” and “1,000” suggests the ability to manage and account for large herds or labor forces, indicating a sophisticated level of administrative control (Yousefi Zoshk, 2010). Similarly, the enumeration of human laborers, possibly using these larger denominations, suggests organized labor practices, possibly related to large-scale agricultural or animal husbandry. The exclusive use of this decimal system for animate objects within the Proto-Elamite corpus highlights a unique aspect of their socio-economic structures and administrative needs (Desset, 2016). The ability to record such high numbers within the decimal system is crucial. It suggests the Proto-Elamites were not merely counting small groups of animals or laborers, but rather managing significant populations. This capability is indicative of a centralized administration capable of tracking and controlling substantial living resources, potentially for economic, political or social purposes. While the precise reasons for this conceptual separation remain speculative, it is clear that the Proto-Elamites treated animate resources differently from inanimate commodities. This distinction could stem from cultural beliefs, economic priorities, or specific administrative requirements. Further research, including comparative analysis with other early counting systems and a deeper understanding of the Proto-Elamite socio-economic context, is necessary to fully elucidate the significance of this distinctive decimal system.

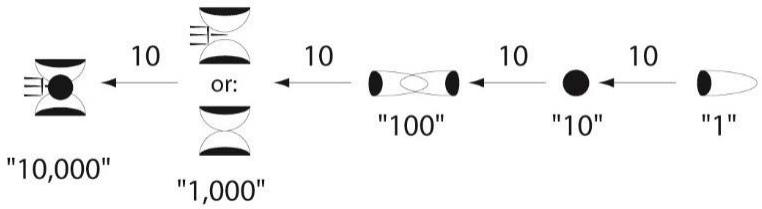
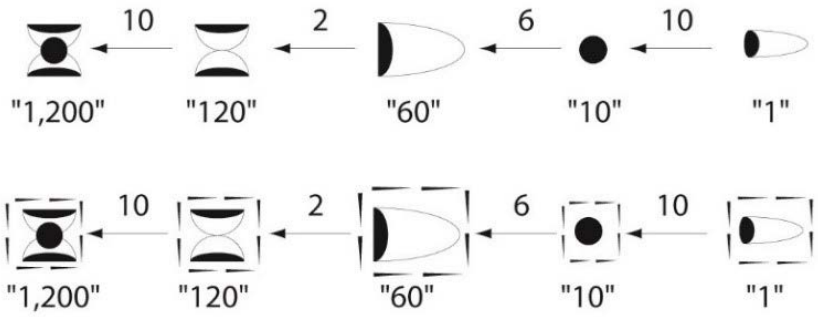


Fig. 2: Decimal Numerical System (D), (After: Desset, 2016). ◄

Bisexagesimal Systems (B and B#)

The bisexagesimal systems (B and B#), as evidenced by the Proto-Elamite tablets, were specifically dedicated to the quantification of grain products (Englund, 2004; Desset, 2016). The base-60 structure, combined with decimal components, indicates a complex system likely used for both large-scale grain accounting and the allocation of rations. These systems reflect the paramount importance of grain as a staple commodity within the Proto-Elamite economy and the necessity for precise distribution to

sustain a growing population. The derivative B# system, while its precise function remains debated, appears to have been employed for counting rations, potentially indicating a structured system of food distribution or labor management. The commodities counted using these bisexagesimal systems (B and B#) likely included barley as given its prevalence in early Mesopotamian and Iranian agriculture, it was likely a primary commodity accounted for using these systems and emmer wheat might also have been quantified using these systems, especially considering the graphical relationship of the C" system to the Mesopotamian emmer measurement system. It might also use for counting flour and other processed grain products as a way to track the distribution of flour, groats, or other processed grain products. The presence of a bisexagesimal system for grain accounting bears similarities to early Mesopotamian practices, where base-60 systems were employed for various commodities, including grain (Friberg, 1984). However, the Proto-Elamite adaptation of this system, particularly the derivative B#, suggests a unique development tailored to their specific administrative needs. The signs within these systems, as shown in the image, illustrate the capacity for precise measurement and accounting. The values "1,200," "120," "60," and "10," along with the unit "1," demonstrate a detailed approach to quantifying grain, suggesting a complex administrative apparatus (Fig. 3). This level of precision would have been essential for managing large-scale storage, distribution, and consumption of grain within Proto-Elamite society.



◀Fig. 3: Bisexagesimal Numerical Systems (B and B#), (After: Desset, 2016).

Capacity Systems (C, C#, and C")

The Capacity Systems (C, C#, and C") represent a crucial component of the Proto-Elamite numerical framework, primarily employed for measuring grain, particularly barley, and, in some cases, bisexagesimally counted cereal products (Friberg, 1978; Desset, 2016). Their widespread use across numerous Proto-Elamite tablets underscores the centrality of agricultural accounting and resource management in this Proto- Urban society (Afshari & Desset, 2022). These systems provide critical insights into the precise

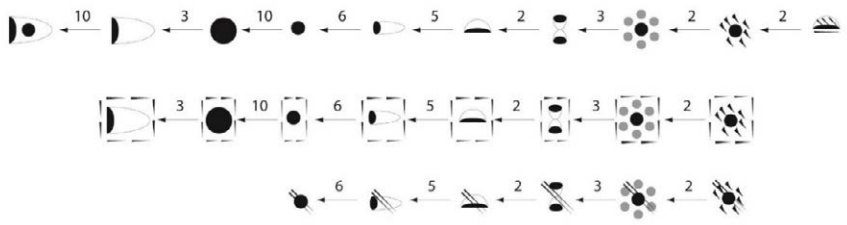
methods used to quantify and distribute grain; a staple commodity vital for sustaining a settled population. The C system, as the primary capacity measure, likely served as the foundation for the derivative C# and C" systems. The C# system, possibly related to the bisexagesimal system B#, may have been employed for specific types of grain measurements or related products, although its precise function remains debated.

The C" system, however, is particularly significant due to its graphical relationship with the Mesopotamian system used to measure emmer (Englund, 2004). This connection suggests potential cultural exchange or shared accounting practices between the Proto-Elamites and their Mesopotamian neighbors. One notable feature of the Capacity Systems is the use of fractions, as seen in the "1/2" sign within the sexagesimal system (S) and implied within the structure of the capacity signs themselves (Englund, 2004; 2011; Desset, 2016). This indicates a sophisticated understanding of measurement and a need for precise quantification, crucial for managing grain stores and distributing rations. The ability to record fractional units would have allowed for detailed accounting of grain volumes, ensuring equitable distribution and efficient resource management. Comparing these systems with Mesopotamian counterparts, we find both similarities and differences. While Mesopotamia also employed capacity measures for grain, the specific forms of the signs and the relationships between the systems may have varied.

The graphical similarity between the Proto-Elamite C" system and the Mesopotamian emmer measurement system suggests a potential shared tradition, but further research is needed to fully understand the nature of this connection (Nissen *et al.,* 1991). The existence of variations within the Capacity Systems (C, C#, and C") likely reflects the nuanced needs of Proto-Elamite agricultural administration. Potential reasons for these variations include different Grain Types, The C, C#, and C" systems might have been used to measure different types of grain or grain products. For example, C could have been used for barley, while C" was specifically for emmer, as indicated by its Mesopotamian connection. The variations might represent different units of measurement, reflecting regional differences or specific administrative requirements. This would allow for a more granular approach to accounting. The systems could have been used in different contexts, such as storage, distribution, or taxation.

The C# system, for example, might have been used for rationing, while C was used for larger storage measurements. The variations might also represent an evolution of the capacity measurement system over time,

with new systems being introduced or adapted to meet changing needs. The C# system, being related to the Bisexagesimal system B#, could indicate a bridge between the two systems, and a specialized function, in relation to grain-based rations, or other specialized goods. The meticulous recording of grain volumes using these systems highlights the importance of agricultural surplus in Proto-Elamite society and the need for efficient administrative control.



◀Fig. 4: Capacity Numerical Systems (C, C#, and C"), (After: Desset, 2016).

This section presents a detailed analysis of four Proto-Elamite clay tablets, originating from Susa, selected for their demonstrably high-scale numerical records. These tablets, pivotal administrative documents dating to approximately 3100-2900 BC, offer a unique opportunity to explore the scale of commodity management and distribution in this Proto-Urban context. By examining the numerical signs and their associated values inscribed upon these tablets, we aim to elucidate the quantitative methods employed by Proto-Elamite scribes and gain insights into the economic and administrative practices of this period.

MDP 26 Corpus

The initial excavations pertaining to the Proto-Elamite period in Susa were conducted by Jacques de Morgan (De Morgan, 1900: 52). Following the commencement of his excavations, numerous Proto-Elamite tablets were discovered. Subsequently, in 1905, de Morgan and Scheil published the first corpus of these tablets, comprising 198 specimens, within a volume of the "Mémoires de la Délégation en Perse" (MDP.6) under the auspices of the Louvre Museum. This publication also included 989 illustrations of "sign-glyphs" or "ideograms," along with their variants, under the heading "Proto-Elamite" (Scheil, 1905).

In subsequent years, from (1907 to 1923), a substantial number of tablets were unearthed from both the northern and southern sectors of the Susa acropole. This led to the publication of a collection containing 490 tablets in MDP.17 in 1923 (Scheil, 1923). Until this time, all Proto-Elamite tablets were transferred to the Louvre Museum. However, following a new agreement between the governments of Iran and France in 1927, all

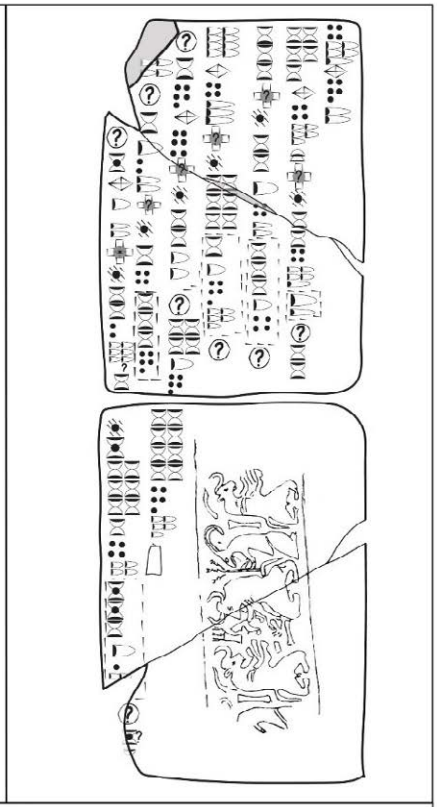
subsequent finds were divided equally between Iran and France (Dahl, 2013). The tablets that came into the possession of the Iranian government and the National Museum of Iran were published in a volume titled "MDP 26" in 1935 (Scheil, 1935).

This collection is comprised of two parts: MDP.26, containing 485 Proto-Elamite tablets, and MDP.26S, which includes tablets from de Morgan's "Grand Trench" (Scheil, 1935). The latter collection is currently housed in the Louvre Museum. The MDP 26 collection is of particular significance, as its tablets likely originate from a single trench and include multiple tablets related to the same subject matter. These tablets potentially represent a relatively unified archaeological context. Comparative analysis of these texts can elucidate the reasons behind their variations and greatly contribute to the decipherment of this writing system. The drawings of the tablets in this collection were initially produced by de Mecquenem's daughter using a lucida camera. However, the resulting unnatural and poor quality of these drawings, coupled with the absence of any photographic documentation (Dahl, 2013), meant that they remained inaccessible to Western researchers for many years.

MDP 26, 360

This tablet, currently housed in the National Museum, Tehran, published initially by Vincent Scheil in Mémoires de la Délégation en Perse (MDP. 26: 360) in 1935, dates to the Proto-Elamite period, approximately 3100-2900 BC (Fig. 5). As a primary administrative document, this tablet, like others from Susa, offers crucial insights into the numerical systems and accounting practices employed during this period in southwestern Iran. The tablet is made of clay, roughly rectangular, although it appears to be fragmented or broken, with pieces separated.

The tablet appears to follow a pattern where entries are grouped, and within each group, there's a sequence of M signs and numerical systems: |M327+M348| M354 (Bisexagesimal system B), M354? (Bisexagesimal system B#), |M351+X| (Bisexagesimal system B), M222 (Capacity system). The grouping layout entries is a significant observation. It suggests that the tablet's information is organized in a structured manner, possibly representing distinct transactions, accounts, or categories. The consistent sequence within each group is also crucial. It indicates a standardized format for recording information. The pattern starts with |M327+M348| M354, which are counted using the Bisexagesimal system B. This could represent a primary commodity or category. It's followed by M354?



Obverse			
0.	M?		
00.	|M327+M365| M354(?), ?(N?)		
1a.	|M351+X| , 1(N54)	1b.	M222 , 1(N34) 2(N01)
2a.	|M327+M365| M354 , 2(N51) 2(N14) 6(N01)	2b.	, 1(N51), ? (N?), 4(N01)
2c.	|M351+X| , 1(N51) 1(N34) 2(N14) 2(N01)	3a.	|M327+M365| M354, 1(N51) 4(N14)
3b.	M354? , 3(N51@b) 5(N14@b)	3c.	|M351+X| , 1(N51) 5(N14)
3d.	M222 , 6(N14)	4a.	|M327+M365| M354, 2(N51) 2(N34)
4b.	M352~h , 4(N51) 1(N34) 5(N14) 8(N01)	4c.	M222 , 4(N14) 3(N01)
5a.	|M327+M348| M354 , 6(N51)	5b.	M354?, 1(N51@b) 1(N34@b) 5(N14@b) 5(N01@b)
5c.	M352~h , 3(N51)	6a.	|M327+M365| M354, 2(N51) 1(N34) 4(N14) 2(N01)
6b.	M354?, 3(N51@b) 1(N34@b) 4(N14@b)	6c.	|M351+X| , 5(N51)
6d.	M222 , 4(N14) 5(N01) 2(N39B)	7a.	|M327+M365| M354, 2(N51) 4(N14) 5(N01)
7b.	M354? , 1(N34@b) 1(N1@b)	7c.	|M351+X|, 2(N51) 4(N14) 5(N01)
7d.	M222 , 5(N14) 2(N01)		
Reverse			
1.	M354 , 1(N54) 7(N51) 4(N14) 4(N01)	2.	M354? , 2(N54@b) 1(N51@b) 1(N34@b) 1(N14@b)
3.	|M351+X| , 2(N54) 8(N51) 5(N14) 5(N01)		

◀**Fig. 5: Proto Elamite Tablet, MDP 26, 360 (©Image courtesy of the Cuneiform Digital Library Initiative (CDLI), Drawing and Transliteration by: Authors, 2024).**

counted in B#. This might indicate a sub-category or a related commodity. Then comes |M351+X|, again in Bisexagesimal B, possibly another primary commodity. Finally, M222, counted in the Capacity system, which as we know is associated with barley. totals for M354 and M351+X on the obverse and reverse sides of the tablet; Obverse Totals: M354: 1744, M351+X: 2972, and Reverse Totals; M354: 2084, M351+X: 3605.

The consistent structure suggests a well-defined administrative or accounting practice. This format might have been used across multiple tablets or within a specific institution. The presence of sub-categories (like

M354? in B#) within the groups hints at a hierarchical organization of information. This could reflect different grades or types of commodities, or different stages in a transaction. The sequence of M signs might reveal relationships between different commodities. For example, |M327+M348| M354 and |M351+X| might represent different types of grain, while M222 (barley) is recorded separately, perhaps as a final product or output.

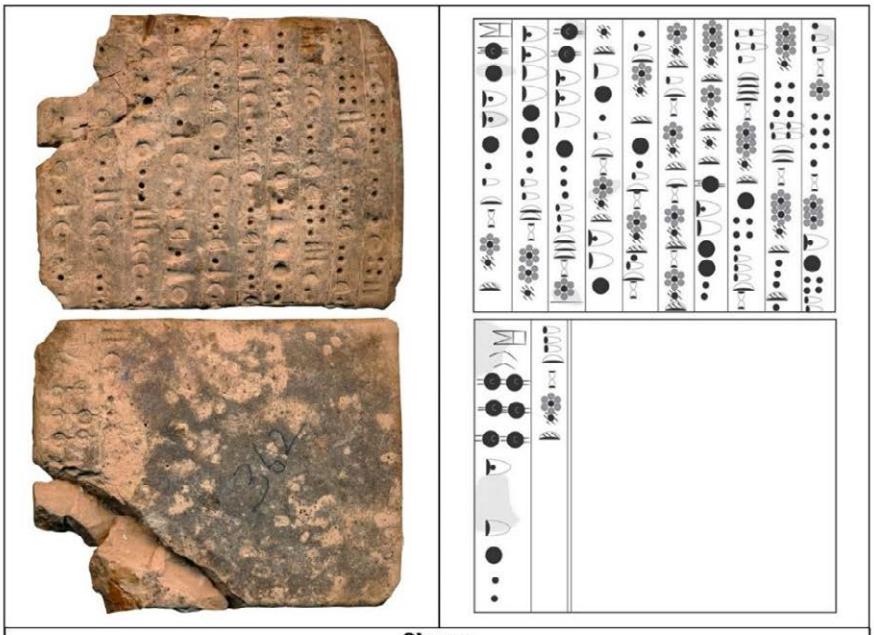
Observation on the reverse side summarizing the totals is very important. It suggests that the reverse side provides a consolidated overview of the information recorded in the groups on the obverse. The absence of M222 on the reverse side might indicate that it was a final product distributed or consumed, rather than an input. Considering this structure, we can refine our interpretation of the tablet as the script records a series of transactions or accounts, each involving specific types and quantities of grain. The obverse side details the inputs or components of each transaction, organized by grain type and category. The reverse side summarizes the totals for each grain type, providing an overview of the overall transaction. This Proto-Elamite tablet, with its distinct numerical systems and commodity designations, likely represents a sophisticated accounting system that goes beyond our basic understanding of debits and credits. The tablet, rather than representing a single static balance, may contain a set of interconnected records functioning as an inventory management tool. These records could encompass: 1) the tracking of inflows and outflows of various commodities, particularly different types of grain; 2) transactional documentation of specific transfers or exchanges between individuals, locations, or resource pools; and 3) detailed accounts of resource allocation for distinct purposes, such as rations, seed grain, or trade. In this sense, the tablet reflects ongoing activities over a defined period, rather than a one-time economic snapshot. It is possible that the reverse side served as a summary of the transactions recorded on the obverse.

Such a tablet would have provided administrators with the means to monitor economic activity, ensure accountability, and make informed decisions in resource management. It was likely associated with the operations of an agricultural trading center. The obverse may list grain inputs received from surrounding areas, alongside allocations for seed and internal consumption; alternatively, it could detail tribute payments received in various grains, or document deliveries of grain to a brewery. Correspondingly, the reverse may record the distribution of cereal rations to the workforce, the redistribution of grain from this central storage facility to various settlements or public works projects, or the allocation

of barley malt, a key ingredient in beer or even the distribution of finished beer.

MDP 26, 362

The Proto-Elamite clay tablet, cataloged as NMI BK 03416 within the National Museum, Tehran, originates from Susa and dates back to approximately 3100-2900 BC. This tablet, bearing the primary publication reference MDP 26, 362 (P009050) in Vincent Scheil's work, is classified as a tablet (Fig. 6).



	Obverse
1.	M288 , 1(N46) 1(N45)# 2(N48) 1(N45) 1(N14) 1(N01) 1(N39B) 1(N24) 1(N30C) 1(N30D) 1(N39C)
2.	[...] , 2(N48) 2(N34) 2(N45) 2(N14) 2(N01) 2(N39B) 1(N24) 2(N30C) 1(N30D)
3.	2(N46) 2(N48) 1(N34) 1(N45) 3(N14) 3(N01) 3(N39B) 1(N24) 1(N30C) 1(N30D) 1(N39C)
4.	1(N34) 1(N45) 1(N14) 1(N01) 1(N39B) 1(N24) 1(N30C) 1(N30D) 1(N39C)
5.	1(N48) 1(N34) 1(N45) 1(N14) 1(N01) 1(N39B) 1(N30C) 1(N30D) 1(N39C)
6.	1(N45) 1(N14) 1(N01) 1(N39B) 1(N24) 1(N30C) 1(N30D) 1(N39C)
7.	1(N14) 1(N01) 1(N39B) 1(N24) 1(N30C) 1(N30D) 1(N39C)
8.	1(N01) 1(N39B) 1(N24) 1(N30C) 1(N30D) 1(N39C)
9.	1(N39C) 1(N24) 1(N30C) 1(N30D) 1(N39C)
10.	1(N24) 1(N30C) 1(N30D) 1(N39C)
11.	2(N30C) 1(N30D) 1(N39C)
12.	1(N30C) 1(N30D) 1(N39C)
13.	1(N30D) 1(N39C)
14.	1(N46) 1(N48) 1(N34) 2(N45) 2(N14) 5(N01) 4(N39B) 1(N24) 2(N30C) 1(N30D) 1(N39C)
15.	1(N45) 5(N14) 3(N01) 1(N39B) 1(N24) 2(N30C) 1(N30D)
16.	6(N14) 4(N01) 2(N39B) 1(N24) 2(N30C) 1(N30D) 1(N39C)
17.	3(N14) 1(N39C)
18.	1(N14) 1(N01)# 1(N24) 1(N30C)
19.	7(N14) 1(N24) 2(N30C)
20.	1(N48) 1(N45) 4(N14) 2(N01)
	Reverse
1.	M288# , 6(N46) 1(N48) 1(N34)# 1(N45) 2(N14) 2(N01) 1(N39B) 1(N24) 1(N30C) 1(N30D) 1(N39C)

◄ **Fig. 6: Proto Elamite Tablet, MDP 26, 362 (© Image Drawing and Transliteration Courtesy of the Cuneiform Digital Library Initiative (CDLI)).**

Tablet MDP 26, 362 is an administrative document from Proto-Elamite Susa, designed to meticulously record barley accounting within standard containers. The tablet's structure is organized around the sign M288, which denotes a large container for cereals, specifically barley. The obverse begins with a crucial entry (line 1) that defines the full capacity of this standard container. It lists various units from the capacity values (N46, N45, N48, N14, N01, and the less understood N39B, N24, N30C, N30D, N39C), quantifying the precise amounts of each needed to fill one M288. Subsequent obverse entries (lines 2-20) omit M288 but implicitly refer to it, documenting different volumes of barley held within these containers. These variations in quantities suggest records of additions, removals, transfers, or allocations of barley. In contrast, the reverse entry serves as a summary, providing a consolidated view of the barley transactions or measurements.

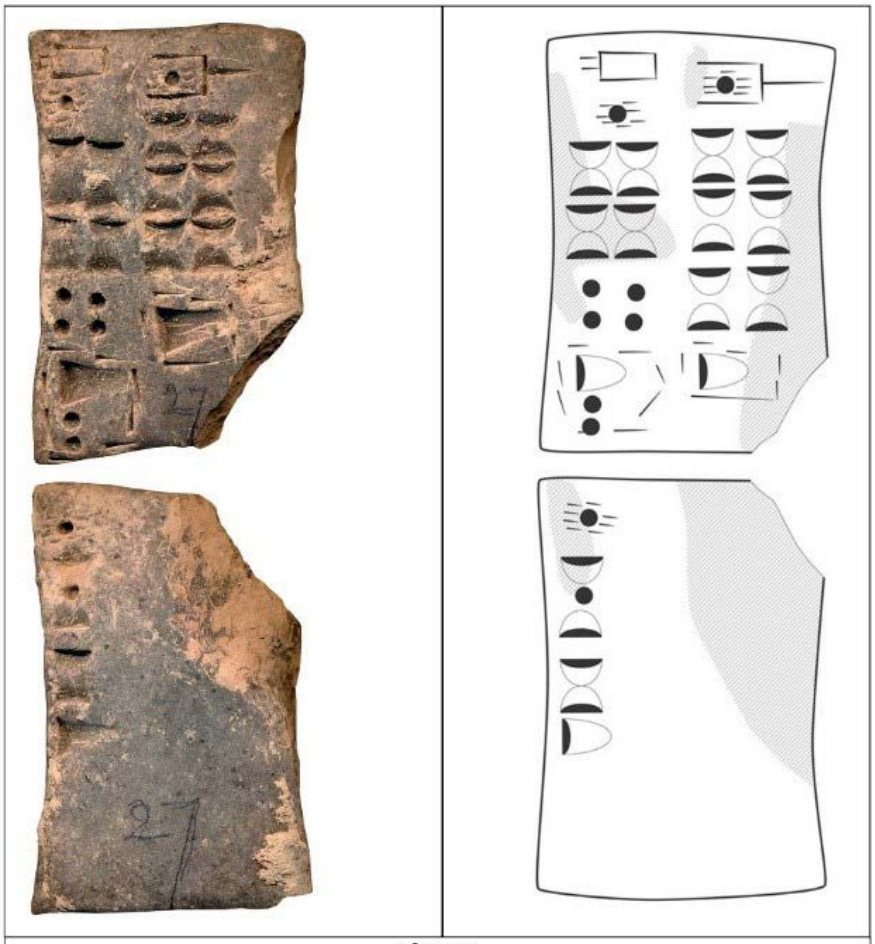
This tablet appears to document the distribution of rations, most likely grain, employing the Proto-Elamite capacity measurement system. To assess the relative quantities recorded, the values in each line may be converted to the N01 unit using the established conversion factors. It is assumed that the entries on the obverse represent individual distributions, while the first entry on the reverse constitutes the aggregate total of the obverse entries. The rations are recorded with the use of the numerical sign M288, which most plausibly denotes distinct types of containers, potentially associated with different commodities or functional purposes.

The obverse seems to list individual distributions, while the reverse provides a total. This tablet shows a significant difference between the total rations recorded on the obverse (17921.171 N01) and the reverse (2416.35 N01). Several factors could explain this discrepancy. The tablet might be damaged, with missing parts on the reverse, or the obverse and reverse might use different accounting methods. Recording errors are also possible. The reverse could show a subtotal, exclude some obverse entries, or use rounded numbers. Further research, including a physical examination of the tablet, comparisons with similar texts, and linguistic analysis, could help clarify these differences. Overall, this tablet exemplifies a sophisticated accounting system developed to track and manage barley, highlighting its economic importance in Proto-Elamite society and the administrative rigor employed in its control.

MDP 26, 027

The Proto-Elamite clay tablet, cataloged as (NMI BK 03577) within

the National Museum, Tehran, originates from Susa and dates back to approximately 3100-2900 BC. This tablet, bearing the primary publication reference MDP 26, 027 (P008715) in Vincent Scheil's work, is classified as a tablet (Fig. 7).



obverse			
1.	M157,	2.	M354 , 4(N51) 4(N14)
3.	M354?, 1(N34@b) 2(N14@b)	4.	|M036+1(N30D)| , 6(N51)
5.	|M036+1(N30D)|?,1(N34@b)		
reverse			
1.	M354 , 1(N54) 1(N51) 1(N34)		

◄ **Fig. 7: Proto-Elamite Tablet, MDP 26, 027 (©Image and drawing courtesy of the Cuneiform Digital Library Initiative (CDLI), Transliteration by: Authors 2024).**

This Proto-Elamite tablet is a significant administrative artifact dedicated to the accounting of grain, utilizing the complex Bisexagesimal B and B# numerical system. The structure of the tablet suggests a meticulous record-keeping practice, essential for managing this vital commodity in Proto-Elamite society. The obverse presents individual entries detailing grain quantities, where the sign M354 likely represents a large unit or standard measure of grain, perhaps a specific container volume or a collective term for stored grain. The sign M036, often associated with grain containers,

when modified with "1(N30D)," may indicate a particular type or size of container, or even a specific variety of grain. Functioning as a header, M157 at the top of the obverse likely designates the overall context of the record, such as the type of grain being tracked (e.g., barley or emmer wheat) or the purpose of the tablet itself (e.g., distribution log or inventory summary).

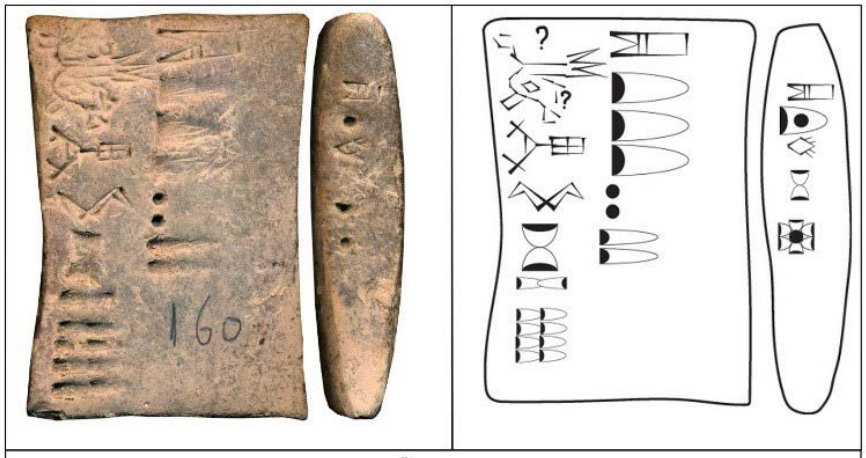
On the obverse, entry 1 (M157) has no numerical value, seems to the header for which the transactions were recorded. Entries 2 and 3 record quantities of grain. The notation with N34 and N14 in entries 3 and 5 on the obverse might indicate that these quantities are counted in the (B# system). On the reverse, the single entry records a quantity of grain, seemingly counted in the standard Bisexagesimal (B system). The use of the (B# system) on the obverse, combined with its absence on the reverse, could indicate a few things as the obverse might record specific types of grain transactions (e.g., incoming grain, or grain for a particular purpose) using the (B# system), while the reverse records the total distribution of grain using the standard B system. The obverse and reverse might represent different levels of accounting, with the (B# system) used for more detailed tracking on the obverse and the (B system) used for a simplified summary on the reverse. The question marks in the transliteration, "M354?" and "|M036+1(N30D)|?", indicate uncertainty in the reading of those specific M signs. This uncertainty doesn't affect the numerical calculations, but it suggests that the scribes might have had some variations or complexities in how they labeled the entries.

This tablet appears to be a well-balanced account, where the total grain recorded on the obverse matches the total on the reverse. This suggests a careful administrative practice, possibly within an agricultural trading center. The tablet might represent a record of grain received (obverse) and then distributed (reverse). Here are some suggestions about why the M signs before the numerical (Bisexagesimal B#) might be omitted, and what they could be that the M sign might be omitted because the context makes it clear what commodity is being counted. If the tablet consistently deals with grain, the scribe might have assumed that the reader would understand that the numbers refer to grain, even without the M sign. Omitting the M sign could have been a way for scribes to save time and space, especially if they were dealing with large numbers of tablets. The M sign could denote the type of grain being counted. The M sign could represent the units of measurement used for the grain (e.g., bushels, liters, etc.). In this tablet, the obverse total is (1380 N01), and the reverse total is (1380 N01).

In conclusion, this tablet offers a glimpse into the sophisticated administrative apparatus developed by the Proto-Elamites to manage and distribute grain, a cornerstone of their economy. The precision of the Bisexagesimal system and the detailed recording practices underscore the importance of grain as a resource and the centralized control likely exercised over its allocation within Proto-Urban settlements.

MDP 26, 160

The tablet appears to be an administrative record, from Susa, dating back to the late fourth millennium BCE. It documents the allocation of resources (rations) to a group of workers. The text uses a combination of the decimal system (D) for counting workers and the capacity system (C) for measuring rations, which, according to Dahl (2005) and Friberg (1978), is a characteristic feature of Proto-Elamite accounting practices (Fig. 8).



obverse	
1.	x ,
2.	M210~f M054 , 1(N51) 1(N23) 8(N01)
3.	M288 , 3(N34) 2(N14) 2(N01)
4.	M288 , 1(N48)
5.	x , 1(N24) 2(N30C)

◀ **Fig. 8: Proto Elamite Tablet, MDP 26, 160 (©Image courtesy of the Cuneiform Digital Library Initiative (CDLI), Drawing and Transliteration by: Authors, 2024).**

In line one, “x” is likely representing an unknown sign used as a heading or a general descriptor. In line 2, “M210~f M054, 1(N51) 1(N23) 8(N01)”, records the first entry. “M210~f M054” could be worker identifiers or job titles. “1(N51) 1(N23) 8(N01)” indicates the number of workers. Given that (N01 = 1, N14 = 10, N23 = 100, and N51 = 1000), the calculation is (1108) workers. In line three, “M288, 3(N34) 2(N14) 2(N01)” records the amount of rations distributed using container “M288”. “3(N34) 2(N14) 2(N01)” indicates the capacity of “M288” containers. In line four which

is on the edge, "M288, 1(N48)". This line records another number of rations distributed, again using container "M288". In line five, "x, 1(N24) 2(N30d)", likely records the amount of rations. "1(N24) 2(N30C)" probably indicates the quantity of grain or other commodity, measured using the capacity system (C). To analyze the relationship between the number of workers and the number of rations, we need to express the rations in to N01 units[2]. The tablet documents the distribution of a significant amount of rations (2355.33 N1) to a large workforce (1108 workers). Workers are counted using the decimal system, while the rations are measured using the capacity system. The entries seem to be organized by worker group or category (M210~f M054) and rations paid through (M288). The calculation shows that each worker received an average of (2.126 N01 units). This suggests a system of organized resource allocation, where a central authority managed and distributed rations to support its labor force. The relatively small number of rations per worker might indicate basic sustenance rations for a large labor force involved in non-intensive labor. Based on the Immersive amount in Line 2 records "1108 workers", here's an analysis of this large number and its potential implications:

The most straightforward interpretation is that the tablet documents labor allocation for a significant construction or agricultural project. Proto-Elamite Susa was a major Proto-urban center, and such a workforce could have been involved in building or maintaining large-scale infrastructure like, Irrigation canals, essential for agriculture in the region, monumental architecture or city walls or perhaps large agricultural fields for organized farming. At the meantime, the recorded number might represent a seasonal workforce employed during peak times, such as harvest season requiring a large number of laborers for a short period or construction season when weather conditions were most favorable. Moreover, the 1108 workers might represent the total available workforce in a specific region or under the control of a particular institution (e.g., an administrative center). This doesn't necessarily mean they were all employed on a single task simultaneously but rather that they could be assigned to various projects as needed. It is also possible that the recorded number is the cumulative number of workers over a specific period of time.

A large, centralized administration in Susa would have been capable of organizing and managing a substantial workforce. The Proto-Elamite writing system and accounting practices, as evidenced by the tablets, support this idea. A large workforce indicates a complex economy with a significant surplus of resources. This surplus could be used to support

a large number of non-subsistence laborers. The presence of a large workforce may imply a stratified social structure, with a class of laborers working for the benefit of the elite. Given the context of Proto-Elamite society, the workers were likely involved in labor-intensive tasks such as working in fields, harvesting crops, maintaining irrigation systems or building and maintaining infrastructure and perhaps producing pottery, textiles, or other goods.

Conclusion

The analysis of the Proto-Elamite tablets MDP 26, 362 and MDP 26, 027 offers valuable insights into the administrative and economic structures of Proto-Elamite society. These tablets, originating from Susa, underscore the critical role of organized accounting in managing essential resources, particularly grain. Tablet MDP 26, 362, reveals a sophisticated system for tracking barley. The consistent use of M288, denoting a standard grain container, and the detailed recording of capacities using a complex system, highlight a standardized approach to measuring and managing this staple commodity. The tablet's structure, with an initial entry defining the container's capacity and subsequent entries detailing transactions or inventory levels, suggests a rigorous administrative practice. The reverse entry likely represents a summary, consolidating the data from the obverse. The presence of the Bisexagesimal system in MDP 26, 027, dedicated to quantifying grain products, further emphasizes the importance of grain in the Proto-Elamite economy. The system's blend of base-60 and base-10 elements indicates a nuanced approach to accounting, potentially serving both large-scale grain management and the allocation of rations. The M signs on this tablet likely denote units of grain, with variations possibly indicating different types or measures. MDP 26, 160 provides a glimpse into the logistical operations of a large-scale labor organization, detailing the accounting of a substantial workforce and the distribution of rations. The tablet employs both the decimal and capacity systems, illustrating a degree of complexity in tracking both personnel and resources. The presence of entries organized by worker groups and ration containers, combined with the sheer number of workers (1108), suggests a centralized administrative system capable of managing significant labor demands, likely for a major construction, agricultural, or public works project. This implies a complex economic structure with a capacity for surplus production and a stratified social organization in Proto-Urban Susa. Together, these tablets illustrate a society with a centralized authority capable of organizing and

controlling the production, storage, and distribution of grain. The detailed accounting practices, as evidenced by the tablets' numerical precision and standardized measures, reflect the need to manage a growing population and ensure the efficient distribution of resources. These findings align with broader understandings of early urban centers in the Near East, where the development of writing and complex accounting systems played a crucial role in supporting social and economic complexity.

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Observation Contribution

The first author was responsible for the writing and analysis of the proto-Elamite tablets in this study. The second author contributed to the design and drafting of the texts, while the third author prepared the relevant research literature.

Conflict of Interest

The Authors, while observing publication ethics in referencing, declare the absence of conflict of interest.

Endnote

1. Approximately 1,646 Proto-Elamite texts are currently known, with the bulk of the published material originating from the works of Scheil (1905; 1923; 1935), de Mecquenem and Rutten (1949), de Mecquenem (1956), and Vallat (1971). In addition, 129 previously unpublished tablets and fragments housed in the Louvre were published by Jacob Dahl (Dahl, 2019), and 89 fragments have been recently released from the storage facilities of the National Museum of Iran on the CDLI website.

2. Here is the calculation the total rations and rations per worker: Total rations = Line 3 + Line 4 + Line 5 Total rations = 3N34 + 2N12 + 2N1 + 6N1 + 10 N1 + 10/3 N1 To simplify this, we need to convert N34 to N1 10N34 = 1N48 3N45 = 1N34 10 * 3N45 = 10N34 30 N45 = 10N34 10N14 = 1N45 30 * 10N14 = 30N45 300 N14 = 10N34 300 * 6N1 = 10N34 1800 N1 = 10N34 180 N1 = 1N34 So, Total rations = 3 * 180 N1 + 2N12 + 2N1 + 6N1 + 10 N1 + 10/3 N1 Total rations = 540 N1 + 2N12 + 18 + 10/3 N1. To convert N12 to N1, we use 6N1 = 1N14 and 10N14 = 1N45 and 3N45 = N34 and 10 N34 = N48 N12 = 2N14 = 12 N1 Total rations = 540 N1 + 12 N1 + 18 N1 + 10/3 N1 Total rations = 570 + 3.33 Total rations = 2355.33 N1. Rations per worker = Total rations / Number of workers Rations per worker = 2355.33 N1 / 1108 workers Rations per worker = 2.126 N1.

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مطالعه‌ای بر مقیاس حسابداری: تحلیل محتوایی گِل‌نبشته‌های آغازایلامی شوش با ارزش عددی بالا موجود در موزهٔ ملی ایران

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چکیده

این پژوهش به تحلیل عمیق چهار گِل‌نبشتهٔ آغازایلامی موجود در موزهٔ ملی ایران می‌پردازد که به‌دلیل برخورداری از حجم قابل‌توجه داده‌های عددی برگزیده شده‌اند. انتخاب این لوح‌ها فرصتی کم‌نظیر برای مطالعهٔ مقیاس حسابداری کالا در نیمهٔ دوم هزارهٔ چهارم پیش‌ازمیلاد در شوش، محوطه‌ای با جایگاه راهبردی در بررسی جوامع پیچیده، فراهم می‌آورد. تمرکز پژوهش بر شناسایی و تبیین نشانه‌ها و نظام‌های عددی پیچیده‌ای است که کاتبان آغازایلامی برای ثبت این داده‌های گسترده به‌کار گرفته‌اند، با تأکید ویژه بر نحوهٔ کاربرد و تعامل نظام‌های شمارش شصت‌گانی، دَه‌دهی، دوشصت‌گانی و حجمی. بررسی این متون پرده از سازوکارهای یک دستگاه اداری کارآمد برمی‌دارد که نه‌تنها توانایی مدیریت، بلکه قابلیت ثبت دقیق مقادیر کلان کالا را دارا بوده است. کالاهای ثبت‌شده طیف وسیعی از منابع موردنیاز جامعه، از انواع غلات و حسابداری نیروی کار انسانی و دامی تا میزان دستمزد را دربر می‌گرفته و بیانگر نظامی سازمان‌یافته برای توزیع و تخصیص منابع بوده است. گستردگی داده‌های عددی این لوح‌ها، شواهد ارزشمندی از پویایی اقتصادی شوش در این دوره به‌دست می‌دهد و بر مقیاس وسیع مدیریت منابع، وجود شبکه‌های منظم توزیع، و امکان برقراری ارتباطات تجاری فراتر از محوطه‌های پیرامونی شوش تأکید می‌کند. هرچند نشانه‌های عددی آغازایلامی در مقایسه با همتایان بین‌النهرینی خود، سبکی بصری متمایز و برخاسته از سنت فرهنگی و کتابتی، ویژه را بازتاب می‌دهند، اما تمرکز مشترک بر کمی‌سازی کلان‌مقیاس، نشانگر دغدغه یکسان برای تدوین شیوه‌های حسابداری دقیق و کارآمد است. چنین دقت و نظمی در ثبت و ضبط داده‌ها، عنصری حیاتی برای مدیریت مازاد تولید، سازماندهی نیروی کار، و حفظ ثبات اقتصادی یک مرکز درحال توسعه به‌شمار می‌رفت. یافته‌های این مطالعه علاوه بر تأکید بر ضرورت تحلیل موشکافانهٔ داده‌های عددی موجود، به فهم بهتر سازوکارهایی یاری می‌رساند که بستر رشد و پیچیدگی جوامع آغاز شهرنشینی در ایران را ترسیم می‌کنند.

کلیدواژگان: آغازایلامی، شوش، گِل‌نبشته، مقادیر کمّی بالا، مرکز تجاری.

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Urartian Chamber Tomb of Khāneqāh

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Abstract

The reign of the Urartian kingdom in Eastern Anatolia, spanning over two centuries, was marked by its dominance in a challenging landscape. Forming alliances with neighboring territories, such as Assyria and Phrygia, Urartu established itself as a significant power in the Iron Age II. Their influence extended over vast regions, including northwestern Iran, Anatolia, Armenia, and a small part of what is today Iraqi Kurdistan. The Urartians' hierarchical religious structure and military conquests played key roles in expanding their control. Various types of Urartian burials have been categorized by construction method, architecture, and materials, shedding light on social stratification. Rock-cut tombs and underground chambers reveal consistent burial customs and architectural features. Urartian burial sites in Iran present unique architectural elements, with discoveries of rock-cut tombs showcasing diverse room layouts and spatial contexts. A chamber tomb discovered during mosque construction features unworked limestone and sandstone blocks, with dimensions of 5×1.2 ×1.8 m. Large stone slabs form the walls, and a unique niche is present above the entrance. To prevent excessive weight on the lintel, this space is designed as a niche a common architectural technique. Resembling other Urartian tombs, it contains trefoil jugs and human bones, suggesting a Urartian attribution. Looting has hindered precise dating, but the pottery and architectural features align with Urartian sites near Lake Van. Similar tombs in Iran, such as those at Lor Balajuq and Bayazid Abad, underscore cultural connections. The tomb's original funerary context remains uncertain due to looting. The trefoil jugs, indicative of Urartian pottery, were likely used for water and funerary purposes, reflecting Urartian mortuary customs. The discovery of the Khāneqāh Chamber Tomb near the Iran–Turkey border, west of Lake Urmia, sheds light on Urartian burial practices. The tomb's architecture, associated objects, and regional context suggest it belonged to a local Urartian elite, showcasing the diversity of burial traditions within Urartian territory.

Keywords: Urartu, Chamber Tomb, Urmia, Khāneqāh.

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Introduction

The dominion of the Urartu kingdom (Biainili), which endured for over two centuries in the rugged terrain of Eastern Anatolia, characterized by challenging high plateaux, mountain ranges, and deep valleys, presents numerous intriguing facets warranting thorough exploration. Urartu stood as a formidable power in the Near East during the Middle Iron Age, fostering political and economic ties with contemporary realms. These included Assyria to the south, Late Hittite states like Melitia, Tablani, and Qumaha in the west, Phrygia in Central Anatolia, as well as Mannae in northwest Iran. Established in the capital of Tushpa (Van) on the eastern banks of Lake Van in the mid-9th century BC, Urartu exerted its influence over a vast territory extending from the Euphrates in the west to the Kars Plateau and Lake Sevan basin in the north, the Lake Urmia basin in the east, and the Taurus Mountains in the south (Köroğlu, 2011).

The narrative of Urartu's influence within Iran gains prominence with the ascension of Shalmaneser III (858-824 BC) to the throne of Assyria. His initial and subsequent military expeditions were aimed at Urartian territories within Iran. The zenith of Urartu's power spanned the 9th to 6th centuries BC, encompassing regions now comprising Iran, Turkey, Armenia, Azerbaijan, Nakhchivan, and Iraq. The Urartians adopted a hierarchical religious governance structure, with religious beliefs serving as a unifying force among the tribes, evident in their religious edifices. From the inception of the kingdom in the 9th century, Western Azerbaijan fell under Urartian dominion. Over the succeeding centuries, Urartu expanded its control eastward, conquering Eastern Azerbaijan and territories beyond the Araxes River during the 9th and 8th centuries (Kroll, 2011: 158). The landscape west of Lake Urmia was under Urartian rule from the kingdom's inception. The period between 820 and 810 BC witnessed a joint military campaign led by Ishpuini and Menua, targeting the southern region of Lake Urmia, including what is today Tepe Hasanlu and its vicinity. These campaigns led to the capture of cities, with the destruction of the Hasanlu IVB citadel by fire (Khatib Shahidi, 2006: 22). The allure of abundant natural resources, wealth, and advantageous geographical positioning spurred the Urartians to assert their authority through military conquests. While the absence of traditional Urartian fortifications in the eastern Lake Urmia basin suggests non-inclusion in the Urartian realm, evidence indicates Urartian presence from Marand towards the Araxes River (Biscione & Khatib-Shahidi 2006, 303). Urartu's southern border, neighboring the Lower Zab basin, linked northern Mesopotamia and the Ushnu-Solduz valley through various

mountain passes. The Sufian-Jaldian mountain pass in the northern reaches enabled access to Urartu, fortified from the Urartian side at Gerd-e Sureh (Binandeh, 2019).

In the 1970s, archaeological exploration of Urartian sites expanded into northwestern Iran, with Kleiss's endeavors at Bastam notably prominent. A large number of Urartian sites have been identified in the northwest of Iran, including castles, settlements, water channels and other water constructions, rock chambers, rock graves, stelae, rock inscriptions, and building inscriptions. During the 2nd half of the 9th century BC, the first Urartian fortresses in the lake Urmia region were set up. They show a new way of construction that can be identified as typically Urartian. All buildings show carefully-laid foundations of stone walls, on which mudbrick walls were set (Kroll, 2011).

Surveys and excavations at Bastam anciently known as "Rusai. URU. TUR" or "Rusaipatari" have identified it as a major Urartian fortress, the largest in Iran during the first half of the 7th century BCE. The citadel is strategically located high above the modern village, on a steep mountain ridge on the left bank of the Aq Çay River, where it enters the wide, fertile plain of Qara Zia Eddin. In antiquity, several channels were diverted from the river to irrigate the surrounding plain. Due to its position on the western edge of the plain, the fortress not only controlled the agricultural area but also oversaw a major west–east route connecting the Urartian capital, Tushpa (modern Van), to Urartian territories in Azerbaijan and Armenia (Kroll, 2004; Kleiss, 1977).

Qalʿa-ye Esmāʿil Āqā, another major fortress, is located west of Lake Urmia, near the city of Urmia, and features cliff dwellings dating to the 8–7th centuries BCE, excavated by an Italian team (Pecorella & Salvini, 1984). Sangar, situated near Maku, is a fortified site occupying a strategic position. The site comprises the remains of a robust fortress with rock-cut architectural elements, an extensive settlement, a cultic area, a rock-cut tomb, an inhumation cemetery, a bridge, and a quarry. Limited excavations were conducted by Kleiss before the revolution, and in recent years, an additional season of excavation has been carried out (Binandeh, 2019). Archaeological evidence indicates that the main phase of occupation dates to the 7th century BCE and is associated with Urartian territorial expansion.

Bastam has been excavated more than other Urartian sites in Iran. Excavations were conducted by W. Kleiss and S. Kroll with a team of archaeologists and experts from Germany, Iran, Italy, the United States and other countries between 1969 and 1978. In 1999, an Iranian archaeological

team resumed work at Bastam under the direction of Hamid Khatib Shahidi. Kleiss also identified numerous other Urartian sites in northwestern Iran, particularly in the provinces of West and East Azarbaijan, and mapped several fortresses.

Urartian fortresses were surrounded by a network of medium- and small-sized fortified sites. All sites maintained line-of-sight communication with one another. The scale of these sites was also unprecedented. Fortresses such as Qalatgah, Ismail Agha, Bastam, Verahram, Livar, and Gavur Qal'eh on the Araxes occupying areas between 8 and 30 hectares had no equivalents in earlier periods. Significant information about Urartu in Iran comes from cuneiform inscriptions. Beginning with Ishpuini, the king of Urartu around 820 BC, it became customary to create large display inscriptions in royal buildings and to erect victory inscriptions on rocks or stelae following successful military campaigns in conquered territories. In Western Azarbaijan, particularly between Maku and Ushnu, Urartian inscriptions primarily commemorate peaceful endeavors, including construction inscriptions by Ishpuini and Menua (circa 800 BC) found at sites like Kelishin, Qalatgah, Ain-e Rum, and Siah Chesmeh. Subsequent rulers in the region also documented only peaceful activities through their inscriptions. In contrast, south of Lake Urmia, inscriptions by Ishpuini and Menua at Tashtepe and Taraqeh indicate conflicts with other kingdoms, such as Mannea. Further east, in East Azarbaijan, particularly in the Ahar region, the oldest inscription at Seqindel is a campaign inscription by Sarduri II, dating to around 750 BCE. Campaign inscriptions often also reference construction projects and fortresses intended to maintain control over newly conquered territories within the Urartian kingdom (Kroll, 2011). Following the Iranian Revolution, Urartian archaeological research predominantly relied on existing data, with surveys and excavations being quite limited; however, several important sites were identified that require further investigation, with Khatib-Shahidi's fieldwork at Bastam, Hasanlu, and more recently at Qalatgah serving as notable exceptions.

Urartian Burial Traditions

Various types of burials have been discovered in Urartian region, categorized based on construction method, architecture, materials used, and size, with suggestions made about the social status of the deceased. Various categorizations of Urartian tombs have been attempted: (1) based on architectural features including size, construction materials, building methods, and layout; (2) categorized according to societal status markers

of the deceased, such as royal burial sites, leaders' graves, common people's tombs, and so on. Urartian tomb structures share several common elements that allow for classification. Rock-cut tombs and underground burial chambers are widespread in the region. Consistent practices can be observed in both architectural forms and burial customs. Urartian multi-chamber tombs carved into rock formations follow a distinct developmental trajectory, reflecting the Urartians' expertise in rock-cut architecture. The most distinctive trait within citadels is the multi-chamber configuration, accessible via staircases. Monolithic structures and facades with platforms are more prevalent in the capital, with smaller versions likely built in rural areas by rulers connected to the central authority. Subterranean burial chambers represent the predominant burial type in Urartian territories, typically categorized as either stone-built or rock-cut. Stone-built chambers usually consist of a single rectangular room constructed with stone walls below the surface, whereas rock-cut tombs more frequently feature multi-chamber layouts. Specifically, some graves in Altıntepe, serving as the capital's burial ground, showcase scaled-down renditions of multi-chamber arrangements and underground rock-cut tombs. Urartian funerary customs are most distinctly evident through subterranean burial chambers. Excavated graves have yielded numerous artifacts, demonstrating how the Urartians honored their deceased. Multiple interments have been uncovered in these burial sites, with inhumation burials often placed in a fetal position. Certain graves also contain cremation burials. An array of jewelry and pottery was interred in the chambers as grave offerings; these artifacts serve as crucial dating evidence for such tombs, although attempts to date them solely based on specific artifact sets have been debated, emphasizing the importance of considering the entirety of the finds and their condition (Konyar, 2021: 205–207).

In Iran, there are notable archaeological sites that feature tombs with distinct architectural elements. At Ismail Aqa fortifications, two rock-cut tombs have been identified, each consisting of a structured room and its surrounding spatial context (Kleiss & Kroll, 1977). Additionally, there are two rock-cut tombs in Chehriq, near Selmas, as documented by Kleiss in 1980 (Kleiss, 1980: 40 Abb. 212). These tombs at Chehriq are characterized by a layout of three rooms, comprising a central room and two adjoining chambers (Kleiss, 1968). Furthermore, Hodar Castle also contains two tombs, described by Kleiss in 1974, situated close to Urmia (Kleiss, 1974). These tombs are intricately designed with two interconnected chambers featuring niches along their perimeters (Kargar, 1368). Moving south

to Urmia, the site of Seduk harbors a pair of tombs, one atop the other, within the rocky terrain (Shojadel & Khanmohammadi, 2013; Kargar, 1989). Another notable tomb worth mentioning is the rock-hewn sepulcher at Delik Dash in Chaldaran, characterized by an entryway leading into a rectangular chamber (Shojadel & Khanmohammadi, 2013). Moreover, a Shedi rock-cut tomb lies adjacent to one of the largest Urartian settlements near the Araxes River (Kroll, 2004). The accidental discovery of Sheikh Selo's tomb in northwest Iran, near the border with Turkey, provides new evidence for Urartian burials, at least in Iran (Binandeh and Karegar, 2023a). In Urartian territory, simple burials constructed as dugouts within the earth, often composed of rubble and stone casings, are prevalent. These burial practices, sometimes accompanied by offerings, are exemplified at sites like Sangar (Binandeh & Kargar, 2023b).

Given the various burial types found in the land of Urartu, particularly in the northwestern region of Iran, and considering their structural characteristics, architectural elements, and the artifacts discovered within them, a pertinent question arises: To which period do these burials belong, and can they be linked to the Urartians? To address this inquiry, we first constructed a detailed map of the burial site and compiled comprehensive architectural details of the tomb. We then examined the existing artifacts, along with preliminary descriptions of any missing items as recounted by witnesses. This data was subsequently compared with similar burial structures and artifacts from surrounding areas to draw meaningful connections.

Chamber Tomb of Khāneqāh

The serendipitous discovery of the Khāneqāh Chamber Tomb near the Iran-Turkey border offers compelling evidence of Urartian burial practices to the west of Lake Urmia. Located in the northwestern foothills of Iran, Khāneqāh Village lies approximately 35 km west of Urmia city and close to the Turkish border. In 2000, while villagers were preparing to construct a mosque, they inadvertently uncovered a stone structure that was later recognized as an Urartian tomb. Regrettably, by the time we arrived at the site, a significant portion of the artifacts within the tomb had already been looted.

Architecture

Today, the chamber tomb in question is situated beneath the village mosque, a unique circumstance that highlights both the historical significance of the site and its integration into the local community. The village itself is nestled

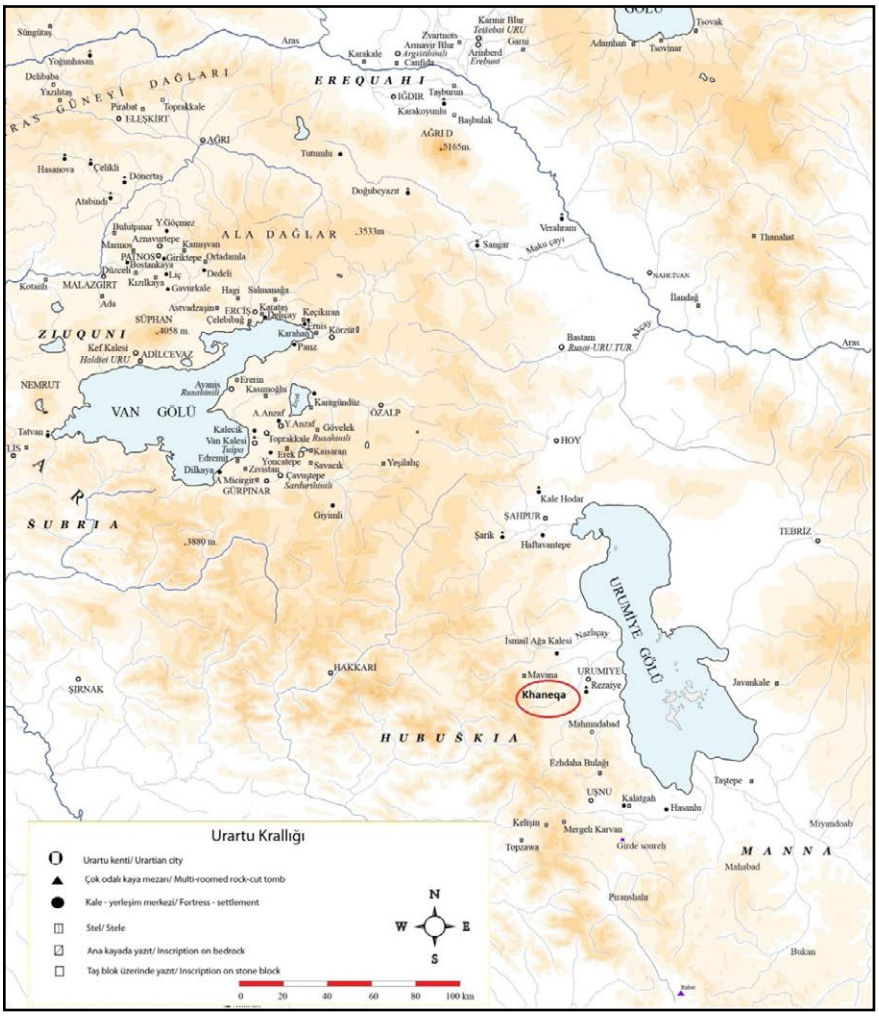
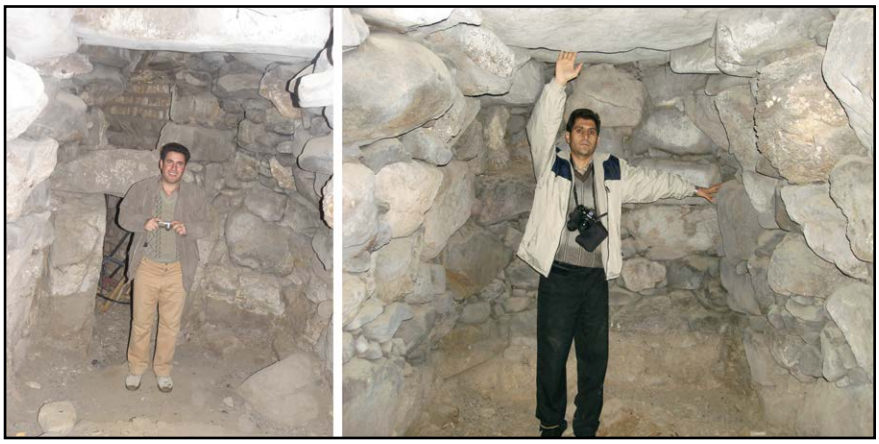
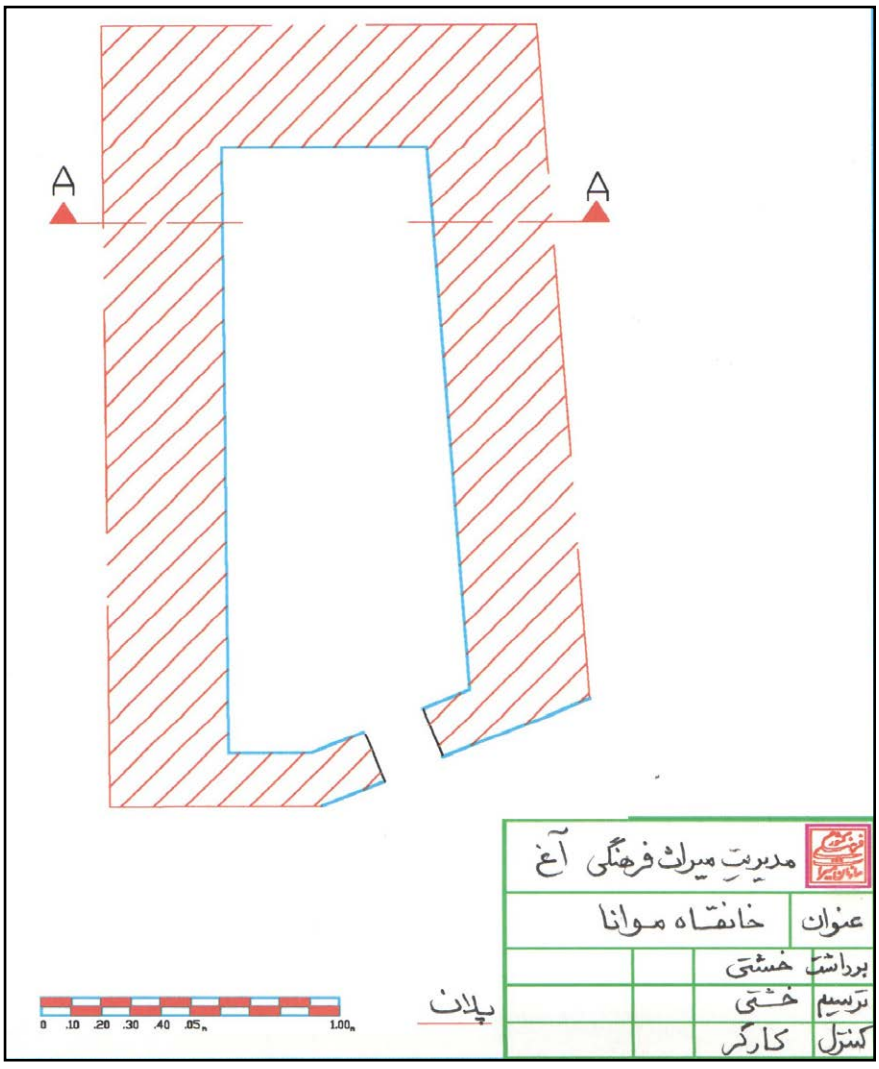


Fig. 1: Location of Khāneqāh Chamber Tomb and Urartian sites (base map Köroğlu, 2011). ▶

in the foothills of the surrounding region, providing a picturesque backdrop to this remarkable archaeological find. The chamber tomb was uncovered during the construction of the village mosque, revealing a fascinating glimpse into the burial practices of the Urartians. It is oriented in a north-south direction, a detail that may hold cultural or spiritual significance. The tomb was constructed within a pit excavated into the earth, showcasing the building techniques of its time. The primary materials used were unworked limestone and sandstone blocks, predominantly rectangular or square in shape (Fig. 2). This choice of local stone reflects the availability of resources in the region and demonstrates an understanding of the materials that would endure over time. The dimensions of the chamber tomb are striking: it measures approximately five meters in length, with a width of 120 centimeters at one end and 180 centimeters at the entrance. Its height reaches up to 180 centimeters from the inside, providing enough space for an individual to enter comfortably (Fig. 3). The design elements of this



◀ Fig. 2. The local stone blocks used at Khāneqāh Chamber Tomb (Authors, 2024).



◀ Fig. 3. The plan of the chamber tomb (B. Kheshti, 2000).

tomb, as depicted in accompanying figures, reveal a robust and practical approach to burial construction. The structural integrity of the chamber tomb is noteworthy. The side walls consist of large, irregularly shaped stone

slabs, which are filled with smaller stones to reinforce the overall stability of the structure. The thickness of the longitudinal walls measures about 50 centimeters, indicating a strong foundation. Remarkably, these walls are dry laid, meaning they were constructed without the use of mortar, a technique that illustrates the skill of the builders in ensuring that the stones fit securely together.

Access to the tomb is provided through an entrance located in the southeastern part. The design of the entrance is quite intriguing; the wider side of this section is almost sloping, creating a natural transition into the tomb. The entryway itself is relatively narrow, measuring less than 50 centimeters in width. Flanking the entrance are two vertical, smooth stone slabs, each approximately 100 centimeters high and 50 centimeters wide, which serve as sturdy markers of the entrance. Above these vertical slabs lies a horizontal stone slab that is 35 centimeters thick, adding another layer of structural support. To complete the entrance, several large stones have been laid atop the structure, extending all the way to the roof, which further reinforces the chamber (Fig. 4).

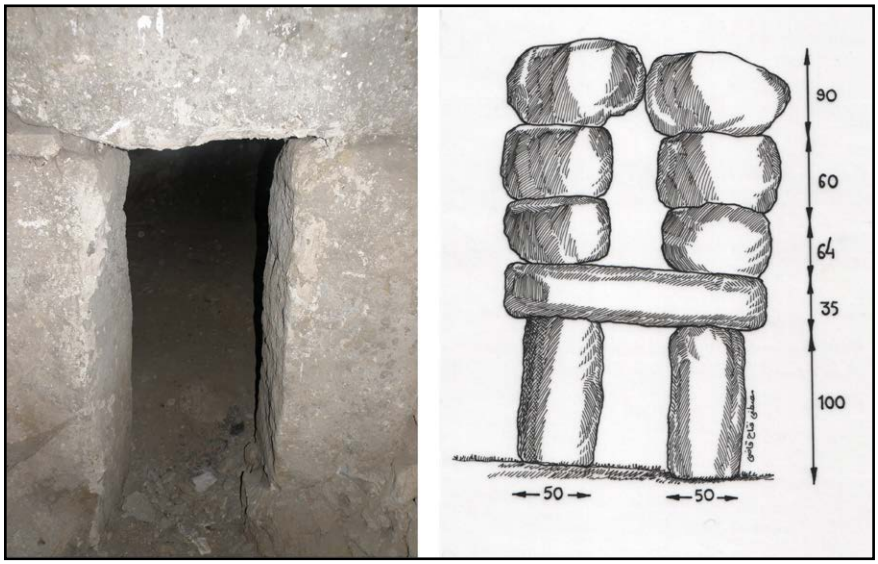


Fig. 4. The entrance of the chamber tomb (Authors, 2024). ▶

The tomb is capped with six large stone slabs that are nearly uniform in size, each extending up to 220 centimeters in length (Fig. 5). This uniformity suggests a deliberate selection of stones for the purpose of creating a stable roof, protecting the interior from the elements while also providing security for the objects within. Among the distinct features of the tomb is a niche that, at first glance, may not seem to be a niche at all. However, upon closer inspection, it becomes apparent that the space above the entrance likely served as a niche, which may have held significant artifacts or offerings. This feature adds an element of intrigue to the tomb, as it raises questions

◄ Fig. 5: Large stone slabs covering the tomb's roof, viewed from the interior (Authors, 2024).

about the burial customs and the practice of the Urartian people. The presence of such a niche could indicate a place for the display of items of personal or ritual importance. Most likely, the space above the entrance is a niche. In Early Iron Age and Urartian chamber tombs although rare in the former niches were often constructed in the long side walls (Kuvanç et al., 2016: 153). To avoid placing excessive weight on the stone above the door, this space was designed as a niche, a common architectural technique. As the exterior of the tomb is currently inaccessible and not visible, it is not feasible to definitively ascertain the presence of a dromos, a feature commonly found in other tombs of a similar nature.

Burial

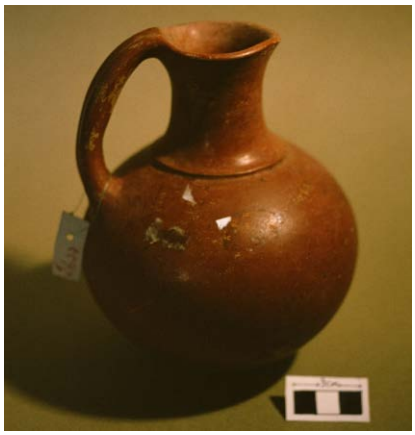
Prior to the notification and arrival of the cultural heritage office personnel, a substantial portion of the grave's contents had been looted. Within the tomb, various human bones, such as skulls, femur and hand bones, were found scattered on the floor (Fig. 6). The precise original positioning of these bones could not be conclusively determined. As a result, the burial status of one or more individuals within the tomb remains undetermined.

Finds

During the visit to the tomb, most of the objects inside had already been looted. Inside the tomb, pieces of human bones, including skulls and hand bones, were scattered across different areas. The most significant type of pottery that was recovered was a trefoil jug (Fig. 7). This Jug is with

Fig. 6. Human remains on the surface of Khāneqāh Chamber Tomb site (Authors, 2024). ▶

a trefoil rim, round body and flat base, has an embossed band under its neck and has a handle. Wheel-made, light red fabric with a dark red slip, brightly burnished and well-fired, it does not have any decoration. This proves that trefoil jugs were also inspired by metal pieces. The same forms could be found among the metal samples, especially those made of bronze (Binandeh & Kargar, 2023). Find conditions and Urartian reliefs show that such jugs were used for carrying and pouring water, as burial gifts and urns in graveyards, and as votive offerings (Emre, 1969: 283). Samples of this type were reported in many Urartian sites (San, 2005).



▲ Fig. 7. Red burnished Trefoil jug from the chamber tomb (Authors, 2024).

Discussion

The architectural features of chamber tombs from the Early Iron Age and the Urartian era reveal significant insights into their construction techniques and cultural significance. One notable aspect is the niche located above the entrance of these tombs. Although niches are relatively rare in Early Iron Age examples, they are a hallmark of Urartian burial architecture. These niches, typically placed in the long side walls, serve not only an aesthetic function but also a structural one. By distributing weight more evenly and alleviating pressure on the stones above the door, this design reflects a refined understanding of construction principles (Kuvanç *et al.*, 2016: 153). Such architectural choices underscore the importance of stability in the design of these enduring structures. However, it is crucial to note that the current inaccessibility of the tomb's exterior prevents us from verifying whether a dromos a sloped corridor that often

precedes the entrance of tombs exists in this case. Dromoi are common features in chamber tombs, serving both functional and symbolic roles by guiding the deceased into the afterlife. The lack of visibility means our comprehension is inherently limited, compelling researchers to rely on comparisons with other, more thoroughly documented tombs. Within the region of Iran, various chamber tombs resembling those found in monastic settings have been identified. For instance, the Ushno Tomb, while smaller than the Khāneqāh, exhibits structural similarities that suggest a shared architectural tradition. The artifacts found at Ushno indicate its association with the Iron Age, providing evidence for cultural continuity and evolution through time (Khanmohammadi, 2013). Similarly, the Lor Balajuq Tomb, located near Urmia, reflects dimensions and a structure comparable to the Khāneqāh. Unfortunately, due to looting, many artifacts that could provide further contextualization have been lost, obscuring the full narrative of this site. Dating back to the first millennium BC, the tomb's design presents challenges for archaeological interpretation, particularly concerning the socio-cultural practices of the time (Khanmohammadi & Sadraei, 2022).

Another key site in this discourse is the Bayazid Abad Tomb, which was discovered during road construction. This tomb has emerged as a comprehensive example of chamber tomb architecture, revealing significant similarities in both structure and size to the Khāneqāh. The diverse collection of artifacts recovered from Bayazid Abad enriches our understanding of the socio-economic contexts within which these tombs were constructed and utilized (Amelirad & Khanmohammadi, 2016). Underground chamber tombs are indeed the predominant form of burial architecture in Urartian territory. They can be classified into three distinct categories: underground stone-built tombs, rock-cut tombs, and hybrid variants that integrate both designs (Konyar, 2011: 218). While the absence of certain objects complicates dating efforts, the architectural styles and pottery discovered within these tombs provide crucial information. For instance, the striking resemblance of trefoil jugs found within these tombs to those from other Urartian sites suggests not only a shared material culture but potentially similar funerary practices across the region. Furthermore, the architectural and structural designs of these tombs align closely with those from the Lake Van area, which has been documented in previous studies (Konyar, 2011; Kuvanç *et al.,* 2016). Given that this region was a core part of the Urartian heartland, it stands to reason that these tombs are integral to our understanding of Urartian identity and burial practices. With each archaeological finding, we further unravel the complexities of past

civilizations, revealing how architecture and artifacts together narrate the stories of those who once inhabited the land.

Conclusion

The territory under Urartian rule was extensive, encompassing various ethnic groups - a diversity reflected in burial traditions. The variation in funerary practices, or the coexistence of different customs within a single region, indicates the population's ethnic and social diversity (Konyar, 2011). The excavations of Karagündüz, Dilkaya, Ernis-Evditepe and Höyüks have presented considerable evidence. These necropoles consisted primarily of chamber tombs containing collective burials and grave goods such as pottery and metal weapons. They are highly significant for understanding the socio-political structures and transformations during the formation process of the Urartian state (Işikli, 2021: 85). From the beginning of Urartu's formation, the Lake Urmia basin - particularly its western sector - held great significance, as evidenced by the construction of numerous fortresses of varying sizes. The Ismail Aqa fortress and several other Urartian fortresses, located near Khāneqāh, served to administer and control the region. Burial traditions in the land of Urartu have been very diverse. Unfortunately, looting and the destruction of tombs at the time of their discovery have resulted in only fragmentary artifacts being recovered, leaving us without information regarding the precise positioning of skeletal remains and associated objects. These types of tombs span an extensive chronological period and became increasingly common beginning in the Bronze Age. The architectural structure and material assemblage of the Khāneqāh Tomb are entirely consistent with Urartian style, dating to the 7th century BC, with the deceased individual most likely belonging to Urartu's local elite class. As archaeological investigations continue, the site maintains significant potential for further discoveries that promise to provide deeper insights into Urartian cultural practices and societal organization.

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Observation Contribution

This research is based on the fieldwork of Ebrahim Kharazi, who explored and collected materials. Ali Binandeh supervised the findings and prepared the original draft

Conflict of Interest

The Authors, while observing publication ethics in referencing, declare the absence of conflict of interest.

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آرامگاه اورارتویی خانقاه

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چکیده

پادشاهی اورارتو به‌مدت بیش از دو قرن بر قلمرو وسیعی حکم‌رانی می‌کرد. این دولت جایگا خود را به‌عنوان یکی از قدرت‌های اصلی عصر آهن تثبیت کرد و وسعت سرزمینی خود را گسترش داد که قسمت‌های وسیعی از شمال‌غرب ایران، آناتولی و ارمنستان و بخش کوچکی از کردستان عراق کنونی را دربر می‌گرفت. در این بین، انواع مختلفی از تدفین در سرزمین اورارتو گزارش شده که بیشتر براساس نوع، شیوهٔ ساخت، معماری و مصالح به‌کار رفته و اندازهٔ آن‌ها دسته‌بندی می‌شود؛ بر این‌اساس، جایگاه اجتماعی متوفی نیز مشخص می‌شود. مقبره‌های صخره‌ای و اتاقک‌های زیرزمینی با معماری خاص نیز از انواع سنت‌های رایج تدفین در این دوره است که در شمال‌غرب ایران نیز نمونه‌های متنوعی از این نوع گزارش شده است. «مقبرهٔ خانقاه» در روستای به‌همین نام، نزدیکی ارومیه، به‌طور اتفاقی و حین انجام فعالیت عمرانی مربوط به ساخت مسجد کشف شد. ابعاد مقبره قابل‌توجه است، طول آن حدود ۵ متر و عرض آن در یک‌طرف ۱۲۰ سانتی‌متر و در سوی دیگر ۱۸۰ سانتی‌متر و ارتفاع آن از درون تا سقف به ۱۸۰ سانتی‌متر می‌رسد. متأسفانه، به‌دلیل جابه‌جایی و آسیب‌های انسانی، نوع و تعداد دقیق تدفین‌ها در این مقبره نامشخص است و اکثر گورنهاده‌ها و اشیاء ارزشمند آن در دسترس نیست؛ با این‌حال، معدود قطعات سفالی به‌دست آمده از نمونه‌های شاخص سفالگری دورهٔ اورارتو به‌شمار می‌روند. داده‌های این پژوهش عمدتاً از طریق فعالیت‌های میدانی و رویکرد کیفی جمع‌آوری شد. این فعالیت‌ها شامل بازدید از: محل، کاوش اضطراری و جمع‌آوری دقیق یافته‌ها (هم در بستر اصلی و هم در نمونه‌های جابه‌جا شده) بود. مهم‌ترین پرسش‌ها و فرضیه‌های متناظر با آن در پژوهش حاضر عبارتند از: ۱. مقبرهٔ خانقاه مربوط به چه بازهٔ زمانی است؟ و ۲. این نوع سنت تدفین گورنهاده‌ها مربوط به چه طبقهٔ اجتماعی است؟از نظر ساختاری، این مقبره شباهت‌های قابل‌توجهی با مقبره‌های لور بالاجوق و بایزیدآباد در حوضهٔ دریاچهٔ ارومیه دارد که همگی به عصر آهن تعلق دارند و نشان از گسترش این نوع تدفین دارند؛ هرچند کمبود یافته‌ها، تاریخ‌گذاری دقیق را دشوار کرده، اما سفال‌ها و ویژگی‌های معماری خانقاه با مقبره‌های اورارتویی ایران و حوضهٔ دریاچهٔ وان مشابه است. معماری مقبره، اشیاء مرتبط و موقعیت آن نشان می‌دهد که احتمالاً این مقبره به یک نخبهٔ محلی اورارتویی تعلق داشته و تنوع سنت‌های تدفین در قلمرو این پادشاهی را به‌نمایش می‌گذارد.

کلیدواژگان: اورارتو، مقبره، ارومیه، خانقاه.

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The Sasanian Architecture at Lalar on the Seymareh River (Central Zagros)

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Abstract

Spanning an estimated 15 hectares, Lalar is an archaeological site positioned on the western bank of the Seymareh River and halfway between Tang-e Cham Qole and Tang-e Kafarin. The outcomes of the excavation carried out at the site, with a specific focus on around 537 square meters of its central portion, demonstrated the existence of an ephemeral occupation level that was established and absconded shortly after its formation. The exposed architecture is characterized by gypsum-mortared limestone masonry. Apart from a general introduction of the site and a functional and chronological appraisal of the recovered historical contexts at Lalar in light of archaeological evidence and historical sources, the central aims of this research endeavor involve gaining a comprehensive understanding of the various factors that influenced the development of the site located on a riverbank surrounded by mountains and isolated from the main regional routes and natural passes. Furthermore, the study seeks to assess the construction quality of the excavated structures and their connections with architectural elements found in coeval sites within the region. In total, the characteristics of the discovered cultural material and the evaluation of the regional ecological and geographical features indicated close stylistic correspondence in both small finds (particularly the late Sasanian pottery) and architecture between Lalar and other centers dating to the late Sasanian until 9th century AD. In addition, Lalar's architecture attests to a purely functional style absolutely lacking in any sort of decorations; a discrete, evanescent but massive constructional level presumably without any precedent or succedent. One may link Lalar to the end of the Sasanian period, which was marred by political instability caused by the failures of the ruling dynasty and the incursion of Muslim Arabs from the west. This resulted in the abandonment of once-thriving cities and the resettlement of populations in remote regions, as part of military restructuring in preparation for impending battles. Yet, the dynasty's eventual downfall and the dominance of the Muslim invaders would lead to the desertion of such settlements (or perhaps temporary barracks). This paper draws on the data from fresh excavations.

Keywords: Central Zagros, Seymareh River, Sasanian Architecture, Lalar.

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Introduction

The last decade saw a series of investigations in the catchment area of the Seymareh Dam. While the plains on the Great Khorasan Road in Central Zagros have long been the focus of archaeological work (see: Alden, 1982), the Seymareh region, lying in southwestern Central Zagros far away from this trunk highway, has received less attention. The Great Khorasan Road linked Mesopotamia and the Iranian plateau. The Seymareh River and this ancient highway thus represented the foremost factors determining the settlement patterns all through history in this part of western Iran, and the regional population benefitted from their proximity to the highway, for instance in the exchange of products and the transfer of culture (Levine & Young, 1986 :15; see also: Henrickson, 1983: 33). This strategic feature of the intermountain valleys of western Iran, especially during the mid- and late Sasanian period when the political power was centered in Mesopotamia, heightened the importance of the triple route system of Susa, Central Zagros and Diyala. In a general perspective, the late Sasanian settlements in western Iran are more abundant than those from any other era in this particular area. The mountainous plains of western Iran held a significant status, particularly during the Sasanian era, as they were among the most densely inhabited areas in Iran. This is supported by mentions of the thriving and densely populated city of Seymareh in this region by Le Strange (1985) and Ibn Hawqal (1966). Expanding on this historical background, this paper will analyze the vast archaeological site of Lalar, identified as dating back to the Sasanian period through surface evidence in the Iranian National Heritage Register, focusing on its function and the factors contributing for its establishment.

The main objectives involve the exploration and determination of the date of the remains, the creation of architectural plans, and the assessment of Lalar's function, role, and position in the Seymareh valley, along with its cultural ties with neighboring sites. Any analysis concerning the emergence of different architectural styles and the appropriate choice of materials requires an investigation into architecture within its local contexts.

Research Questions and Assumptions: The primary inquiry pertains to the cause behind the emergence of a sizable, single-phase site spanning over 15 hectares within a limited area devoid of access or linkage to the main regional roads. The second question deals with the chronological attribution of this peculiar architectural structure in terms of construction techniques and technical details. By seeking answers to these questions, insights into clearer assumptions may be derived through

the influence of local environmental factors. The technical similarity to the contemporary architectural structures is mainly from two perspectives, viz. the application of fieldstone masonry set in gypsum mortar and the evident rushing on the construction. These features technically link the structures excavated at Lalar to such renowned structures as Khosrow Palace, Chahār Qāpi Fire Temple and several other monuments attributed to the Sasanian period in western Iran. Yet, it shows an obvious departure from the royal and monumental Sasanian architecture in Ctesiphon, where the focus lay on extroversion and the use of multifarious original architectural adjuncts and embellishments. Accordingly, to answer the first question, one could assume that a kind of urgency and haste following the abrupt events was the main factor in setting up such a sizable settlement site forthwith. There exist three hypothetical indications that the settlement at Lalar was transitory: 1) Low levels of environmental carrying capacity; 2) Inaccessibility to regional communication lines and being surrounded by an impassable landscape; 3) Lack of evidence for any occupational levels either preceding or succeeding this vast settlement in the currently excavated exposures, implying that the site was destined for an immediate relinquishment shortly after its establishment.

The second hypothesis is developed by examining the technical aspects of the architectural context and archaeological artifacts, particularly pottery. This analysis reveals a correlation between the overall dataset from Lalar and the structures that belong to the period of transition from the end of the Sasanian era to the early Islamic period. Therefore, a date of the 7 to 8th centuries AD is proposed for this settlement site.

Research Methods: This paper draws on the new data from the excavation of the archaeological site of Lalar complemented with the insights provided by historical written sources to investigate the political and social developments that brought about population displacements. The research method employed is primarily descriptive/analytical in nature.

History of Research

Archaeological inquiry in western Iran tracks its history back to the pioneering works by foreign nationals and teams in the 1940. Schmidt's surveys, excavations and aerial photography largely instantiated the archaeological and historical relevance of the region (Schmidt, 1940). Also notable was the coeval fieldwork in the Central Zagros plains by Sir Aurel Stein (Stein, 1940). But it is Braidwood's prehistoric project in western Iran that is credited with the foremost, focused and seminal

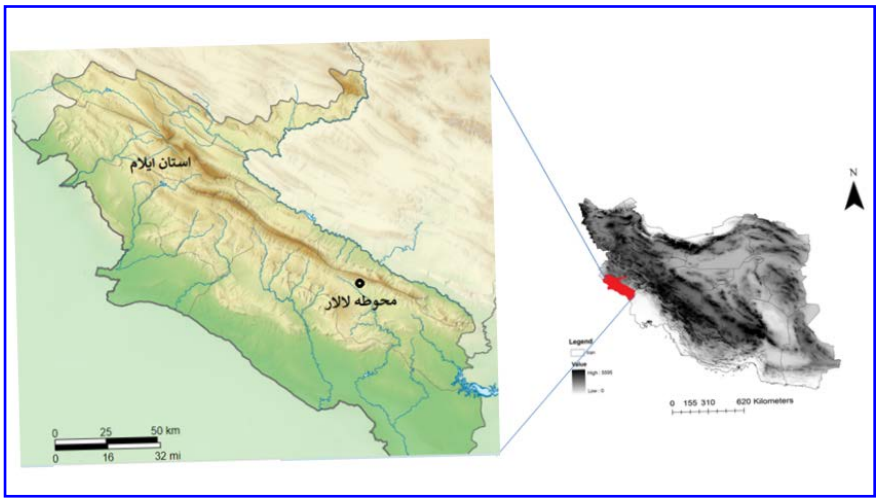
work that produced tremendous results (Braidwood, 1961). The students of the Braidwood school would then embark on meticulous studies on the archaeology of Dehluran and the Khorram Abad valley, using the same approach in interpreting the region's history. Then followed the Mahidasht plain investigations by the Royal Ontario Museum expedition led by Cuyler Young Jr. and Levin, who recorded and excavated multiple sites (for the results of these investigations see: Henrickson, 1983; 1985; Levine & McDonald, 1977). The western and southern swathes of the Central Zagros were mainly explored by Belgian and Danish expeditions, notably including the surveys and excavations by Meldgaard and Mortensen in the Holeylan valley of the Seymareh basin (Melgaard et al., 1964; Mortensen, 1975). In Addition, vanden Berghe led a Belgian team that investigated almost the entire valleys around the Seymareh basin during over a long period exceeding 17 years (Haerinck, 1989). Following their visit to the ruins of Seymareh (modern Darreh Shahr), Stark and Rawlinson ascribed the site a Sasanian date (Stark, 1990), a view also reiterated by Stein, who went further to propose a possible existence of some Parthian evidence at the site (Stein, 1940). It was not until 2009 that the excavation at Lalar took place, focusing on the central mound that exhibited visible architectural features on the surface. This excavation involved the opening of four trenches, collectively covering an area of 537 m^2 (Motarjem, 2015) before the water reservoir gradually submerged the whole site. Several ongoing excavations in the basin came to an abrupt end in 2012 following the submersion of the sites, among them being Qaleh Guri (Hasanpour, 2015; 2016), Qaleh Seyrom-Shah (Mohamadifar, 2015), Gandomzar (Sharifi, 2015), Rueh (Niakan, 2019) and Cham Routeh (Sharifi, 2020; 2022).

Historical Geography of Seymareh

Throughout history, the Seymareh valley has enticed various human societies owing to its natural, social, and economic appeal, as well as its strategic placement between the Kabir Kuh mountains and the Seymareh River. Kabir Kuh has formed two separate geographic zones in western Iran, namely Pish-e Kuh and Posht-e Kuh. Geographers and travel writers have often referred to Posht-e Kuh as the province of Masabadan and Pish-e Kuh as the province of Mihrajanqadhaq, mentioning Sirvan (Shirvan) and Seymareh as their capitals, respectively. Many historians have described Seymareh as a thriving city with its buildings mostly made of gypsum and stone (Ibn-e Hoghal, 1966; Ibn Khordadbeh, 1991; Istakhri, 2009). Al-Maqdisi refers to a fortress of Hormuzan, the region's last Sasanian

ruler, in Seymareh (Maghdisi, 1982). Hamdallah Mustawfi puts that to the west of Little Luristan (Lor-e Kuchek), bordering Arab Iraq, lie the two provinces of Masabadan and Mihrajanqadhaq. Ibn Hawqal reports Sirvan as a small town consisting of structures mostly constructed with gypsum and stone (Le Strange, 1990). Al-Buldan includes references to the provinces of Masabadan and Mihrajanqadhaq, and Seymareh (Yaghoubi, 1964). Seymareh is mentioned in Abu Dulaf's travelogue as a city known for its exceptional beauty (Abu Dulaf, 1963), and it is also documented in Āthār al-Bilād by Qazvini. All these textual evidence speak of the clustering of the population centers along the Seymareh valley. Under the reign of Yazdegerd III, when the Arabs attacked Iran from the west, the regions of Ilam, Luristan and Khuzestan were ruled by one of the seven Persian governors, named Hormuzan. The conquest of Ctesiphon as the political center in the second caliph's reign marked the downfall of the Sasanian empire, putting large parts of Iranian regions under the Arab rule. It was then that Hormuzan designated Seymareh as his seat of government and built there a fortress in preparation for facing the Muslim army. Subsequent events however proved that this preparation was far from being much effective. On the other hand, Rawlinson maintained that the strong fortress perching on the mountains east of Ctesiphon, to which Khosrow II sent his harem during the Roman Heraclius's attack of Ctesiphon, lay in Seymareh (Rawlinson, 1984). An abundance of coeval buildings and coins of Khosrow II discovered in the Seymareh Valley by de Morgan in the opening years of the 20th century which corroborates Rawlinson's claim (Hasanpour, 2015).

The opinions of historians are split regarding the incursion of Arabs into this particular region, as some argue that the Muslim army, commanded by Abu Muslim, clashed with the locals of Masabadan and Seymareh, resulting in casualties on both sides. Dinawari cites Khuzestan as the direction from which the Muslim attack and conquest of Seymareh occurred (Dinawari, 1888). Despite the extensive damage inflicted upon the city during the invasion, it would eventually undergo a revival in prosperity during the early Islamic periods, echoing its previous success in the Sasanian era. Regrettably, this resurgence was abruptly halted by a catastrophic earthquake that resulted in the complete devastation of the city and its neighboring towns and villages. The earthquake, dated by Ibn al-Athir, Hamza al-Isfahani, and al-Tabari to 258 AH/871 AD, was a tragic event. Al-Masoudi also reports a seismic incident in Seymareh as taking place in 334 AH/945 AD and razing the city to the ground (Masoudi, 2002).



◀**Fig. 1: The map of Iran shows the precise location of Lalar within Ilam Province (Google Maps).**

Topography of Lalar

Lalar is situated at coordinates N 33°21.19'64" & E 47°04'21.02", with an elevation of 669m above sea level on the western bank of the Seymareh. The site is characterized by a series of prominent mounds arranged in a northwest-southeast orientation. The riverbed runs along the entire eastern side of the site. Geomorphologically, Lalar is composed of alluvial deposits formed by the periodic flood events of the Seymareh, upon which the structures were built. Currently, the surface of the site is covered with rubble of various sizes, with scattered remnants of walls and architectural features visible. The construction materials used in these structures include rubble held together by gypsum mortar. Lalar encompasses an area exceeding 15 hectares.

◀**Fig. 2: General view of the alluvial valley of the Seymareh River in Lalar, view from west (by: A. Motarjem, 2010).**

Fig. 3: The map of Iran shows the precise location of Lalar within Ilam Province (by: A. Motarjem, 2010). ▶

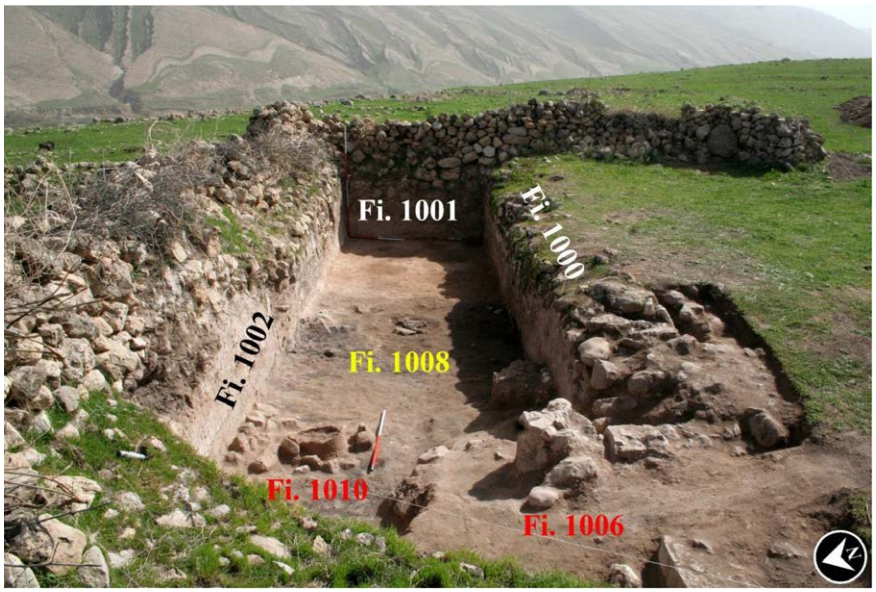
Excavation and Recording Methods

Given the special conditions surrounding rescue excavations, the trenches were placed in the center of the site at the points where architectural remains were readily visible. To enable locating the architectural finds on the map, the four trenches, each measuring 10×10 m were exactly opened along the north and south directions. At an average depth of 135 cm from the starting point of excavation in the central trench, the first architectural space was encountered consisting of a long hall with a width of 4.19 m. The floor of the room was formed of a layer of soft sand and clay.

Architectural Description

S.01

Lalar's single-period architecture represents a vast horizontal and concomitant occupation (Fig. 4). As the first discovered space, S.01 was a rectangular room longitudinally aligned east-west, measuring 16.74 m long and 4.19 m wide. All the walls, about 1.8 m thick, were formed from rubbles bonded together with gypsum mortar, while the floor consisted of a thick deposit of beaten earth and sand. On the floor were recovered remains of ash and charcoal. The walls survived at a maximal height of 1.7 m. Inside S.01, three storage jars were set into the floor (Figs. 5–6). Two piers of rubbles and gypsum mortar each measuring 0.68 m identified against the south wall might have been later additions to help strengthen the roof beams (Fig. 7). The entrance to the room lay on the northwest and connected S.01 to a corridor or room called S.07. Also, in the middle of the northern wall of the room, a niche 1.18 m long and 0.6 m wide existed within the wall, though its upper part was missing.



◀Fig. 4: General view of S.01, view from the southwest (by: A. Motarjem, 2010).

◀Fig. 5: Storage jars set into the floor of S.01, view from the north (by: A. Motarjem, 2010).

◀Fig. 6: Ground stone (bedder) and storage jars found on the floor of S.01 (by: A. Motarjem, 2010).

S.02

This square room of 12.22×8 m lay at the far end of the northwest side of S.01. The same masonry materials as the latter were employed. Part of the floor was recovered in the northwest corner. The structure was directly built on the virgin soil and lacked any footings. The walls were fairly regular and rectilinear, and the entrance faced south.

S.02 has been divided by a wall into two distinct sections: a square room and a porch-like area. The square room could be accessed through a 1.15 m doorway, while the porch had a wider entrance of 2.55 m that led

Fig. 7: Piers of rubbles and gypsum mortar discovered against the south wall in S.01, view from the east (by: A. Motarjem, 2010). ▶

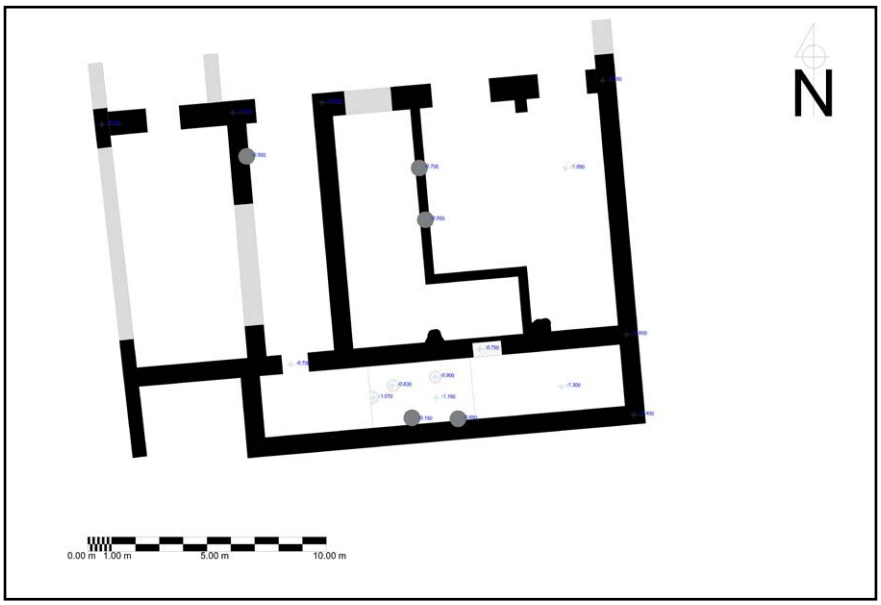


Fig. 8: Plan of S.01 and its lateral extensions (by: A. Motarjem, 2010). ▶

to the outside open area (see: Fig. 8). The walls of the structure are quite regular and form right angles. The square room measured 6.88 m on each side, resulting in a total area of approximately 48 m^2. Evidence of an oven was discovered on the floor, located 30 cm below the surface. The presence of debris between the main floor and the lower part of the oven strongly suggests that the room was reused after a period of abandonment (Figs. 9–10).

The walls' inner surfaces were entirely covered with gypsum, devoid of any embellishments. The floor, on the other hand, consisted of a compacted layer of earth and sand approximately 15 cm thick. In order to gain insight

into the stratigraphic sequence of preceding architectural periods, a 2×2 m area of the northwest corner was excavated to a greater depth as a sounding. Upon removal of the floor, it was revealed that the structure was built directly on undisturbed soil without any foundations, indicating that the historical activities at Lalar were confined to a single level. This construction method contrasts sharply with the prevailing architectural style of the time, suggesting that the site may have been initially established as a temporary shelter or in response to an imminent crisis, and remained untouched or unreconstructed even after abandonment (Fig. 11).

◀ **Fig. 9: Square room with cubic column bases, S.02 (by: A. Motarjem, 2010).**

◀ **Fig. 10: Remains of the oven built on the debris layer on the floor of the columned room, S.02. (by: A. Motarjem, 2010).**

Characteristics of Architectural and Pottery Finds from Lalar

The first season of excavation at Lalar cleared a total area of about 600

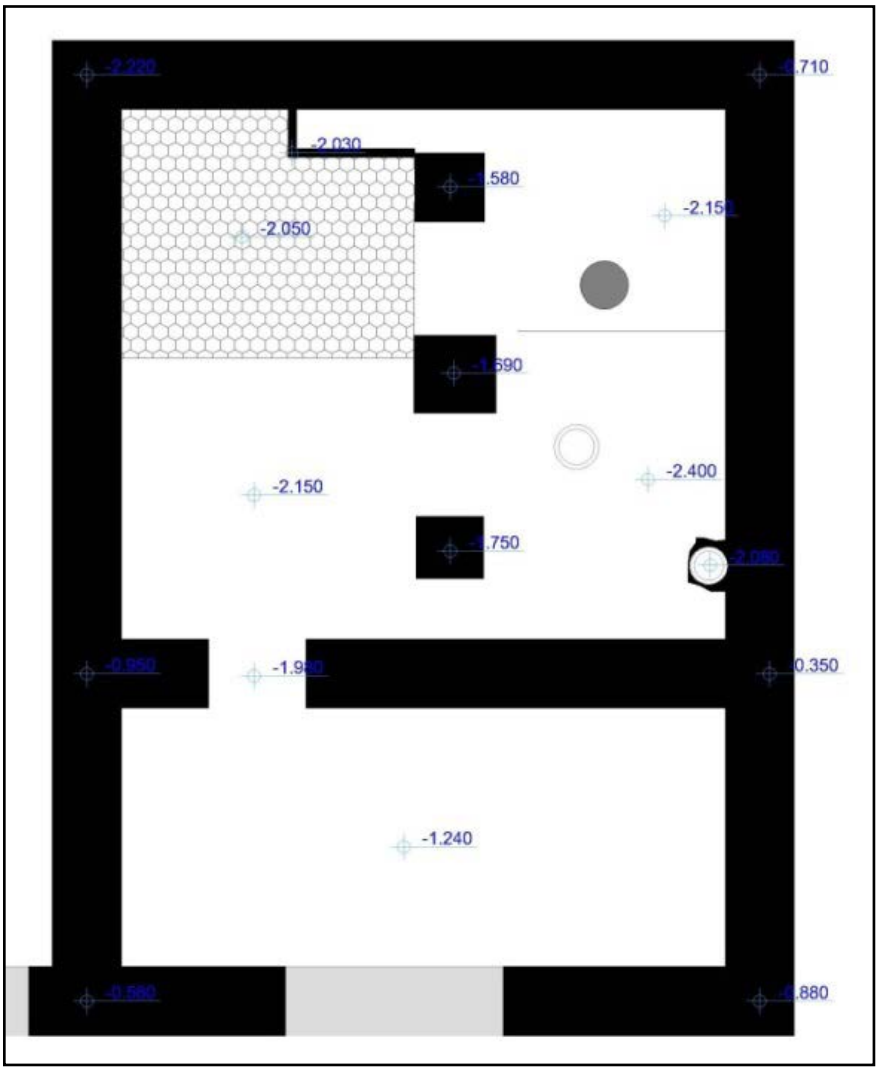
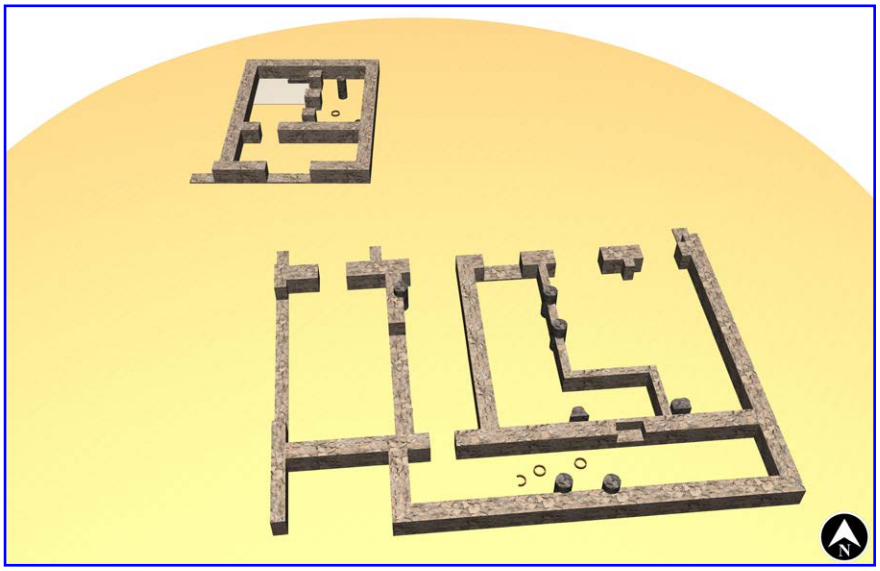


Fig. 11: Columned room, S.02 (drawing by: ©Bakhtiari). ▶

m² of a horizontal level that consisted of at least two separate structures (Fig. 12). Both structures identified at Lalar contained evidences of piers, and consisted of thick walls of rubbles held together with gypsum mortar. The most notable architectural feature is the use of columns, though unlike the formal architectural styles of the Sasanian and Islamic periods, the placement of the columns did not follow the geometric principles of space division, and even in S.02 the column bases were not installed exactly in the center of the room. This per se suggests an informal architecture by some inexperienced builders. Yet, it is noteworthy that the use of inconsistent columns made of stone and mortar is an established practice in the late Sasanian architectural tradition and has been reported from many complexes such as the structures attributed to Khosrow II in Qasr-e Shirin and at Takht-e Suleiman (Naumann, 1967: 71–76).



◀**Fig. 12: Isometric plan of the architectural remains discovered at Lalar (drawing by: ©Bakhtiari).**

Architectural Structures in the Seymareh Valley and Comparative Studies

Here an outline of the architectural features of a series of excavated buildings in the Seymareh valley will be presented, because the close geographic proximity and stylistic relations between the pertinent structures can help specify their function and date. Among the Sasanian buildings in Seymareh, only those at Cham Ruteh (Sharifi, 2020; 2022) and Lalar have been identified as residential structures, and the exposed architectural remains at Barzeh Ghaveleh, Qaleh Guri, and Rue are known as mansions. Apart from the applied building materials, other common features shared in all these buildings are the rectangular plan and rectilinear rooms, and niches with crescent arches within thick walls. It should be noted that while the cited features are not unique to this period, most of the architectural structures in the Seymareh valley have them in common.

I. Building materials: All the structures recovered in the valley were built with rubbles bounded together with plaster-saruj mortar, a fact also mentioned in historical sources. At least in the case of the Seymareh region, they were the most readily available local materials. Such masonry materials were used in many other Sasanian constructions such as Qaleh Dokhtar in Firuzabad, Fars Province (Huff, 1999: 635), Ctesiphon (Keall, 1987), Takht-e Suleiman (Naumann *et al.,* 1965: 66), Bisitun, as well as other buildings in the Seymareh region like Darr-e Shahr (Mihrajanqadhaq). Therefore, given the considerable temporal and spatial distances of these structures, one may conjecture that rubble and gypsum mortar went far beyond an indigenous style to become a general tradition in the Sasanian

architecture. Evidently, even in areas laying far from gypsum quarries, there was still a strong tendency for using this mortar in construction. A case in point is Kangavar where no gypsum deposits are present all over the plain. Such substantial amounts of gypsum were transported from nearby regions like Luristan to the construction site of the historical structure in Kangavar that centuries later the local people considered the site as a gypsum quarry (locally called "Gachkan" quarry), as it was the sole place in the entire region where they were able to procure gypsum from the ruins of the gypsum elements of the structure (see Table 1). This situation continued until Kambakhshfard started his excavation and restoration work in the region.

II. Column: Wide span structures like large halls and naves require columns for structural support, making them a technical necessity. The positioning of columns is based on the load distribution points of the roof, adhering to the principle of symmetry. In contrast, the columns found in the Lalar structure do not conform to this principle, as they are irregularly built with round cross-sections that are not complete circles, and one column even has a square cross-section. This unconventional design choice is characteristic of an unofficial architectural style, often attributed to amateur builders.

III. Flooring: At Lalar, the floors were typically constructed using a mixture of clay and sand with an average thickness of 15 cm. However, at Qaleh Guri, the flooring was created by layering beaten earth, cobblestone, and multiple layers of gypsum, with rubbles serving as an intermediate layer between two gypsum layers for added strength (Hasanpour, 2015). Additionally, at another site within the same region, Barzeh Ghavaleh, building floors were paved with rubbles set in gypsum mortar (Sharifi, 2015). These variations in flooring techniques once again distinguish Lalar from other sites in the Seymareh basin.

IV. Niche: At Lalar, remains of a niche were recovered in the north wall of S.01. This 1.19 m long and 0.6 m deep recess lay 0.75 m above the room's floor. The missing upper part was possibly in the form of a simple arch. Niches have been found at other regional excavations. In addition to Cham Ruteh (Sharifi, 2022), they have been reported from Barzeh Ghavaleh and Qaleh Guri (Hasanpour, 2015; 2016), Rueh (Niakan, 2019), Darr-e Shahr (Faryadian, 2009) and Sargandab (Mohammadifar, 2014: 285).

V. Gypsum: Gypsum was widely utilized as a construction material in ancient Iran. The earliest evidence of its use in architecture, glyptic art, and ritual skeleton restoration dates back to the Kebaran and Natufian cultures

(8500–10300 BC). By the Neolithic period, gypsum gradually gained more popularity across the Middle East (Kingery *et al.*, 1988). Beginning from the Neolithic Period of Hajji Firuz Tepe (Voigt, 1983), gypsum processing for architectural use persisted throughout the historical period in different extents given the mineral's accessibility for the locals in different regions. But apparently, the use of this mortar peaked during the Sasanian period. Gypsum use is attested in the Lalar architecture. At Barzeh Ghavaleh it served both functional and decorative purposes (Farhani, 2022: 242). The decorations were either molded or carved (Hasanpour, 2015: 265). All the walls in Sargandab in the Seymareh region, were covered with gypsum (Mohamadifar, 2015: 287).

Site	Entrances	Roofing	Niche	Dimensions
Rueh	Main entrance decorated with arches	Barrel vault	Half-dome and symmetric	360 x 270 (Niakan, 2019: 133)
Qaleh Guri	Entrances span: 155cm, 70cm	Barrel vault with oval arch, uncut rubbles, half-beaten and half-baked gypsum mortar	Cubic Niches in varying sizes with curved bodies	874 x 232 cm (Hasanpour, 2016: 41)
Lalar	Northwest side	Collapsed	Niche on northern wall, column of rubble and gypsum	475 x 255 cm (Motarjem, 2015)
Cham Ruteh	Entrances span: 70 cm, 90cm	flat	A small rectangular niche	West side 23 m; east side: external and internal ca. 107 and 22.29 m (Sharifi, 2022)
Darr-e Shahr	Southern side	Camber arch and application of gypsum molds, symmetric niches within walls	Several niches on the walls	500 m^2 (Faryadian, 2009)

◀ **Table 1: Characteristics of the newfound structures in the Seymareh valley (compiled by: Authors, 2021).**

Pottery

The excavation at Lalar revealed a significant horizontal extent, however, the pottery assemblage recovered was relatively sparse, possibly due to the unique or temporary nature of the occupation. The recovered pottery can be categorized into common and coarse types based on paste quality, with variations in exterior surface color including brick red, red, light brown, and buff. Various forms such as bowls, closed and open jars, and bases were identified within the assemblage. Technical features of the pottery are outlined as follows:

A. Pottery in red paste: Related pieces are often handmade. The body was not properly smoothed and shows variations in thickness in different parts. Firing was rather inadequate. In cases, decorative elements occur in the form of raised bands, rope appliques, applied pellets, and incised and applied motifs (Figs. 14, 15, 16).

▲ Fig. 13: Pottery from Lalar (A. Motarjem, 2021).

B. Friable, sand-tempered pottery in buff paste: These utilitarian pieces lack any sort of surface coating, polishing, or decorations.

Overall, the pottery evidence from Lalar is extremely limited. The required clay was procured from local resources. Thus, given the presence of gypsum and lime particles in the soil, the manufactured vessels are rather low in quality. Yet, in style and form, such as the short jars with rope appliques and handled long-necked jars, comparisons are attestable at other regional sites like Barz-e Ghabaleh and Seyrom Shah (Mohamadifar, 2015), Mihrajanqadhaq (Mazaheri, 2014) and Cham Routeh (Sharifi, 2022) (see: Table 2).

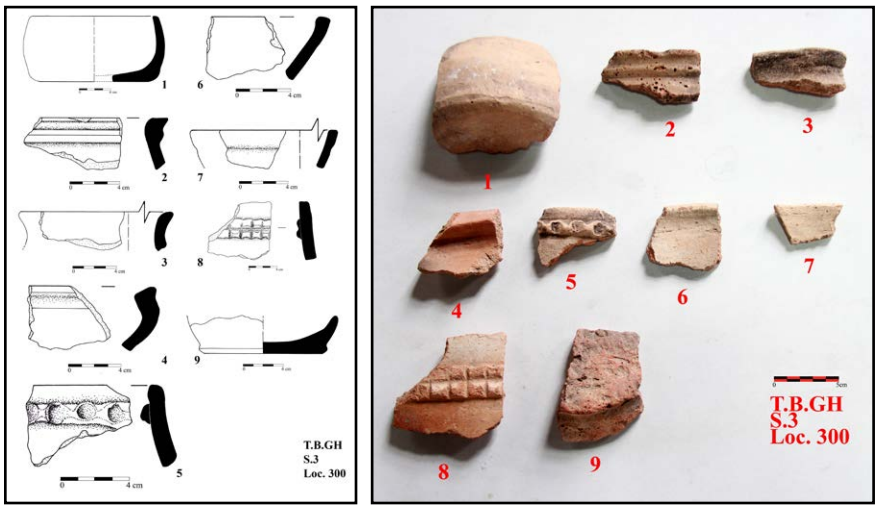


Fig. 14: Pottery from Lalar (A. Motarjem, 2021). ▶

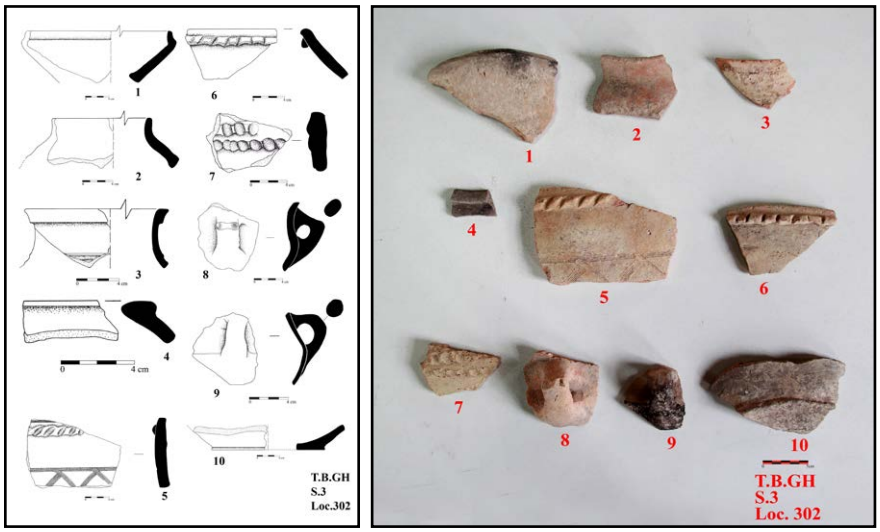
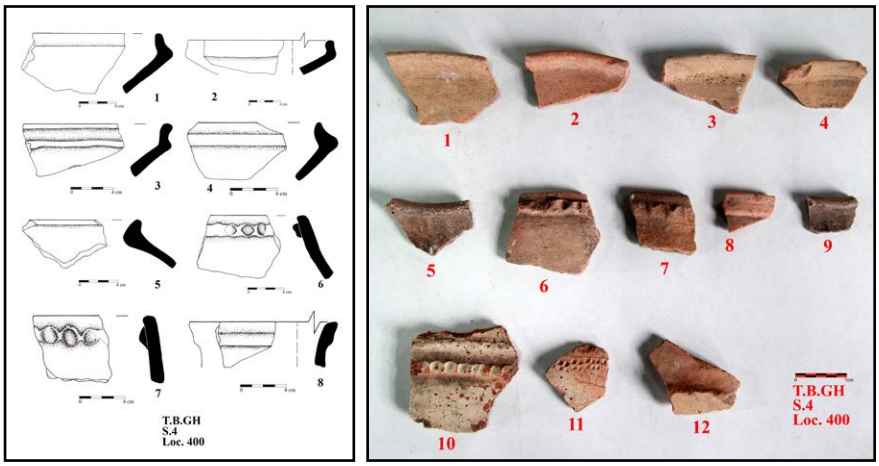


Fig. 15: Pottery from Lalar (A. Motarjem, 2021). ▶

Discussion

The Seymareh Basin is characterized by an elongated valley abundant in pastures situated between Pish-e Kuh and Posht-e Kuh (Zagarell, 2008: 21–22). The climate and geomorphology of the Zagros massif have



◄ **Fig. 16: Pottery from Lalar (A. Motarjem, 2021).**

◄ **Table 2: Specifications and comparative study of Lalar pottery (compiled by: Authors, 2021).**

No.	Form/fragment type, temper, firing, manufacture, exterior color, decoration	Relative dating
Fig. 10, no. 3	Rim, mineral, adequate, wheelmade, brown, plain	Qaleh Seyrom Shah Mohammadifar & Tahmasebi, 2014: 138, fig. 5
Fig. 10, no. 8	Body, mineral, adequate, wheelmade, light brown, rope applique	Cham Ruteh Sharifi, 2022: 167, fig. 17, no. 18
Fig. 10, no. 5	Storage jar, mineral, adequate, wheelmade, buff, rope applique	Cham Ruteh Sharifi, 2022: 167, fig. 17, no. 18
Fig. 10, no. 6	Open bowl, mineral, adequate, wheelmade, light buff, plain	Diyala and southern Mesopotamia Wells, 2015: 107, fig. 7af
Fig. 11, no. 1	Bowl with inverted rim, mineral, adequate, wheelmade, brown, plain	*Mihrajanqadhaq* Mazaheri *et al.*, 2014: 99, fig. 2, no. 11
Fig. 11, no. 3	Rim, mineral, adequate, wheelmade, buff, plain	Marv Priestman, 2009: 174, fig. 1
Fig. 11, nos. 5–7	Body, mineral, adequate, wheelmade, buff, rope applique	Qaleh Seyrom Shah Mohammadifar & Tahmasebi, 2014: 147, fig. 35
Fig. 12, no. 6	Rim, mineral, adequate, wheelmade, red, rope applique	Qaleh Seyrom Shah Mohammadifar & Tahmasebi, 2014: 147, fig. 35
Fig. 12, no. 7	Rim, mineral, adequate, wheelmade, red, rope applique	Mihrajanqadhaq Mazaheri *et al.*, 2014: 99, fig. 2, no. 10
Fig. 12, no. 10	Body, mineral, inadequate, wheelmade, red, rope applique	Mihrajanqadhaq Mazaheri et al. 2014: 99, fig. 1, no. 7
Fig. 12, no. 11	Body, mineral, inadequate, wheelmade, red, incised	Mihrajanqadhaq Mazaheri *et al.*, 2014: 99, fig. 1, no. 6
Fig. 12, no. 9	Rim, mineral, adequate, wheelmade, brown, plain	Qaleh Seyrom Shah Mohammadifar & Tahmasebi, 2014: 139, fig. 6

significantly influenced the evolution of local cultures, as well as the interactions, connections, and even the subsistence patterns of the local populations. The challenging routes and rugged terrain have hindered communication, resulting in the emergence of isolated indigenous cultures. Lalar, being a small and secluded valley, was primarily utilized as a temporary settlement area. The difficult terrain continues to pose challenges for accessing the valley, despite the presence of modern facilities.

The cultural characteristics of Lalar are the main subject of this paper. The primary inquiries revolve around the rationale behind the distinctive placement of the site in comparison to other contemporary sites along the Seymareh river, and the function of its structures. The excavation results reveal the existence of residential edifices constructed using typical materials from the late Sasanian period. In addition to the architectural remnants, Lalar shares a key similarity with other known sites in western Iran, namely the use of standard pottery that is diagnostically characteristic of this period.

In the assessment of the historical era of the site through its architectural features and technical attributes, it is proposed that, as per Huff (1987, 1999), the Sasanian architecture is distinguished by its extensive use of stonecutting and gypsum-saruj mortar, as well as its adaptable construction methods. Related structures made of rubbles and gypsum are known on the Zagros slopes in the Seymareh valley (e.g. Barzeh Ghavaleh and Qaleh Guri), which are entirely comparable in architectural elements to Takht-e Soleiman (Naumann & Huff, 1965), Firuzabad (Huff, 1999), Bishapur/ Qasr-i Shirin (Rether, 1939: 553), and Sasanian fire temples (Boyce, 1975) that are scattered across Iran. The same building materials and such structural details as crescent-shaped niches and columns made of rubbles and gypsum mortar clearly links Lalar to the Sasanian constructions at Khosrow Palace in Qasr-i Shirin and Takht-e Soleiman, notwithstanding the asymmetric arrangement of the columns at Lalar.

Also, a brief overview of the Lalar pottery speaks of a local pottery tradition. Over 60% of the total assemblage are in a poor-quality fabric with gypsum and lime inclusions procured from local resources, a fact resulting in their premature disintegration. Formal classification reveals two classes: in situ large storage jars and practical receptacles like bowls, plates, handled jars, and a spouted vessel. The most frequent decorations include rope appliques and undulating grooves.

Conclusion

The part of the valley of Seymareh where the sites of Cham Ghuleh, Tang-e

Kafari and Lalar lie forms a part of the natural alluvial valley through which runs the Seymareh river. Its limited flat lands were formed as a result of the deposition of the sedimentary flows during the flood times. Given its low expanse and difficulty of access, the area is only suitable for temporary settlements. Also, the valley has limited environmental capacity as regards agriculture and food production, and permanent living is virtually impossible within its 15-hectares total area (Sumner, 1989: 638). Thus, the existence of the archaeological site of Lalar with its remarkable expanse as an objective reality calls for analysis to pin down its function and the reasons behind its establishment. The site is close to the magnificent structures and mansions of Seymareh. Rubble-walled structures with gypsum mortar in western Iran are traditionally attributed to the Sasanian period. The same approach shows itself in the registration file of the site of Lalar. However, this parameter in effect is not sufficient for dating a building, and other lines of evidence and categories of finds deriving from the excavation need to be examined in detail. On the other hand, the two parameters of political developments and hostilities, and natural calamities like earthquakes had brought about profound changes in regional settlement patterns. Accordingly, the Lalar architecture gives clear indications of rushing in the construction process, so that in most cases the gypsum mortar was not packed well into the gaps between the rubbles and thus the resultant walls are not much resilient. It was attempted to rise a rubble-filled dry laid walls before packing their surface with gypsum plaster, which was used in very restricted amounts between the rubbles themselves. The second point is the use of relatively crude architectural techniques in different parts of the structure, including the erection of unattached rubble piers with both circular and square cross-sections at the same time in the same building. The columns failed in distributing a uniform roof load at the central points, and they were frequently positioned near the primary walls. Functionally, such a pattern in all probability represents an unofficial or a local one that was invoked by some unskilled builders.

Generally speaking, the preliminary results of the excavation of a 537 m2 area showed that the site was settled only for a very short period of time before being abandoned. Not even a single piece of evidence exists for a preceding or succeeding occupation phase. As the size of pottery assemblages, ash accumulations, and trash deposits serve as indicators of extended occupations, the scarcity of such finds bears further testimony to the transient nature of settlement at Lalar.

Positioned at the geographical center of the tumultuous late Sasanian period and the initial Arab conquests of the first century AH, Lalar's

challenging local topography offered a secure refuge, making it a temporary settlement likely constructed for immediate needs and subsequently abandoned following the resolution of political upheaval. Even, assuming a relation between the site and the political centers of Rueh, Barzeh Ghavaleh, and Galeh Guri, it might have been part of the defense system belonging to the survivors of the Sasanian dynasty in the first century AH. Because historical sources contain frequent references to abortive efforts by Sasanian survivors and princes to restore the imperial rule. It is plausible that Lalar, like Rueh, Barzeh Ghavaleh, and Galeh Guri, were part of a larger regional power structure that was either controlled by the Sasanians or by Sasanian princes in exile. These areas not only controlled the regional roads but also served as a strategic passage and a refuge for local Sasanian rulers and nobles who sought shelter in the Seymareh valleys after Arab invasions, as they attempted to regain their power unsuccessfully (Zakeri, 1995: 96).

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All authors contributed equally to the writing of the article.

Conflict of Interest

The Authors, while observing publication ethics in referencing, declare the absence of conflict of interest.

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۴۵ پژوهش‌های باستان‌شناسی ایران

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دانشگاه بوعلی سینا
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گزارش یافته‌های نخستین فصل از کاوش در محوطهٔ باستانی لالار در حاشیهٔ رودخانهٔ سیمره (زاگرس‌مرکزی)

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چکیده

محوطهٔ لالار به مساحت حدوداً ۱۵هکتار در حاشیهٔ غربی رودخانهٔ سیمره حدفاصل تنگ چم‌قوله و تنگ کافرین واقع شده است؛ این اثر در شهریور سال ۱۳۱۰هـ.ش. و به فاصلهٔ کوتاهی پس از تصویب قانون عتیقات به شمارهٔ ۵ در فهرست آثار ملی ایران به ثبت رسیده است. باوجود سال‌ها فراموشی مطالعهٔ این اثر تاریخی بالأخره در سال ۱۳۸۹هـ.ش. و تنها با هدف نجات‌بخشی، ناشی از غرق‌شدن آن توسط دریاچهٔ سد سیمره برای یک فصل مورد کاوش نجات بخشی قرار گرفت. نتایج این کاوش که طی آن ۵۳۷مترمربع از بخش مرکزی اثر خاکبرداری گردید نشان‌داد که این محوطه، بقایایی از یک بافت استقراری تک‌دوره‌ای است که تنها برای مدت‌زمان کوتاهی به یک‌باره ایجاد و به‌زودی هم متروک شده است. بقایای معماری محوطهٔ لالار با مصالح قلوه‌سنگ آهکی با ملاط گچ ساخته شده است. هدف اصلی این پژوهش معرفی و ارزیابی کارکرد و قدمت بافت تاریخی محوطهٔ باستانی لالار بر اساس شواهد داده‌های باستان‌شناختی و منابع تاریخی است و لذا فراتر از بحث نجات‌بخشی اندکی از اطلاعات موجود در این اثر طرح و پاسخ به این پرسش مهم است که، چه عامل یا عواملی موجب شکل‌گیری و توسعهٔ این محوطهٔ استقراری وسیع (شهر) در حاشیهٔ رودخانهٔ سیمره، محصور در ارتفاعات و خارج از مسیر دسترسی به راه‌های اصلی و معابر طبیعی منطقه شده است؟ درمجموع حسب داده‌های به‌دست آمده و ارزیابی ویژگی‌های بوم‌شناختی و جغرافیایی منطقه نشان‌داد که اشتراک سبک‌شناسی و اسلوب معماری به‌کار رفته در این محوطه با دیگر بقایای معماری منسوب به اواخر دورهٔ ساسانی تا قرن سوم هجری‌قمری هم‌خوانی و شباهت کامل دارد؛ این اشتراکات علاوه‌بر کاربست و تکنیک‌های معمارانهٔ معطوف به‌وجود دیگر داده‌های فرهنگی مانند گونه‌هایی از سفال‌های شاخص اواخر دورهٔ ساسانی در این محوطه است.

کلیدواژگان: باستان‌شناسی دوران صدر اسلام، زاگرس‌مرکزی، حوضهٔ رودخانهٔ سیمره، معماری دورهٔ ساسانی، محوطهٔ لالار.

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Rock Reliefs in the Western Parthian Empire: A Case Study of the Province of Adiabene

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Abstract

Relief carving is one of the most important archaeological and artistic artifacts from various historical periods. The Parthians, as one of the most significant empires of antiquity, exhibit lesser-known artistic and historical aspects, particularly in the realm of relief carvings. The Parthians ruled with a distinct approach, and some of their provinces, such as Adiabene, enjoyed a degree of autonomy. Located in the western part of the empire, Adiabene held a strategic position on the border between the Parthian and Roman worlds, playing a crucial role in the political, military, and cultural developments of the region. Despite the importance of this border province during the Parthian period, its reliefs have not been systematically studied. This research seeks to address the question: How do the stylistic and symbolic features of Adiabene's relief carvings reflect the cultural, political, and artistic interactions between this province and its neighboring regions? The study aims to analyze the artistic and identity-related significance of Adiabene by examining 13 reliefs across five regions, employing a descriptive-analytical-comparative approach. The research data were collected through library-based methods, utilizing historical, geographical, and archaeological sources, as well as comparisons with reliefs from neighboring regions. The findings reveal that Adiabene's reliefs reflect Parthian elements—such as crowns, hats, clothing, trousers, hanging ribbons, and standing postures—that appear throughout the vast territories of the Parthian Empire. In addition to Parthian influences, local Mesopotamian elements are also identifiable, including depictions of the god Nergal, the framing of reliefs, body curvature, and the one-legged stance seen in statues and reliefs from Hatra. The reliefs of Adiabene also exhibit Hellenistic influences, such as three-quarter profiles, depictions of the goddess Nike, and a sense of dynamism and movement. Religious and political themes form the cornerstone of Adiabene's reliefs. Unlike some other regions, Adiabene's carvings do not feature reclining figures or indications of religious shifts toward Judaism or Christianity. Instead, they showcase Parthian and regional traditions that were widespread across the empire.

Keywords: Adiabene, Rock Reliefs, Parthian Empire, Hatra, Hellenistic.

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Introduction

The Parthian Empire, one of the greatest powers of antiquity—within which several provinces enjoyed relative autonomy (Ellerbroek, 2022: 159)—left profound impacts not only through its territorial expanse but also across cultural, artistic, and political dimensions in Western Asia and beyond. Among these, the frontier provinces, particularly Adiabene, played a pivotal role in international interactions and in preserving Parthian imperial identity. Adiabene, located in the western part of the Parthian Empire, functioned as a semi-autonomous province (Marciak, 2017: 257–398), though the exact degree of autonomy in Parthian vassal states remains a subject of scholarly debate. Due to its strategic position on the frontier between the two great empires of Parthia and Rome, it consistently emerged as a key region in the political and military developments of the Parthian period. Beyond serving as a vital trade and military corridor, Adiabene also functioned as a cultural and artistic hub, leaving enduring influences on the history and art of the region.

Apart from Abdissar and Monobazus I, no coins have been found bearing the names of other kings of Adiabene. This likely suggests that the region lost its minting privileges in later periods. Nevertheless, historical sources indicate (Josephus & Feldman, 1965: 399-441, Dio, 75: 197-199) that Adiabene maintained relative autonomy, and its local rulers skillfully exploited the internal conflicts of the Parthians and the Parthian-Roman wars to consolidate their position.

Numerous rock reliefs dating to various periods have been identified within the territory of Adiabene. The recent discovery of the Rabana-Merquly rock reliefs and the re-examination of the Amadiya reliefs have opened new avenues for research on Parthian-era rock carvings in Adiabene. To date, thirteen rock reliefs have been documented in this region, yet they remain understudied as a distinct corpus within the broader archaeological investigations of Parthian art. A systematic study of Adiabene and its surviving rock reliefs promises to yield deeper insights into the province's Parthian identity and its geopolitical significance during the Parthian period. This research aims to examine Adiabene's role in preserving and promoting Parthian cultural identity—as well as its interactions with neighboring imperial powers—through the lenses of geography, political history, and artistic production. Such an investigation will not only enhance our understanding of Parthian-era developments but

also underscore the critical role of frontier regions in shaping the history and culture of ancient Iran.

The study addresses the following research questions: This study, while documenting the rock reliefs of Adiabene, seeks to address key questions: 1. Which cultural traditions exerted the strongest influence on the stylistic and symbolic elements of the Adiabene reliefs? The composition of stylistic and symbolic elements in the Adiabene reliefs demonstrates that, in addition to Parthian artistic features, Hellenistic and Mesopotamian influences are also identifiable within these carvings.

2. In what ways do the thematic and stylistic characteristics of the Adiabene reliefs reflect the distinct identity-building strategies of local rulers? The thematic and stylistic variations in the Adiabene reliefs can be interpreted as reflections of the political and cultural identity-building strategies adopted by the rulers of Adiabene and the broader Parthian realm. These reliefs were not arbitrary but rather intentional manifestations of the political and cultural agendas of the local rulers.

Research Methods: This research employs a descriptive-analytical-comparative approach within the framework of the constructive-interpretive paradigm, one of the five interpretive paradigms in qualitative research (Denzin & Lincoln, 2018: 19). Hodder is a pioneer of interpretive archaeology (Johnson, 2020: 108–111). Although Hodder (1991: 7–15) does explicitly label his work as "interpretive archaeology," his emphasis on three key components—guarded objectivity, hermeneutic methods, and reflexivity—particularly his focus on the researcher's active role in meaning-making, allows his theoretical framework to be applied in defining the constructive-interpretive paradigm as a distinct paradigm in archaeology.

Drawing on Hodder's theories, the constructive-interpretive paradigm in archaeology can be defined as a research approach grounded in the belief that archaeological realities are socially constructed and derive meaning through interpretation and subjective understanding. This paradigm places greater emphasis on the role of human, cultural, and social factors in shaping archaeological findings.

The research data were collected through library-based methods, including historical sources, archaeological records, and comparative studies. After examining the reliefs of the Adiabene region, 13 reliefs featuring Parthian artistic elements were identified and selected for this study. In this approach, the Adiabene reliefs are analyzed not as objective

facts but as culturally constructed texts emerging from the interaction of three analytical layers: Historical context, Material characteristics, and Researcher interpretation, supported by comparative data.

Research Background

Previous studies on the rock reliefs of Adiabene during the Parthian period have been limited in scope, with researchers examining either individual reliefs or small groups of these carvings rather than conducting comprehensive analyses. A key figure in documenting these reliefs was R.M. Boehmer, whose work remains particularly valuable since some reliefs have now completely eroded away - in these cases, Boehmer's sketches, photographs and field notes serve as the only reliable records (Boehmer, 1981-1982; Boehmer & von Gall, 1973). His research included important documentation of reliefs at Gali Zardak, Herir, Khanes and Amadiya sites. Von Gall contributed significantly to the study of Adiabene's rock reliefs (Boehmer & von Gall, 1973). Mathiesen's work 'Sculpture in the Parthian Empire' (1992) provides a brief examination of the rock reliefs at Gali Zardak, Khanes, and Amadiya. Iraqi archaeologists Taha Baqir and Fuad Safar documented these monuments while preparing the archaeological map of Iraq. More recently, Kurdish archaeologist Dlshad Marf Zamua published important studies on the Amadiya reliefs (2008) and the Rabana-Merquli complex (2011). Grabowski conducted new studies on the Batas-Herir relief (Grabowski, 2011). Reade & Anderson (2013) examined all known rock reliefs in the Navkur plain, including those at Khanes and Gali Zardak. In his book Sophene, Gordyene, and Adiabene, Marciak (2017) discusses the reliefs at Herir, Gali Zardak, Amadiya, and Khanes. In a 2018 study, Khounani and Mohammadifar conducted a detailed examination of the Rabana-Merquli rock reliefs (Khounani & Mohammadifar, 2018). Subsequently in 2019, a Columbia University research team employed modern photogrammetric techniques to document the Amadiya reliefs (Bahrani *et al.,* 2019).

This study advances previous research in three key ways. First, it achieves comprehensiveness: unlike earlier works—often fragmentary or restricted to a small set of reliefs—it provides a systematic and exhaustive examination of all known Parthian-period rock reliefs in Adiabene. Second, it analyzes these reliefs within the broader framework of Parthian art. Rather than viewing them as isolated local productions, the study positions them as integral elements of Parthian artistic traditions, rigorously examining their

stylistic and thematic connections. Third, it makes extensive use of primary sources and recent research. By incorporating the latest archaeological discoveries and the most up-to-date field research, the study offers a more precise and nuanced understanding of these monuments.

Geographical Position of Adiabene

The province of Adiabene (Hadyab) was located in the western Parthian Empire (Fig. 1). According to historical sources, its territory largely corresponded to ancient Assyria (Mashkour, 1992: 882-881), situated between the Greater and Lesser Zab Rivers and the Tigris River. This area spans what are now the border regions of Iran, Iraq, and Turkey, specifically in modern Iraqi Kurdistan. Plutarch (74/73-63 BCE) distinguishes between Assyria and Adiabene (Marciak, 2017: 257-263). The geographical boundaries of Adiabene were never stable throughout its political existence due to its location on the contested frontier between the Parthian and Roman empires - a situation reflecting Adiabene's ongoing geopolitical predicament. Adiabene likely reached its greatest territorial expansion during the reign of either Artabanus II (Ellerbroek, 2022: 159) or Artabanus III (Debevoise, 1968: 270) between 11/12-38/40 AD, when its domains extended to include the city of Nisibis (Josephus & Feldman, 1965: 425 [Antiquities XX.67-70]; Ellerbroek, 2022: 159). In addition to Nisibis, historical sources identify Nineveh, Arbela, and Gaugamela as principal cities within the province of Adiabene (Dillemann, 1962: 147-192). The discovery of a marble statue of tlw (Attalos), a king of Adiabene, in Temple III at Hatra (Safar & Mustafa, 1997: 250) further suggests Hatra may have fallen within Adiabene's sphere of influence during this period. While some scholars interpret Roman sources as identifying Adiabene as part of Assyria (Marciak, 2017: 375-376), others equate Roman references to "Assyria" with Babylonia. Significantly, Šāpūr I's inscription at Naqš-e Rostam distinctly differentiates between Adiabene, Āsūrestān (Assyria), and Arabayestān (Arabia) (Akbari, 2008: 37). The Zagros Mountain range held profound strategic importance for the region of Adiabene. The well-known Kurdish proverb - "They have no friend but the mountains" - aptly encapsulates both the cultural and political significance of mountainous habitation in Adiabene's context. Unlike the arid southern plains, most of Adiabene received sufficient rainfall for productive agriculture (Dahlman, 2002: 273). A crucial factor in Adiabene's research landscape was its position as a frontier region between the two great empires of Parthia

and Rome. This strategic location along major trade routes established Adiabene as a vital military and economic gateway, cementing its geopolitical importance.

◄ **Fig. 1: Approximate territory of the kingdom of Adiabene (https://ebrary.net/161768/history/vassal_states_kingdoms_under_parthian_influence).**

Political History of Adiabene

Reconstructing the political history and status of Adiabene's kings remains challenging due to the scarcity of sources. The earliest classical reference to Adiabene appears in Plutarch, who mentions it as an ally of Tigranes, the King of Armenia, during the Battle of Tigranocerta (Plutarch, 2001: 346; Gutschmid, 2009: 80; Marciak, 2017: 345). This reference confirms that Adiabene was already part of the Parthian provinces by 69 BCE. Based on available sources, Adiabene likely became a tributary kingdom and vassal state under Parthian suzerainty during the reign of Mithridates II (ca. 121-91 BCE) (Marciak, 2017: 246-247; Ellerbroek, 2022: 159). Classical sources consistently present Adiabene as an integral part of the Parthian realm, particularly in contexts documenting Parthian-Roman diplomatic relations and conflicts (Marciak, 2017: 257-263). Recent research, based on coinage attributed to Abdissar (Fig. 2) (Abdisars – a Semitic name meaning "Servant of Ishtar"; Marciak, 2017: 345; Marciak & Wójcikowski, 2016: 81), identifies him as Adiabene's first attested king (mid-2nd century

BCE – ca. 164 BCE?). These studies suggest the kingdom's formation occurred between the late 3rd century BCE and early 1st century BCE (Marciak, 2017: 345–346; Brown, 2022: 931; Grabowski, 2011: 117). The proposed chronology remains subject to debate due to varying interpretations of Abdissar's coinage. The political status of Adiabene during the Parthian period—particularly from the 1st century BCE to the 1st century CE—is comparatively clearer in historical sources than in earlier periods. Artaxares, a king of Adiabene, was likely a contemporary of Phraates IV. His name appears in a text related to Augustus alongside Tiridates I of Parthia (26–29 BCE)—who is referred to as Tiridates II in some sources (Ellerbroek, 2022: 88–89). However, no further information about Artaxares survives. The mention of Artaxares as a ruler alongside Tiridates—both appearing before Augustus—strongly suggests that Adiabene sought to exploit Parthia's internal turmoil and Rome's support for Tiridates to negotiate advantageous terms. This mirrors the strategy of Izates II, who later expanded Adiabene's territory to Nisibis by backing Artabanus. Izates I (late 1st century BCE) is sparsely documented, with his name appearing only in a single text referencing Queen Helena's memorial in Jerusalem (B.J. V.147) (Josephus & Feldman, 1965: 438; Ellerbroek, 2022: 159; Marciak, 2017: 351; Debevoise, 1968: 165). Notably, Josephus identifies Helena as Izates' daughter (Marciak, 2017: 350). Monobazus I, son of Izates I, is documented as both the brother and husband of Helena while reigning as king of Adiabene (Pigulevskaya, 1993: 97). He likely died in 38 CE (Debevoise, 1968: 166).

Monobazus I's kingship is confirmed by coinage bearing his name (Fig. 3). The obverse displays ΒΑΣΙΛΕΩΣ MONOBAZOY ("King Monobazus"), while the reverse bears the inscription ΕΒ ΛΤ, which most likely dates to 20/21 CE. Josephus' account reveals that Monobazus I transferred control of Gordyene (Corduene) to his son Izates (Antiquities XX.24), strongly suggesting this region's incorporation into Adiabene during their rule. Contemporary with King Abinerglos of Characene under Parthian King Phraates IV, Monobazus established Adiabene's growing influence. This political prominence reached its peak under Izates II, whose involvement in Parthian dynastic conflicts and the royal family's conversion to Judaism became exceptionally well-documented through Josephus' Jewish Antiquities (Josephus & Feldman, 1965: 399-441) and supplemented by Tacitus' Annals as the sole non-Jewish source. Izates II was likely born around 1 BCE. During his residence in Characene from

18/19 CE to 22/23 CE and until 37/38 CE, he married Symacho, daughter of the Characene king (Marciak, 2017: 358). His political significance emerged through supporting Artabanus II during Parthian succession struggles, for which he received distinctive royal privileges including the Parthian tall crown, a golden throne, and control over Nisibis (Josephus & Feldman, 1965: 425). The latter years of his rule saw mounting opposition, culminating in 52 CE when Adiabene's nobility petitioned Vologases I for assistance against their king. Vologases I's planned invasion of Adiabene was aborted when eastern hostilities (likely occurring early in his reign) demanded his attention. Josephus further records that in Izates' final years, King Abias of the Arabs launched an attack against Adiabene (Josephus & Feldman, 1965: 331-337). Izates II probably died in 55/56 CE. Tacitus provides critical insight into Izates' opportunistic role during the 49 CE Parthian civil war between Gotarzes II and Mithridates. Initially supporting Mithridates, Izates ultimately betrayed him by withdrawing his forces when his political calculus shifted toward favoring Gotarzes II (Marciak, 2017: 359). Monobazus II, brother of Izates II, likely ascended to the throne of Adiabene in 55/56 CE. During his reign, Tigranes VI established Roman-backed rule over Armenia, with Tigranocerta falling under Roman control by 61 CE. Tigranes subsequently launched an invasion of Adiabene, prompting Monobazus II to request military aid from Vologases I (r. c. 51/50-79 CE). The ensuing Parthian counterattack on Tigranocerta escalated into full-scale Roman-Parthian warfare (54-63 CE), which concluded with a formal peace treaty (Pigulevskaya, 1993: 106-107; Debevoise, 1968: 185-196). Notably, Monobazus II participated as a signatory witness during the treaty negotiations (Debevoise, 1968: 195).

Monobazus II is again documented during the Jewish revolt against Rome in 66 CE (Marciak, 2017: 362). Historical records remain silent about Adiabene until 115-117 CE, coinciding with Roman invasions of Mesopotamia and Armenia. During Trajan's eastern campaigns against Parthian territories, Adiabene was ruled by King Mebarsapes (Marciak, 2017: 366-374; Pigulevskaya, 1993: 109-111). Trajan first conquered Armenia in 114 CE, followed by the capture of Antioch and Dura-Europos (Mohammadifar, 2010: 41). When the Roman army advanced into Mesopotamia, King Mebarsapes of Adiabene mounted a defense but ultimately lost Nisibis before retreating to Arbela, Adiabene's capital. By 116 CE, both Adiabene and Ctesiphon had fallen to Roman forces.

Following Trajan's death in 117 CE, Mebarsapes successfully reclaimed his throne (Marciak, 2017: 373-378). The Chronicle of Arbela (Arbela 1985), which documents the lives of Christian bishops in Arbela (ca. 104–544 CE), mentions a certain Raqbakt as the ruler of Adiabene during the reign of Vologases II (?). Although Pigulevskaya considers Raqbakt a semi-legendary figure, the Chronicle describes him as a closet Christian subordinate to Vologases, whom the Magi sought to execute due to his newfound faith (Arbela 1985: 4–6). In addition to governing Adiabene, Raqbakt held the military rank of commander (equivalent to the Parthian title vspuhr). According to Pigulevskaya (1993: 113–116), he was dispatched by Vologases to aid the Parthians in their campaign against the Alans, where he perished in battle. Following this period, references to Adiabene disappear from historical records. During the Roman-Parthian wars of 161-166 CE, when Rome captured extensive Parthian territories including northern Mesopotamia, it is plausible that Adiabene too saw military engagement (Marciak, 2017: 379-382). The chronicles mention one final ruler—Narseh (c. 170-200 CE)—who rebelled against Parthian authority according to the Arbela Chronicle. For this defiance, Vologases IV launched a punitive campaign, culminating in Narseh's dramatic demise by drowning in the Great Zab River (Debevoise, 1968: 259; Arbela Chronicle, 1985: 13). The name Adiabene resurfaces in historical records in 195 CE when Vologases V (r. c. 191-208 CE), leveraging Rome's internal power struggles and supported by Adiabene and Osroene, launched a military campaign against Rome. During this conflict, Adiabene backed the Roman usurper Gaius Pescennius Niger's imperial claim and participated with Osroene's forces in besieging Nisibis. In response, Septimius Severus counterattacked, conquering Parthian territories including Adiabene (Cassius Dio, 75.1-3).

In 216 CE, Emperor Caracalla proposed marriage to the daughter of Artabanus IV (?) (r. c. 216-224 CE), but the Parthian king rejected the offer. Seizing this pretext, Caracalla launched an invasion of Adiabene (Ellerbroek, 2022: 111). The Roman forces advanced through Mesopotamia before turning toward Adiabene's heartland (Pigulevskaya, 1993: 123), marking one of the last major confrontations between Rome and the fading Parthian Empire. According to Roman historical accounts, Caracalla "razed fortress walls, captured Arbela, violated Parthian royal tombs, exhumed and scattered the bones of their kings" (Pigulevskaya, 1993: 123; Debevoise, 1968: 265). The Arbela Chronicle suggests the last Parthian-era ruler of

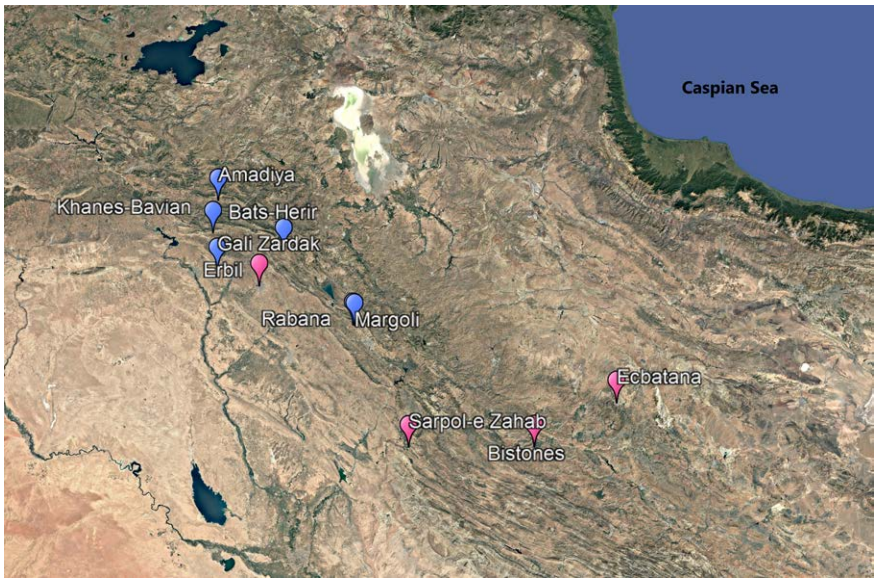
Adiabene was likely a certain Shahrat (or Shahrad, c. 220 CE) (Arbela Chronicle, 1985: 14-15), marking the twilight of this ancient kingdom before the Sassanian rise. Shahrat reportedly accompanied Artabanus IV during his invasion of Roman territories. Following the fall of the Parthian Empire and the rise of the Sassanids, the inscription of Shapur I at Ka'ba-ye Zartosht - which refers to Ardashir, the Sasanian prince, as the "King of Adiabene" (Akbari, 2008: 58) - can be considered as evidence documenting the end of Adiabene's local dynasty.

▲ Fig. 2: Coin of Abdissar (Marciak, M., & Wójcikowski, 2016: Fig. 2).

Rock Reliefs of Adiabene

Within the territory of Adiabene, thirteen rock reliefs (Fig. 4) have been identified as particularly significant among all known reliefs in Iraqi Kurdistan for Parthian-era studies. These carvings are documented across five sites: Herir, Amadiya, Khanes, Gali Zardak, and Pir Magrun. The reliefs have suffered extensive damage, with some completely obliterated over time. For instance, certain reliefs at Gali Zardak can now only be identified through early archaeological reports. Scholars attribute these carvings to three distinct cultural periods: Hellenistic, Parthian, and Sasanian, reflecting the region's layered artistic heritage.

▲ Fig. 3: Coin of Monobazos I (Marciak & Wójcikowski, 2016: Fig. 8).



◄ Fig. 4. Geographical distribution of Adiabene rock reliefs at Amadiya, Bātas – Herir, Khanes – Bavian, Geli Zardak and Rabana-Merquly (Authors, 2024).

The Bats-Herir Rock Relief

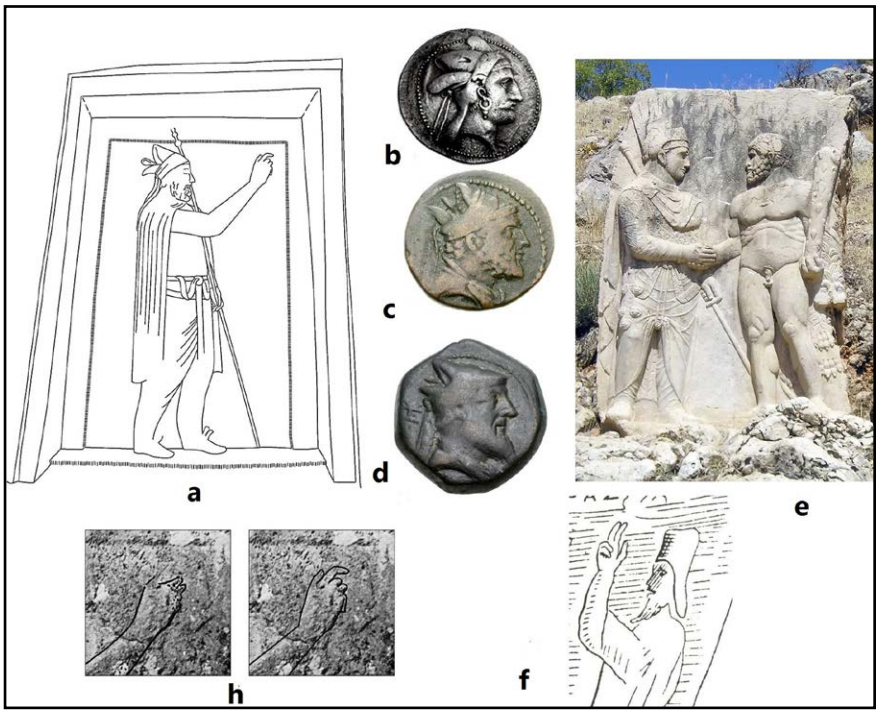
The Bats-Herir rock relief (Fig. 5) is located approximately 74 km northwest of Erbil, near the village of Bats in the Herir region. The nearest archaeological site to the relief is Tell Tlai, where Hellenistic and Parthian pottery has been identified (Boehmer 1974: 103–104). Carved

▲ Fig. 5: The rock relief of Bātas-Herir (Boehmer & von Gall, 1973: Pl. 28).

into a natural rock face, the relief depicts a standing male figure in profile view. Unfortunately, the sculpture has suffered significant weathering and damage over time. Based on a drawing (Fig. 6: a) by Grabowski (2011: 121), the figure in this rock relief raises his right arm in a bent-elbow posture, performing a symbolic gesture of worship or reverence with a curled finger (Fig. 6: h). His left hand holds a royal scepter at his waist. The figure wears a tiara (a type of Iranian headdress) adorned with a royal diadem, its edges folded upward. The figure wears a knee-length tunic tightly fastened with a belt, with the front of the garment gathered by a ribbon hanging from the waistbelt. A cloak with regular folds is draped over his shoulders and knotted at the chest. His lower attire consists of fitted trousers and laced boots. His short hair, beard, and mustache are clearly delineated, and he is depicted wearing earrings. The Bats-Herir rock relief exhibits comparable and shared characteristics with artistic traditions across a broad spectrum of the Iranian cultural sphere. The relief's frame likely represents a regional feature, also observed in the Rabana-Merquly rock reliefs (Khounani & Mohammadifar, 2018: 53) and on two Parthian-era columns from Ashur (Mathiesen, 1992: 191).

The tiara depicted in the relief resembles those worn by Bagadates (the frataraka) (Fig. 6: b) (Mohammadifar & Amini, 2015: 7), Abdissar of Adiabene (Fig. 6: c), and Xerxes of Sophene (Fig. 6: d) (Marciak, 2017: 506 & 543). Stylistic parallels between the Bats-Herir relief and Commagene sculptures—particularly in the use of royal scepters and fitted trousers—are evident (Fig. 6: e) (Brijder, 2014: 159). However, a key distinction lies in the frontal depiction of figures in Commagenean art, contrasting with the profile view at Bats-Herir. The tiara and cloak motif was widespread in Parthian art, while the raised-arm gesture with a bent index finger closely mirrors that of Mithridates II (Fig. 6: f) (123–87 BCE) at Bisitun (Mohammadifar, 2010: 190).

Scholars have proposed varying chronological attributions for the relief based on stylistic analysis. Debourse and Marciak date it to the late 2nd or early 1st century BCE (Mathiesen 1992: 182; Marciak 2017: 337–338), while Boehmer (1974: 101–102) and von Gall (Boehmer & von Gall 1973: 75–76) assign it to the 1st century CE. Conversely, Grabowski (2011: 134–135) associates it with the first half of the 2nd century BCE. The form of the tiara (Fig. 7) in this rock relief has been the subject of extensive scholarly debate, prompting various historical interpretations. Boehmer and von Gall identified this headdress as a royal upright tiara, proposing that Izates of



◄ **Fig. 6. a: Bātas-Herir relief (Grabowski 2011: 121); b: Bagdād AR drachm (Mohammadi-Far & Amini 2015: 7); c: Abdissar AE (Marciak & Wójcikowski 2016: Fig. 2); d: Xerxes (Adiabene) AR (Marciak & Wójcikowski 2016: Fig.4); e: Antiochus I (Commagene) (Livius.org); h. Hand Gesture (Bātas-Herir) (Mohammadifar 2010: 190); f: Mithridates (Bisotun) (Grabowski 2011: 128).**

Adiabene may have received permission to wear it from Ardavan II, the Parthian king. They attributed the relief to Izates II, king of Adiabene, and suggested a creation date between 52–54 CE (Boehmer & von Gall 1973: 75–76). In contrast, Grabowski (2011: 120–125) rejects the identification as an upright tiara, arguing that the headdress's peak tilts backward, closely resembling the tiara of Apages (or satrapal tiara). He contends that it bears greater similarity to the headdresses depicted on coins of Abdissar, king of Adiabene, and proposes that the relief likely portrays Abdissar, the first known king of Adiabene (ca. 164 BCE). However, due to the relief's severe damage and lack of accompanying inscriptions, all attempts to definitively identify the figure remain speculative. The stylistic features of this artwork—including its parallels with Commagenean art, the coin portraits of Xerxes of Sophene, Bagadates the Frataraka ruler of Persis, and Abdissar, as well as the bent-elbow gesture with curled finger (similar to Mithridates' relief at Bisitun)—more strongly suggest a late 2nd or early 1st century BCE date rather than a 1st century CE attribution.

The Rock Reliefs of Amadiya

Three rock reliefs are located in the city of Amadiya (also known as Amadi/ʿImadiya), situated in the Zagros Mountains within the Duhok Governorate of the Iraqi Kurdistan Region. The city is perched on a

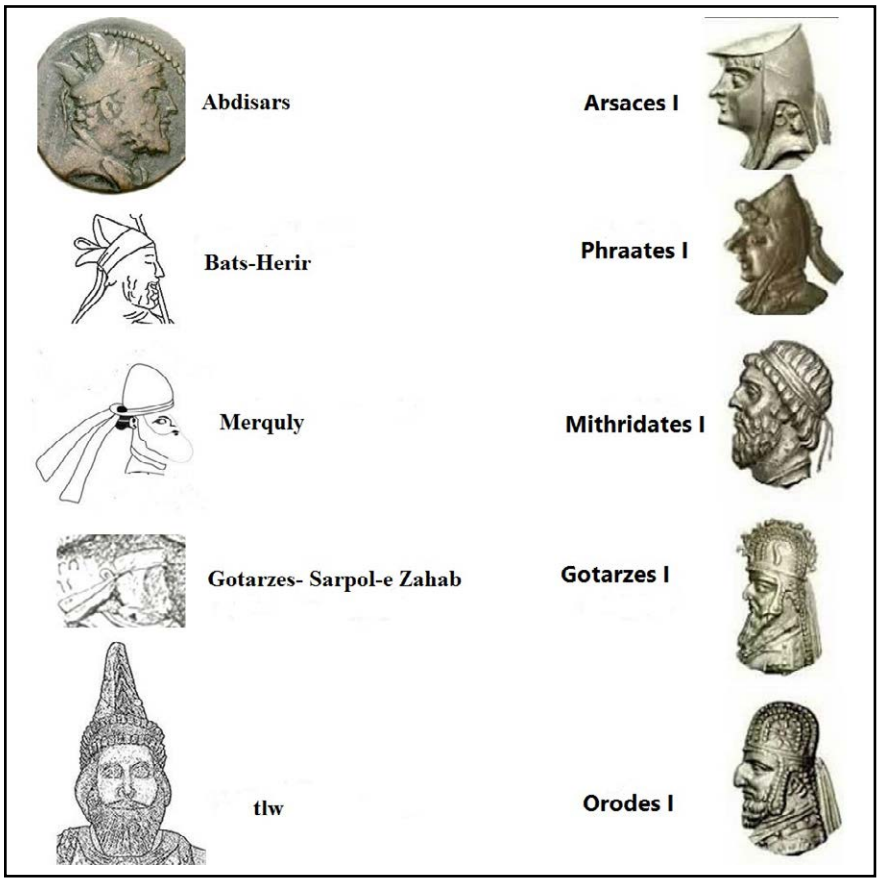


Fig. 7: Comparison of royal headgear types on Parthian coins (Abdissar), Adiabene rock reliefs, and the statue of Tlw at Hatra (Authors, 2024). ◄

rocky elevation, giving it a naturally fortified and defensible position. The existing Amadiya Fortress was constructed by the Seljuk emir Imad al-Din Zengi (r. circa 1085–1146 CE). However, older architectural remains have been documented both inside and around the fortress (Bahrani *et al.,* 2019: 1). Carved into the rock face adjacent to the western Bhedinan/Mosul Gate are three arched niches, each measuring 10-40 cm in depth, featuring life-sized depictions of standing figures. These reliefs have suffered significant deterioration over time. Scholarly opinions vary considerably regarding their chronology: Huff attributes them to the Hellenistic period, interpreting the figures as regional princes; Debourse proposes a late Parthian or early Sasanian dating (Mathiesen, 1992: 183); Boehmer draws parallels with reliefs at Geli Zardak and assigns them to the second century CE (Boehmer, 1981: 157); while Taha Baqir and Fuad Safar advocate for a broader temporal range between 138 BCE and 226 CE (Marf Zamua, 2008: 116). The Columbia University mapping and archaeological team has likewise dated the reliefs to a period spanning the 1st century BCE through the late 2nd century CE (Bahrani *et al*., 2019: 1).

Rock Relief No. 1 of Amadiya

Located just 5 meters from the Bhedinan Gate, rock relief no. 1 (Fig. 8) is the closest such carving to the gate. The life-sized frontal depiction of a male figure is housed within an arched niche measuring 2.81 meters in height and 1.54 meters in width at its broadest point (Marf Zamua, 2008: 115). According to published images from the Columbia University team (Bahrani *et al.*, 2019: 7), the male figure leans slightly to the left with a faint forward bend at the torso, his weight clearly placed on the right leg. His left arm is bent with the hand resting on a sword hilt, while the right arm extends outward to hold a long spear or staff. The hand grasps the spear/staff precisely above the elbow, topped with a distinctive curved, bell-shaped element. This spear/staff spans the full height of the relief, serving as a framing element along the figure's right side. The man appears to wear full-length trousers that taper at the ankles. Although the face and head are severely eroded, traces of hairstyle and a headband remain discernible. The figure's thick, rounded locks cascade down to shoulder level, appearing particularly distinct on the left side of the body. While no definitive beard is visible, a slight protrusion on the upper chest may suggest stylized facial hair. From behind the head, two long, flowing ribbons extend diagonally leftward - bending at the shoulder and terminating near the left elbow. Additionally, a separate semicircular element (unrelated to the ribbons) frames the head, positioned above the figure's left side and possibly representing either a ceremonial ornament or part of the headdress. On the left side of the figure, two distinct weapons are clearly visible: a broad, elongated sword that follows his leg line down to the foot, and a narrower, long sword extending from the man's hand to the edge of the relief space. Along the right side, tracing the thigh and waist, appears a curved, spiral-like line. Beneath this line, faint traces suggest another weapon adjacent to the right calf. While the damage to the relief prevents detailed analysis and comparison, its overall composition - particularly the body's curvature and one-legged stance - shows distinct features also seen in Hatrene art (Al-Salihi, 2023: Figs. 33, 60B, 67, 73, 86), the Hercules depiction at Tang-e Botan (Group 1), and the northern facade of Tang-e Sarvak I (Mohammadifar, 2010: 205-215). The figure's frontal orientation, curved and sloping body contours, bundled hairstyle, headdress ribbons, and weapon positioning all bear noticeable similarities to Parthian representations found at Tang-e Sarvak, Khong-e Nowruz, and Bisitun (Ibid: 194-219), suggesting strong stylistic connections within this artistic tradition.

Fig. 8: Rock Relief No. 1 at Amadiya (Bahrani *et al.*, 2019: 7). ▶

Rock Relief No. 2 at Amadiya

The second rock relief (Fig. 9) is situated 17.75 meters from the gate, featuring a full-length standing female figure carved within a robust niche measuring 2.35 meters in height and 1.61 meters in width. Positioned along the descending slope of the castle's exterior staircase, Relief No. 2 is the most severely weathered of Amadiya's reliefs. The niche's lower contours are slightly more rounded, and the overall structure is somewhat smaller than the other two relief niches (Marf Zamua, 2008: 115). Despite the niche's extreme deterioration - previously described as an empty frame by European travelers and scholars and notably omitted by Boehmer and Mathiesen in their studies of Amadiya's reliefs - it was successfully identified and documented during Dlshad Aziz Marf Zamua's 2008 survey. The photogrammetry conducted by the Columbia University team has revealed traces of a standing figure wearing a long garment (Bahrani *et al.*, 2019: 8). Based on the published sketch, the upper section—where the head was likely located—is heavily eroded and damaged, but the slope of the left shoulder is discernible. Traces of clothing are visible. According to the Columbia University team's assessment, the figure may represent a female, dressed in a Greek-style tunic (chiton) and a cloak (himation). The folds of the cloak drape diagonally across the body, seemingly pulled to the side and held in place by the left hand in a conventional pose associated with Seleucid and Parthian-era art. This feature is also observed in some female statues from Hatra (Fig. 10) (Safar & Mustafa, 1997: Nos. 240-241-

◄ Fig. 9: Rock Relief No. 2 at Amadiya (Bahrani *et al.*, 2019: 8, Fig. 3).

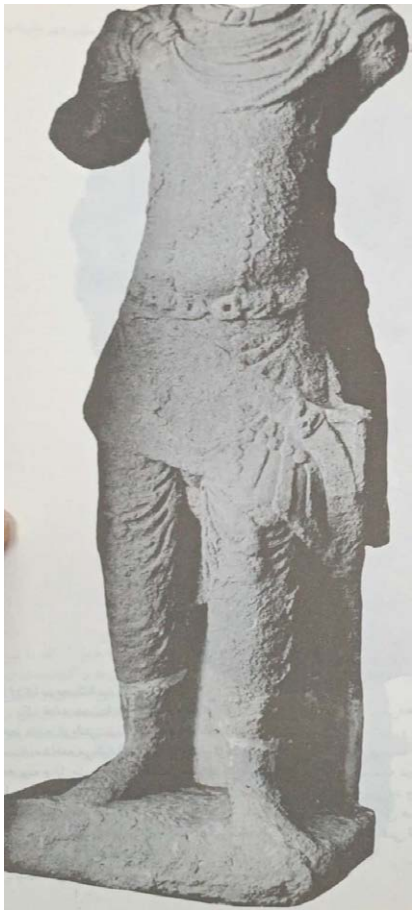
243). Since the head area leaves a significant space in the niche—consistent with the composition—it can be speculated that a headband was present at the top, and a few short vertical lines may indicate such an ornament. Near the left foot of the figure, there appears to be an object resembling an oval shield. On the opposite side, to the right of the figure, the space in the relief and the expected compositional balance suggest that the figure was holding something beside it. No visible evidence remains there, but based on the spatial context and comparative materials, it can be speculated that an object such as a spear, a flag, or a palm branch—similar to depictions of goddesses on Parthian coins (Sarfaraz & Avarzamani, 2010: 41-42)—was once represented. Delshad Aziz has reported the presence of a hanging ribbon, measuring 65 cm in length, in this relief (Marf Zamua, 2008: 115).

Amadiya Relief No. 3

Relief No. 3 (Fig. 11) is located 7 meters from Relief No. 2 and 25 meters from the Behdinan Gate. Within an arched niche, a full-length male figure is depicted in profile, measuring 2.21 meters in height and 1.79 meters in width. Among the three reliefs, this one has the deepest carving. The niche narrows toward the top and widens at the base (Marf Zamua, 2008: 115). According to the published sketch by Columbia University's team (Bahrani *et al.*, 2019: 10), the figure in this space is carved in a distinct style and with different proportions compared to the first relief. The image portrays a male figure in profile, with his upper torso slightly leaning

▲ Fig. 10: Statue No. 243 from Hatra (Safar & Mustafa, 1997: No. 243).

Fig. 11: Relief No. 3 at Amadiya (Bahrani et al., 2019: 10, Fig. 5). ▶



▲ Fig. 12: Statue No. 215 from Hatra (Safar & Mustafa, 1997: Cat. 215).

backward, suggesting an upward movement. The figure is depicted mid-stride, moving upward toward the right side of the relief as if in an ascending motion. The right side of the body and traces of the head are visible. The right arm is slightly raised, bent at the elbow across the chest. The figure's movement aligns with the slope of the staircase. Carved larger than life-size, the figure dominates most of the relief's height. Behind the figure, on the left side of the relief and behind the right leg, we see what appears to be fabric strips - possibly parts of a belt, a cloak, or perhaps indications of a weapon. The figure wears a knee-length tunic and a tight-fitting upper garment or armor. Behind the figure's right shoulder, there are traces of fabric ends that could be identified as part of a hanging headband. The lower section of this fabric appears neither flat nor pleated, but rather displays a thick, curved pattern along its bottom edge. The figure likely held a spear raised by the left arm, as traces of a pointed object are visible in the enhanced photogrammetric imagery. A curved object appears near the right side of the waist. Relief No. 3 of Amadiya presents a particularly unique upward movement that has no direct parallel in Parthian art. While the profile composition bears comparison with Parthian reliefs, its dynamic quality surpasses that of typical Parthian representations such as those at Rabana-Merquly. In fact, its style may evoke Hellenistic artistic traditions. The clothing and weaponry find closer parallels with certain sculptures from Hatra (Fig. 12) (Safar & Mustafa, 1997: Nos. 37-215).

The Khanes-Bavian Relief

The Khanes-Bavian relief (Fig. 13) is located near the villages of Khanes and Bavian in the Navkur Plain of Iraqi Kurdistan, close to Sennacherib's canal (Mathiesen, 1992, II: 184–185). The area contains a series of Assyrian reliefs, to which a depiction of a horseman—likely added during the Parthian period—was incorporated, possibly replacing part of an original inscription or relief. Scholars such as Layard, Bachmann, Andrae, and Debevoise studied and documented this relief in the 19th and 20th centuries. According to research by Reade & Anderson (2013: 97-120), three distinct phases can be proposed for the relief's development:

Phase One: During the Neo-Assyrian period, the rock face was decorated with reliefs depicting Assyrian kings and deities, likely including either an inscription or a large-scale figural composition.

Phase Two: In the Parthian period, portions of the original Assyrian relief were deliberately defaced and replaced with an image of a mounted rider. This alteration may reflect contemporary political or religious shifts.

Phase Three: In subsequent periods, two burial niches? were carved into the existing relief, representing a later functional repurposing of the monument (They should not be older than 230 AD, but they are probably not later than the 4th or 5th century AD either.).

Based on the reconstruction proposed by Reade and Anderson, the original Assyrian relief featured scenes of two standing Assyrian figures worshiping Assyrian deities. These carvings were executed on a large rock surface covering approximately 9.5 square meters. The relief depicts two standing figures - likely Assyrian kings - facing each other in an act of divine worship. The Assyrian gods are represented either mounted on sacred animals or accompanied by their divine symbols. Additionally, there exists a separate stone projection standing over 8 meters tall with dimensions of roughly 8 by 6 meters. This massive structure is surrounded by colossal carvings of winged bulls with human heads, featuring additional scenes of the king worshiping his gods. Two or three lion/sphinx-shaped pedestals atop the cliff and on the large panel likely supported statues or a columned structure. A group of approximately eleven or more carved stone stelae, each about 2 meters tall and bearing inscriptions depicting the king in worship, overlook the canal route. The stone carvings were probably once brightly painted (Reade & Anderson, 2013: 97). The equestrian relief, likely added during the Parthian period, shows a bearded male rider wearing a crown-

like headpiece and spiral necklace, mounted on a galloping horse moving rightward. The 4.2m tall by 6.7m wide panel depicts the rider holding a long spear in his right hand while wearing garments with U-shaped folds and a V-shaped neckline (Mathiesen, 1992 II: 184). The horse's carefully trimmed mane and decorated bridle are visible, with its forelegs raised and hind legs planted. The relief has suffered severe damage from both natural erosion and later incorporation of two burial niches into its surface.

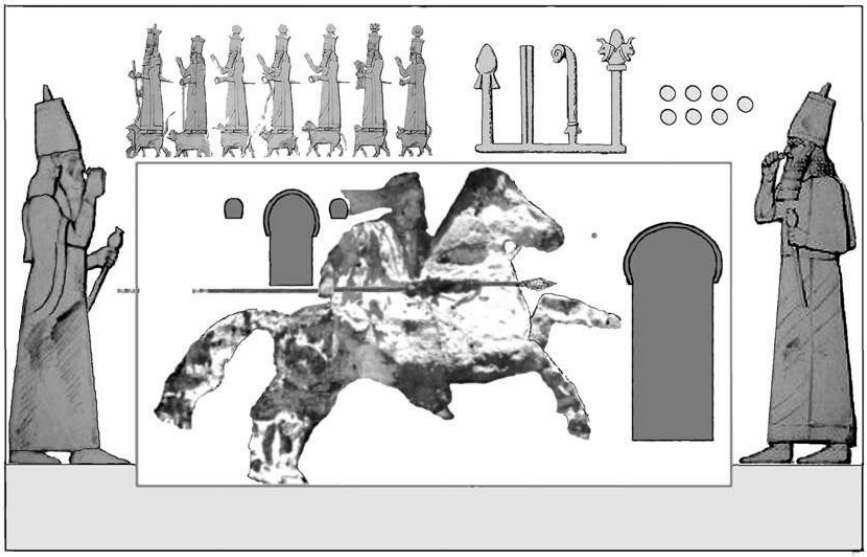
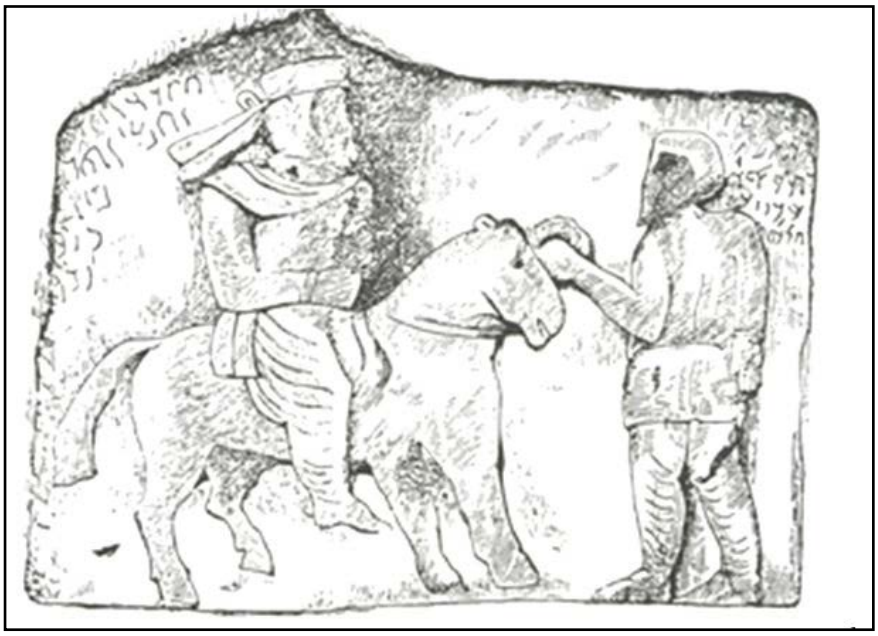
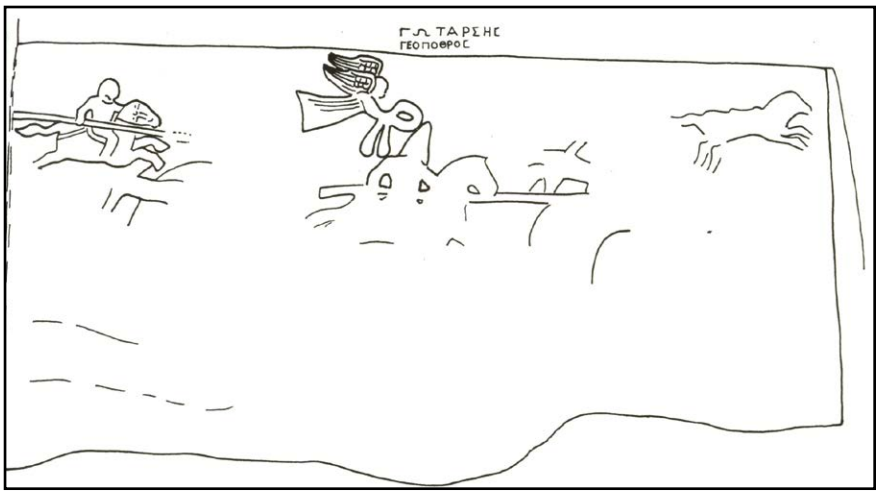


Fig. 13: Khanes-Bavian rock relief (Reade & Anderson, 2013: Fig. 68). ▶

The equestrian relief is generally attributed to the Parthian period. Some scholars, such as Debevoise, have suggested that it might depict Tigranes II, the King of Armenia. However, this suggestion has been questioned due to inconsistencies with Tigranes' coin portraits, which consistently show him clean-shaven. An alternative hypothesis proposes that the relief could represent Alexander the Great commemorating his victory at the Battle of Gaugamela (331 BCE), though this interpretation has also been challenged based on stylistic and iconographic discrepancies (Mathiesen, 1992, II: 184; Reade & Anderson, 2013: 111-114; Marciak, 2017: 340-341). The depiction of a spear-bearing horseman held particular popularity in the Parthian-era Near East (Kawami, 2013: 63). This relief can be compared to the portrayal of Gotarzes at Bisitun (Fig. 15), particularly in terms of the horse's dynamic posture. Additionally, the headband with ribbons in the Khanes-Bavian relief finds parallels with Gotarzes' depiction at Sarpol-e Zahab (Fig. 14). Overall, this relief likely dates to the 1st century BCE through 1st century CE and probably represents a Parthian ruler or king commemorating military victories.



◄ Fig. 14: Rock relief of Gotarzes at Sarpol-e Zahab (Mohammadi-Far, 2010: 196).



◄ Fig. 15: Rock relief of Gotarzes at Bisotun (Mohammadi-Far, 2010: 192).

The rock reliefs of Gali Zardak

In northwestern Mosul, at a site called Gali Zardak - a roughly oval-shaped valley - six rock reliefs and one rock-cut chamber have been identified (Fig. 16: h). In some cases, the reliefs have completely eroded away. The following description is based on sketches, photographs, and writings by Boehmer (1981: 151-165) and Mathiesen (1992 II: 182-183). The Gali Zardak reliefs have been attributed to the Parthian period. Boehmer has suggested with high probability that this complex represents a burial site for Parthian princes dating to the 2nd century CE, approximately contemporary with Hatra.

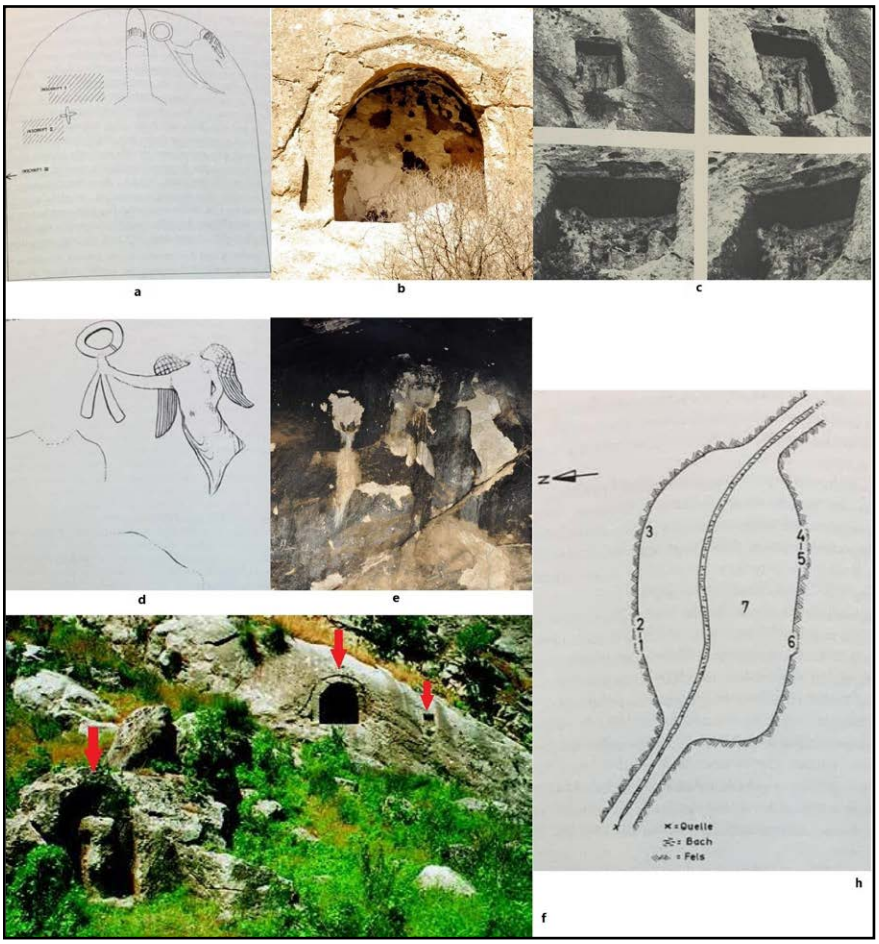
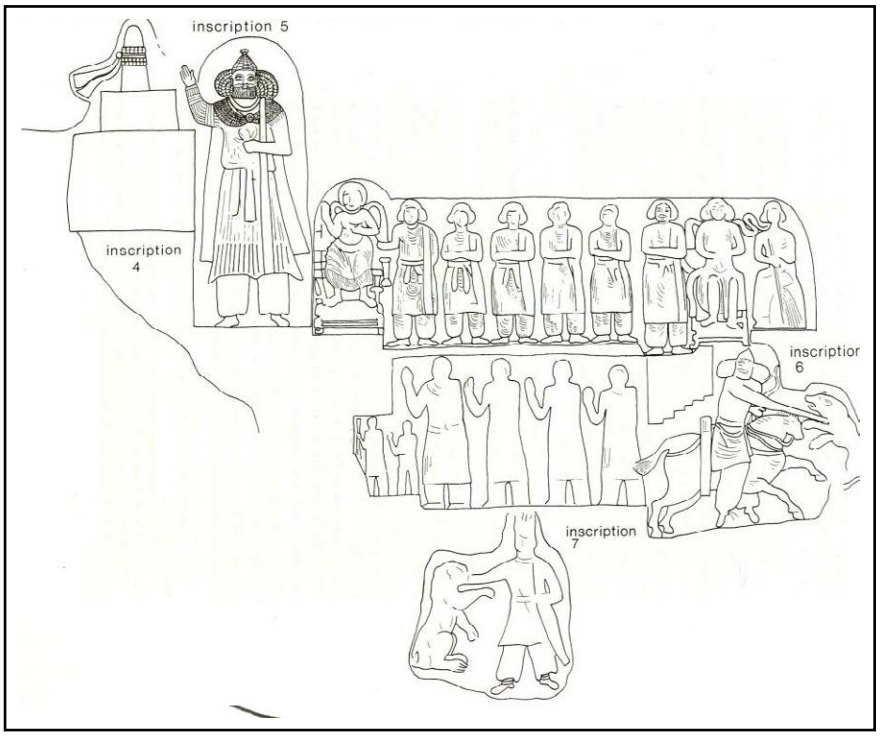


Fig. 16: a) Drawing of Gali Zardak Relief No. 1 (Boehmer, 1981: 155, Fig. 12); b) Current state of Relief No. 1 (Pierdaniele, 2021: Fig. 22); c) Relief No. 2 (Boehmer, 1981: Pl. 40); d) Drawing of Relief No. 4 (Boehmer, 1981: 160, Fig. 15); e) Current state of Relief No. 4 (Pierdaniele, 2021: Fig. 23); h) Location of reliefs and Chamber 3 at Gali Zardak (Boehmer, 1981: 154, Map 5); f) Position of Reliefs 1, 2, 7 (Reade & Anderson, 2013: Fig. 67). ▶

Gali Zardak Relief (Mathiesen No. 136 / Boehmer No. 1)

When reaching the oval-shaped valley, on the left side of the smooth, sloping northern wall, at a height of 2 to 3 meters above the valley floor, there is a deep niche. The niche is semicircular at the top and separated from the rock by a wide frame (Fig. 15: b). The back wall of the deep arched niche (approximately 2.2 by 2 meters) is decorated with a betyl (which Boehmer identified as a person's headgear) and the goddess Nike flying opposite it while holding a ribboned wreath (Fig. 16: a). The arm and hand of the goddess Nike are extended forward. During Boehmer's visit, only the left wing of the goddess Nike remained visible. To the left of the betyl, there were two damaged inscriptions. Additionally, a third inscription existed on the left wall of the niche. Today, the relief has been completely destroyed by both human and natural factors. The Oxford Dictionary defines a betyl as a "sacred meteorite stone." The term betyl is of Semitic origin, meaning "house of God." The veneration of stones or their sacred status has ancient roots. Betyls have been documented in historical sources and

archaeological records across various regions of Western Asia, Greece, and Rome (Marinatos, 2009: 73-80). The betyl appears on the reverse of coins from Roman emperors such as Trajan (Rowan, 2008: 35-39). The betyl depicted in the Gali Zardak relief can be compared to the betyl of Tang-e Sarvak II (Fig. 17) (Mohammadifar, 2010: 217). The goddess Nike holding a ribboned wreath of power also finds parallels with the Gotarzes relief at Bisotun (Ibid: 192), though the wings of the Nike figure at Gali Zardak differ from those at Bisotun and show greater similarity to examples from Hatra (Al-Salihi, 2023: 19).



◄ **Fig. 17: Tang-e Sarvak II (Mohammadi-Far, 2010: 217).**

The Gali Zardak relief (Mathiesen No. 137/Boehmer No. 2) has no surviving drawings, only a few poor-quality photographs (Fig. 16: c) and Boehmer's descriptions remain. This small relief is carved on a nearly vertical rock face, measuring about 0.90 meters tall and 0.80 meters wide. It shows a standing male figure on the right side with the head missing. The figure wears a knee-length tunic with loose trousers and a short cloak over it. In his left hand he holds either a sword or staff that reaches to hip level. The head, right shoulder and arm are completely gone. The left arm is separated from the body with the hand resting on the waist, probably holding the hilt of a sword hanging down from that point. This type of clothing is commonly seen in Parthian period statues and reliefs, like those found at Hatra. The three-dimensional statues of Parthian princes placing

their hands on their weapons in this manner are well-documented. His right hand rests above what appears to be an altar(?) positioned beside him. His right foot seems broader than the left, suggesting a side view perspective. Additionally, his chest appears relatively narrow. The altar-like structure beside him might represent the lower portion of a standing figure, possibly a woman wearing a full-length garment. Boehmer has compared this relief with the depiction of Vologases at Bisitun.

Gali Zardak Relief (Mathiesen No. 138 / Boehmer No. 4)

The relief is carved on the back wall of a deep arched niche (approximately 3.30 by 4.10 meters). It appears to depict a rider moving leftward, with the goddess Nike holding a ribboned wreath positioned above his head (Fig. 16d). Currently, the relief is heavily covered in soot due to fires lit by shepherds (Fig. 16e). The front edge of the relief is severely damaged. However, as can still be seen today, a 15-17.5 cm wide border of rock remains along the sides. Behind this border, the side walls have been carved vertically to a length of 3.27 meters and a height of 1.82 meters up to a protruding band-like feature, beyond which the vaulted arch begins. The height of the arch measures 3.45 meters from the floor at the front and 3.73 meters at the rear. The architect of this structure appears to have been familiar with arched constructions and decorative bands, similar to those well-preserved at Hatra. The rear wall was decorated with a relief sculpture. While the main portion of this relief is severely damaged, it can still be discerned that it originally depicted a horseman. The horse's back line and the point where the tail attaches remain clearly separated from the background. Of the rider, only the rough outlines of the upper torso are distinguishable, with the shoulder lines being the most clearly visible parts. One arm appears bent while the other was extended forward. The head and neck are completely destroyed. Behind the rider, a well-preserved figure of the goddess Nike is visible, appearing slightly brighter against the soot-blackened background. She wears a long skirt, with her right leg emerging from beneath it. Two wings sprout from her shoulders - the wing feathers rendered in a scale-like pattern and the arm feathers in linear designs, similar to depictions of Nike at Hatra (Fig. 18) (Al-Salihi, 2023: 19). The head remains discernible in its general outline. The left arm is bent while the right arm extends forward. In her right hand, she holds a well-preserved victory wreath. Two ribbons hung from the wreath - one remains clearly visible while only the end of the other survives. Victory

wreaths with hanging ribbons are known from Parthian period coins (Sarfaraz & Avarzamani, 2010: 41-42) and the Gotarzes relief at Bisotun (Mohammadifar, 2010: 192). The arched niche created for this relief is comparable in depth and scale to the Taq-e Bostan arch.

◀ Fig. 18: Relief of the goddess Nike at Hatra, Mrī period (Al-Salihi, 2023: 19).

Gali Zardak Relief (Mathiesen No. 139 / Boehmer No. 5)

The relief frame is square-shaped, similar to the frame of Relief No. 2. The relief itself has been completely destroyed. No dimensions are available, and no further information about it exists.

▲ Fig. 19: Remains of Relief No. 6 by Boehmer at Gali Zardak.

Gali Zardak Relief (Mathiesen No. 140 / Boehmer No. 6)

This relief is set within a rectangular frame measuring 0.74 meters in width. The visible portion of the relief shows part of a head surrounded by a circular halo (Fig. 19), similar to depictions of various deities at Hatra. On the left side of the relief, the beginnings of two strong, rigid rays are visible. Between them lies a thin, flaming ray, above which a horizontal line curves vertically upward. Boehmer suggests this may represent a type of horn and compares it to depictions of the god Nergal at Hatra (Fig. 20) (Al-Salihi, 2023: 101). However, at Hatra, horns always project vertically from the forehead, unlike the angled orientation seen in the Gali Zardak relief.

The Gali Zardak relief (Mathiesen No. 141/Boehmer No. 7) features a rock-cut niche with a rounded top at the center of the complex, now severely damaged. It depicts a standing male figure (Fig. 16f) with the head missing and the body, particularly the legs, heavily eroded. The dimensions are: height (from left shoulder) 1.80 m; width (at waist) 0.57 m; thickness 0.33 m; niche depth 0.34 m; niche base width 1.75 m. The broad-shouldered figure narrows at the waist. The right arm remains intact to the elbow, likely bent in a raised greeting gesture commonly seen in Hatra sculptures. The left hand probably grasped a sword hilt. As was typical for Hatra's kings (Safar & Mustafa, 1997: Nos. 197-199-212), the

▲ Fig. 20: The god Nergal at Hatra (Al-Salihi, 2023: 101).

▲ Fig. 21: Rabana rock relief (Khounani & Mohammadifar, 2018: 53).

Gali Zardak figure appears to have carried a dagger on his right side, as suggested by the stone's thickness at that point.

The rock reliefs of Pir Magrun (Rabana-Merquly)

The Parthian fortress of Rabana-Merquly is located on Mount Pir Magrun, approximately 43 km northwest of Sulaymaniyah city. The main settlement was concentrated at Rabana. At this site, a small altar (fire altar?) is carved into a nearly rectangular niche on a flat section of the mountain slope near a waterfall. Excavations in 2017 near this altar relief uncovered Parthian pottery and spearheads (Brown *et al*., 2022: 65, 70 & 73). Two nearly identical rock reliefs are carved into the cliff face at Rabana-Merquly on its western slope, likely associated with two gate entrances to the fortress. The two reliefs are situated about 4 kilometers apart. The following description is based on drawings, photographs, and publications by Brown *et al.* (2022: 930-931), Khounani and Mohammadifar (2018: 51-52), and Delshad Aziz Marf Zamua (2011: 230-235). Both reliefs portray bearded figures in right profile, each wearing long garments with belts, their right hands raised with palms facing inward, all set within irregular rectangular frames and executed in similar styles.

The Rabana Rock Relief

The Rabana rock relief (Fig. 21) is damaged, making it difficult to discern its details clearly. The relief is framed within an irregularly proportioned arched border. The frame itself measures 188 cm in height, 80 cm in width, and 13 cm in depth. The carved scene depicts a bearded male figure shown in right profile. The figure wears a conical headdress adorned with a diadem at its base, from which a hanging ribbon extends downward. His garment consists of a long robe that falls to just below the knees, featuring two parallel lines across the chest area that likely represent either decorative elements or the fastenings of a cloak. Notably, instead of the typical loose or pleated trousers (shalvar) commonly seen in Parthian period art, the figure appears to be wearing either boots or close-fitting leggings that extend beneath the robe - an unusual stylistic feature for the era. Other distinctive elements include a long waist belt with hanging ends, a beaded necklace around the neck, and the right hand raised with the palm facing inward and fingers slightly spread apart.

The Margoli Rock Relief

The Margoli rock relief (Fig. 22) also features an arched frame. The frame measures 203 cm in height, 90 cm in width, and 13 cm in depth. The surfaces of the relief are not smooth but instead exhibit a uniformly rough texture. The depicted figure has a rectangular beard and wears a tall, domed headdress. The base of the headdress is encircled by a diadem. The figure is clad in a long garment that reaches below the knees; however, due to the stone's surface condition, it is impossible to determine whether this is simply a tunic or a tunic with a cloak. Nevertheless, two short, wavy vertical lines are visible on the chest, possibly representing the fastenings of a cloak. A belt with long hanging ends is clearly discernible at the waist—the straps of Margoli's belt are longer than those of Rabana. A plain, undecorated ring encircles the man's neck. Similar to the Rabana figure, the Margoli relief also depicts the individual wearing trousers.

The striking similarities between the Rabana and Margoli reliefs suggest they were carved either contemporaneously or within a short time span of each other. However, several distinct differences are evident:

• Headdress: The Margoli figure wears a domed hat (Parthian tiara), while the Rabana figure has a conical headdress.

• Necklace: Margoli's plain neck ring (goshtāvar) contrasts with Rabana's beaded necklace.

• Beard: Margoli's beard appears fuller and longer, whereas Rabana's is more finely detailed and less dense.

• Eye Rendering: While both depict the right eye in profile, Margoli's is incomplete, while Rabana's is shorter and more naturalistic.

These stylistic variations may reflect either chronological differences or distinct regional workshops within the Parthian artistic tradition.

The Rabana and Margoli rock reliefs share common features with other Parthian-era artworks while also exhibiting certain regional distinctions. These two reliefs employ a framing style similar to Parthian Assyrian columns (dated to 12-3 BCE), which depict standing figures within arched niches (Mathiesen, 1992: 191). The headdresses with their diadems and hanging ribbons closely resemble those seen in the relief of (Mohammadifar, 2010: 196). This stylistic continuity suggests these reliefs belong to the broader Parthian artistic tradition, while their unique characteristics may reflect local variations in craftsmanship or chronological developments within the period. The beards of both figures can be compared to depictions

▲ Fig. 22: Merquly rock relief (Khounani & Mohammadifar, 2018: 51).

of Parthian and Elymaean men in Mesopotamia, such as the slave reliefs (1st century CE), the carvings at Masjed-e Soleiman (late 2nd to early 3rd century CE) (Kawami, 2013: 162-165), and various sculptures from Hatra (2nd century CE). Their raised hands, which may represent prayer or power, have roots in ancient Near Eastern art. The closest parallel to the Rabana-Margoli reliefs is the marble statue of tlw, King of Adiabene, from Temple III at Hatra (Fig. 23) (Safar and Mustafa, 1997: 250). The Rabana and Margoli reliefs are depicted in three-quarter view, a rare feature in Parthian art that was likely influenced by Hellenistic traditions (Khounani and Mohammadifar, 2018: 54). Their standing posture is also unusual, with slightly bent knees that suggest movement. The headdress worn by the Margoli figure resembles the Parthian tiara (Parthian tiara) but lacks the characteristic ear flaps. The closest parallels to Margoli's headdress appear in several Parthian-era depictions: a standing male figure (2nd century CE), a male head in a relief from Masjed-e Soleiman (50-150 CE), and a gift-bearer in the slave relief (first half of 1st century CE) (Kawami, 2013: 148-165). Significantly, all these sculptures portray political figures who may have also held religious authority, suggesting Margoli's headdress might similarly indicate a person of dual status. Mathiesen suggests that religious dedicators during what he terms the Middle Parthian phase (1-150 CE) wore long, pointed headdresses (Mathiesen, 1992: 28). Indeed, the priests of Hatra wore similar long headdresses lacking ear flaps. Furthermore, principal figures in the Dura-Europos wall paintings depicted wearing comparable headgear (Mathiesen 1992: 196, fig. 50). The three-quarter view likely reflects Hellenistic artistic influence, as this perspective became widespread following the Parthian conquest of Mesopotamia (Khounani & Mohammadifar, 2018: 54). This hybrid style ultimately became predominant in Parthian imperial art, blending Hellenistic techniques with local traditions. The adoption of the three-quarter view in the Rabana and Margoli reliefs thus represents a significant artistic development during this transitional period in Parthian visual culture.

▲ **Fig. 23: Marble statue of Tlw, king of Adiabene, from Temple III at Hatra (Safar & Mustafa, 1997: 250).**

Conclusion

The rock reliefs of the borderland province of Adiabene during the Parthian period reflect the profound influence of Parthian culture in this region of the Parthian Empire. This study, by examining thirteen rock reliefs across five areas (Herir, Amadiya, Khanes, Gali Zardak, and Pir Magrun), demonstrates that from an artistic and technical perspective,

these works exhibit not only Parthian stylistic and symbolic elements but also discernible Hellenistic stylistic influences and Mesopotamian motifs. Parthian elements like diadems, tall hats, hanging ribbons, rings of power, pleated garments, weapons, body proportions, standing postures, and expressive movements highlight Adiabene's cultural ties to the Parthian sphere, especially Hatra. Mesopotamian elements such as the presence of the god Nergal and the framing of reliefs reflect local influences in the Adiabene reliefs. The three-quarter view, the goddess Nike, and the dynamism are influenced by the Hellenistic style.

As mentioned in the political history section, Adiabene was under Parthian influence. This can be inferred from an examination of Adiabene's rock reliefs. The dating of these reliefs—with the exception of the "Bats-Herir" relief—goes back to the first and second centuries CE, coinciding with the peak of Parthian dominance over the region. Among the reasons for this attribution are the presence of Parthian artistic elements and the absence of the dynamic Roman style in Adiabene's reliefs, unlike similar examples in Hatra and Commagene, which were influenced by Roman art. Additionally, these reliefs show no signs of religious shifts (such as a turn toward Judaism or Christianity, as suggested by historical sources) during the Parthian period, though Christian traces (from the 3rd century CE onward) can be identified in the "Khanes" relief and the "Gali Zardak" complex. Another difference between Adiabene's reliefs and Parthian reliefs is the absence of "reclining figure" scenes, which were common in Hatra and other Parthian works. Instead, religious and political themes form the core of Adiabene's reliefs. Particularly in the "Gali Zardak" complex—which holds special significance due to its relatively hidden geographical location—depictions of the gods Nergal, Beital, and the goddess Nike with a ribboned ring (a ring of power) emphasize the region's religious importance. Furthermore, the portrayal of a horseman alongside Nike and the ring of power, as well as images of men with raised hands, likely reflect the political-religious function of these works. The rock reliefs of Khanes-Bavian, Rabana, Merquli, Amadiya, and Bats-Herir, considering their form, geographical location, and positioning, indicate objectives of political propaganda. The reliefs of Adiabene reflect the strategies of the Parthian Empire and local Adiabene rulers in identity construction. Their stylistic and thematic similarities to Parthian reliefs may signify Parthian dominance over Adiabene, the loyalty of Adiabene's rulers to the Parthians, and the consolidation of local legitimacy.

Endnote

It should be noted that Josephus Flavius's text contains inaccuracies and problems when compared to the Talmud and certain historical records. In the case of Izates II, he employs symbolic numbers—such as a 24-year reign, 24 daughters, and 24 sons (Josephus & Feldman, 1965: 437)—which hold importance in sacred texts. Moreover, Josephus's account of the Dahae and Scythians invading the eastern Parthian territories finds no mention in other sources, though two approximate parallels can be noted: the Hyrcanian tribal revolt of 57 CE and the Hyrcanian-Dahae alliance during the Parthian civil wars (the conflict between Gotarzes and Vardanes).

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Observation Contribution

All authors have equal contribution as the main contributors in this paper.

Conflict of Interest

The authors, while declaring compliance with publication ethics in references, declare the existence of any conflict of interest with a person or government agency.

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نقش‌برجسته‌های غرب شاهنشاهی اشکانی با تمرکز بر ایالت آدیابن

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چکیده

نقش‌برجسته، یکی از مهم‌ترین داده‌های باستان‌شناسی و هنری در دوران مختلف است. اشکانیان، به‌عنوان یکی از مهم‌ترین شاهنشاهی‌های دوران باستان، دارای جنبه‌های ناشناختهٔ هنری و تاریخی، به‌ویژه در زمینهٔ نقوش برجسته است. پارتیان با شیوه‌ای خاص حکومت می‌کردند و برخی از ایالت‌های آن، مانند آدیابن، از استقلال نسبی برخوردار بودند. آدیابن، در غرب این شاهنشاهی، به‌دلیل موقعیت استراتژیک خود در مرز بین دو امپراتوری اشکانی و روم، نقش مهمی در تحولات سیاسی، نظامی و فرهنگی منطقه ایفا می‌کرد. پژوهش حاضر به بررسی نقش‌برجسته‌های باقی‌مانده از ایالت آدیابن در دورهٔ اشکانی می‌پردازد. هدف اصلی این پژوهش، تحلیل جایگاه آدیابن در دورهٔ اشکانی و بررسی نقوش برجستهٔ این منطقه به‌منظور درک بهتر هویت پارتی و تأثیرات فرهنگی، سیاسی و مذهبی آن است. پژوهش با رویکرد توصیفی، تحلیلی-تطبیقی و به روش کتابخانه‌ای، با استفاده از داده‌های تاریخی، جغرافیایی و باستان‌شناسی انجام شده است. پرسش اصلی پژوهش این است که کدام‌یک از نقش‌برجسته‌ها در محدودهٔ ایالت آدیابن ازنظر سبکی می‌تواند در بازهٔ زمانی حکومت اشکانیان قرار گیرد؟ هم‌چنین، نقوش‌برجستهٔ آدیابن چه ارتباطی با هنر دوره‌های مختلف دارد و چه تفاوت‌ها و شباهت‌هایی با دیگر مناطق تحت نفوذ اشکانیان دارد؟ نتایج مطالعات نشان می‌دهد که درمجموع ۱۳ نقش‌برجسته در مناطق: باتس-حریر، آمدیه، خنس-باویان، گلی زردک و ربانا-مرقولی در محدودهٔ آدیابن دورهٔ اشکانی قابل‌بررسی است. این نقوش تلفیقی از هنر پارتی با عناصر محلی (به‌ویژه هترا) و هلنیستی است و بازتاب‌دهندهٔ هویت فرهنگی و سیاسی حاکمان این منطقه است. هم‌چنین، این نقوش نشان‌دهندهٔ اهمیت آدیابن به‌عنوان یک منطقهٔ مرزی کلیدی در دورهٔ اشکانی و تأثیرات متقابل هنری بین اشکانیان، روم و فرهنگ‌های محلی منطقه است. در نقوش برجستهٔ آدیابن، نقوش افراد لمیده و هم‌چنین نشانی از تغییرات مذهبی به یهودیت و مسیحیت مشاهده نمی‌شود، بلکه سنت‌های پارتی و منطقه‌ای که در حوزهٔ وسیعی از مناطق اشکانی وجود دارند، نمایش داده شده‌اند.

کلیدواژگان: آدیابن، نقش‌برجسته، اشکانی، هترا، هلنیستی.

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A Study on the Development and Evolution of the Ancient Goat Motif in the Decorative Art of Iran (From Antiquity to the Medieval Islamic Period)

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Abstract

The mountain goat motif is regarded as one of the oldest applied patterns in both the art of the ancient world and that of Iran. Undoubtedly, this motif, which conveys essential symbolic meanings of fertility, life, and protection, remained widespread until the close of the Sasanian period and continued to flourish during the Islamic era. Numerous studies have examined the various representations of the ibex across different regions and historical periods, but none have addressed the process of its emergence, evolution, or transformation, nor identified the motifs that resulted from this transformation in the Islamic period. One of the central questions this research seeks to address is: What has been the process of development and transformation of the ibex motif and its prominent horns in ancient Iranian art, and what artistic themes did it embody? How was it reinterpreted in Islamic art, and what new meanings did it acquire? Which decorative motifs in Islamic art can be traced to this evolution and metamorphosis? The research method is descriptive, analytical, and comparative, based on a detailed study of motifs. Selected examples of the ibex motif and its horns, as well as other decorative motifs in ancient Iranian art through to the medieval Islamic period, were examined, illustrated, and analyzed. The findings from the analysis and comparison of motifs indicate that the ibex motif, consistently associated with the sacred tree of life (alluding to the Asurik tree motif), initially appeared in the form of spiral horns and later became integrated with the sacred plant of life. Over time, this fusion was further combined with the wings of birds. The resulting composite symbol of the triad—ibex horns, sacred plant, and bird wings—formed the basis of the early Islimi (Arabesque) and Khatai motifs of the Sasanian period. These motifs, with their geometrically symmetrical spiral structures resembling the wheel of the sun (chakra), subsequently developed into the Islamic versions of the Islimi (Arabesque) and Khatai motifs.

Keywords: Ibex Motif, Goat's Horns, Islimi (Arabesque) and Khatayi, Decorative Motifs, Ancient Iran.

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Introduction

The ibex and ram, characterized by their long, spiraling horns, represent some of the oldest and most frequently recurring motifs in the art of various periods across the Iranian plateau. Consequently, diverse representations of these animals are observed throughout Iranian art history. In rock carvings from Timareh and cave paintings in Lorestan, including Mir Mallas, Dusheh, and Homyian, as well as figurines recovered from Ganj Dareh in Kermanshah (9th and 8th millennia BCE), the ibex is depicted with an elongated body and crescent-shaped horns. The discovery of several ibex skulls with prominent horns on the floor of the hall within the "Great Structures" (likely a sanctuary) at Sheykh-Abad, Harsin (9800–7600 BCE), underscores their significance and sacred status among prehistoric Iranian communities.

The continuous recurrence of various ibex and ram motifs is evident on pottery from Tepe Bakun, Tepe Hissar, and Sialk, as well as on stone vessels from Jiroft, extending through Elamite, Achaemenid, and Sasanian artifacts. A salient feature in most of these depictions is the emphasis on their horns and their juxtaposition with the sacred plant (referencing the ancient concept of the Tree of Assurík and the ibex).

Given that composite motifs integrating human, animal, and plant elements are characteristic of ancient Iranian art and culture (e.g., Gopets, lamassu, griffins, Trees of Life, etc.), modern classifications that strictly separate vegetal, faunal, and human motifs do not fully apply, as these motifs are often interconnected. For instance, Mashy and Mashyana, the cypress tree, the ibex, and the Tree of Assurík all possess humanistic identities. Based on this understanding, motifs and symbols with similar or shared meanings undergo fusion, combination, or substitution, evolving into new forms or symbols. While their appearance may transform, their inherent vital characteristics are preserved throughout this process. Consequently, fundamental motifs and symbols are consistently maintained across ancient cultures.

In light of these interpretations, how could the ibex horn motif, which references the narrative of the Tree of Assurík and was utilized in various artistic forms—ranging from naturalistic to stylized and abstract representations—from the prehistoric era until the late Sasanian period, suddenly disappear in the Islamic era? The importance of this research lies in examining the evolutionary trajectory and transformation of ancient motifs to trace prominent motifs and symbols within Islamic arts. These

might be the result of the combination, fusion, and evolution of ancient motifs and symbols, reimagined and refined with Islamic concepts.

Research Questions: What was the evolutionary trajectory and transformation of the ibex motif and its emphasized horns in ancient Iranian art, and how was its recreation in Islamic art perpetuated through changes and metamorphoses in terms of themes and forms? Which decorative motifs in Islamic art are the result of this evolution?

Research Objective

The aim of this research is to identify, analyze, and examine the genesis, transformation, and continuity of the ibex motif up to the medieval Islamic centuries.

Research Background

Roman Ghirshman and other archaeologists have made numerous references to the pictorial ibex motif across various periods of Iranian history. Among them, Ernst Herzfeld has interpreted this motif in Iran more extensively than others, comparing it with similar motifs in other Eastern lands. He divides Sasanian art, following the Hellenistic and Parthian periods, into three evolving phases. In the late Sasanian era (third period), the primary artistic impulse was to incorporate ancient Iranian symbols that had either endured or remained alive in the subconscious of Iranians (Herzfeld, 1381: 344). In Arthur Upham Pope's writings, the ibex motif is described as a prevalent design in ancient Near Eastern art and a symbol of power (Pope, 1388: 10). J.C. Cooper praises the majesty of the ibex on mountain peaks and links its crescent-shaped horns to the moon, rain, and fertility. In her view, the ibex's horns signify supernatural power, divinity, strength, victory, procreation, and fertility (Cooper, 1379: 218).

Gholamreza Masoumi refers to the early humans' interest in depicting divine manifestations and their worship through animal symbols, attributing the eagle, lion, bull, deer, and ibex to the sun. He believes that every ancient civilization considered the ibex a manifestation of a beneficial natural element, such as: the angel of rain in Lorestan, a symbol of abundance and the deity of vegetation in Elam, and so on (Masoumi, 1349: 182 & 183). Fatemeh Modarresi, in the Encyclopedia of Iranian Mythology, discusses the importance of the ibex in Iranian myths as a center of power. Citing the views of Dadvar, Mansouri, and Pourkhaleghi, she notes that the ibex with unusually large, moon-crescent-shaped horns

is depicted on pottery. Sometimes, the horn symbolized the moon, and in most artistic creations, Anahita (the goddess of water) was embodied as an ibex. It is a symbol of life force, creator of power, and guardian of the Tree of Life. It also symbolized abundant harvest and the manifestation of plant life. After the dominance of the sun, the ibex was named the sun animal and is a zoomorphic symbol of the sun in Lorestan art. Moreover, quoting James Hall, Modarresi writes that it is a special characteristic of Shiva that he holds an ibex in one of his left hands, and this concept of the god of animals might have originated from the Indus Valley. In Egypt, Satis, an Egyptian goddess associated with the annual inundation of the Nile, wears the Upper Crown adorned with ibex horns, and was probably worshipped as an ibex initially (Modarresi, 1401: 262). Majidzadeh and Morteghart have written extensively on the ibex motif in Mesopotamian art and its reciprocal influence on Iranian art. Taheri, who has conducted numerous studies on the ibex in Iranian thought and writings, states that the goat, as the first domesticated animal, dates back eleven thousand years and served as a food source for Iranians, contributing to the expansion of human societies in this region. The ibex holds significant importance in Avestan texts and is referred to as "Aza" (Taheri, 1396: 164).

Chevalier and Gheerbrant analyze the concept of horns in the art and diverse cultures of world civilizations. They discuss concepts such as: the ram's horn on Alexander's helmet symbolizing the ram or Amun; the sun symbol (goat's horn) and the moon (cow's horn) and their connection among Sumerians and Indians; their meaning as power and strength, linga in Sanskrit and corno in Latin; the immortal horns of Agni, sharpened by Brahma; and the celestial ram in Dogon beliefs. Furthermore, in Jewish and Christian traditions, the horn signifies a force that embodies the concept of light, lightning, and thunder. "And when Moses came down from Mount Sinai… his face shone." The phrase "shone" in the Vulgate (the Western Bible) was specifically translated to mean "horn," which is why medieval painters depicted Moses with horns on his forehead. These two horns resembled the moon in its waxing phase. The four horns of the altar in the Temple symbolized the four cardinal directions of space, representing the infinite expanse of God (Chevalier & Gheerbrant, 1385, Vol. 4: 1-6).

Ghorbani and Sadeghi, in their article "A Comparative Study of the Ibex Motif in Rock Carvings of Eastern and Western Iran (Case Study: Sarbisheh and Oraman)," and Ashtari-Lorki and Kolahkaj, in their article "Visual Comparison of Ibex Motifs in Rock Carvings of Lorgardou and

Kiaras in Khuzestan with Rock Carvings of Timereh, Mazayen, and Khoravand in Isfahan and Central Provinces," have examined the role of the ibex in their respective regions. Behnood, Afzal Tousi, and Mousavi-Lor, in their article "A Study of the Historical Evolution of the Ibex Motif during the Sasanian Period," investigated the evolution of the ibex motif in a realistic manner, primarily focusing on the technical evolution and development of Sasanian artworks.

Most of the valuable studies mentioned above have described and analyzed this motif from visual, historical, and mythological perspectives. Although researchers have attempted to study and examine the ibex motif and its convoluted horns from various dimensions, and some of them (such as Pope and Herzfeld) have referred to the succession of this motif in the Islamic era, none have provided an analysis regarding its succession and evolution after Islam, and the resulting motifs from this evolution have not been sought in the remaining artworks.

Research Methods

The research method adopted is descriptive-analytical, which is based on the comparative examination of motifs. Data collection was conducted through library resources, and the research data was compiled via study, observation, and written sources. The statistical population of the study includes the ibex motif and its horns, as well as decorative motifs in ancient Iranian art up to the medieval Islamic period. The samples consist of thirty-one motifs from pre-historic Iranian works, twenty-nine from historical ancient Iranian periods, and eleven from the Islamic period, all of which have been analyzed in nine tables. The samples were selected with a specific purpose, and every effort was made to utilize drawings of the motifs rather than actual images of the artworks. In designing the samples, the motifs were initially sketched with a pencil and then systematically executed using Photoshop and CorelDRAW software, followed by analysis through both interpretive and illustrative methods. The artworks are organized chronologically from ancient to modern to effectively demonstrate the process and accurately analyze the evolution of the motifs.

Theoretical Foundations: The Ibex Motif in Ancient Iranian Culture, Religions, and Pahlavi Texts

Mohammad Naseri-Fard, an expert in rock carvings in Iran, states in an interview: "More than 90% of Iran's rock carvings are of the ibex, and the

ibex motif is a symbol of ancient Iran, carrying themes of water-seeking, fertility, abundance, and protection" (Pārsāzādeh, 1394: 269).

• **The Guardian Ibex: Naseri-Fard believes:** "In ancient culture, the ibex was an expression of an angel, sought for help in times of hardship, and the root of this belief goes back to one of ancient Iran's myths" (Pārsāzādeh, 1394: 269). In the written sources studied, the ibex motif is often depicted alongside a sacred plant or symbol, guarding it. The sacred tree or plant in ancient Iranian culture represents various symbols: the cosmos, life, the sun, existence, and an embodiment of love, worship, religion, and a symbol of water, associated with the Mithraic ritual and the goddess Anahita, consistently protected by the ibex with its long, winding horns. "Among the ritual ornaments of Lorestan, the Marlik bronze necklaces, glass pendants from Bactria, and even Achaemenid-period artifacts, the ibex motif is frequently seen as a protective amulet, indicating the virility of the male ibex and its connection to benevolent deities" (Taheri, 1396: 165). The Avesta also states, "To mothers who have given birth to a stillborn child, goat's milk should be fed" (Vendidad, Fargard 5, Band 52)[1].

• **Symbol of the Moon:** The long, curved horns of the ibex are considered the closest depiction to a crescent moon. One of the moon's attributes is "promoting greenery," and the moon is regarded as the source and overseer of life and fertility on Earth. Ancient Iranians believed the moon was the source of honey, and honey was considered a purifier of fruits and a protector against mortality. Therefore, the moon was regarded as the guardian of fruits and plants (Taheri, citing Vermazen, 1396: 166).

• **Symbol of Water-Seeking:** "According to ancient Iranians, the ibex is the manifestation of an angel sent by God for the survival and continuation of human life. Hence, wherever there is a watercourse, we see numerous ibex motifs, symbolizing water-seeking, and expressing the unique value and importance of water to the ancient Iranians. Similarly, the French archaeologist Stanley Cohen, in an article titled 'The Ibex Motif on Ancient Iranian Pottery,' identified it as a symbol of water-seeking" (Interview with Naseri-Fard, Pārsāzādeh, 1394: 270).

• **Symbol of the Deity Bahram:** The eighth and ninth manifestations of the deity Bahram were the mountain ram with spiral horns and the male ibex with sharp horns. "Bahram, created by Ahura Mazda, charges towards the demons in the beautiful body of a mountain ram with intricately twisted horns" (Bahram Yasht, Karda 8, Band 23)[2].

• **Connection to the Story of Mashi and Mashiane (or Mithra and Mithriane):** They are the first Iranian parents. King Kayumars or Gayomartan (the living immortal) was killed by Ahriman after thirty years of life. Two drops of the water that were behind him fell to the earth and sank into the soil. That plant remained in the ground for forty years, and then a two-stemmed plant, like rhubarb, grew from it, which was called Mashi and Mashiane. Their food was the milk of a white goat (Bundahishn, Chapter 9, Band 103)[3]. After fifty years, they had offspring, all of whom they ate. Until they had an offspring whom they did not eat and named Siamak. He is the ancestor of all humans (Taheri, citing Biruni, 1396: 34).

• **The Story of the Asurik Tree:** The most frequent depiction of the ibex with long, winding horns is associated with the Asurik tree. From prehistoric rock carvings to works of the Islamic period, this motif appears repeatedly and alternately. The Asurik tree is the name of a rhyming story in Pahlavi and is among the few non-religious texts that have survived from this language (Navabi, 1386: 7). This epic poem concerns a symbolic debate between a tree (likely a date palm) and an ibex. In this debate, each tries to prove its superiority while belittling the other. It begins with the tree's boastfulness (Stanzas 1-28 of the poem), followed by the date palm's humiliation by the ibex (Stanzas 29-46 of the poem), and finally concludes with the ibex's boastfulness and victory, leaving the date palm dejected (Stanzas 47-117 of the poem)… (Aryan, 1398: 25).

The Genesis, Evolution, and Transformation of the Ibex Motif from Prehistory to the Early Islamic Period

The various designs of the ibex motif in art from prehistory to the early Islamic period can be broadly categorized into three types:

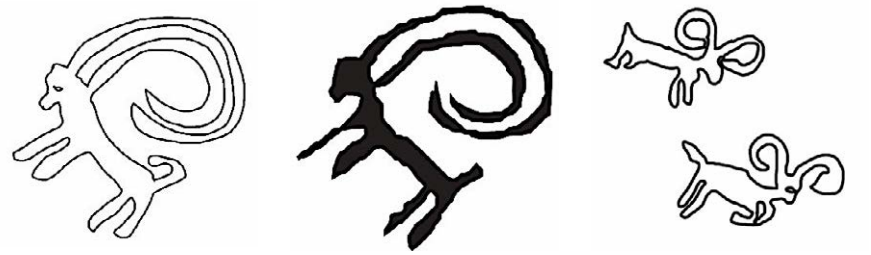
1. The sequence of the ibex motif alongside the sacred plant, presented realistically and evolving purely in terms of technique.

2. The ibex and sacred plant motif gradually becoming abstract, to the point where the ibex is eliminated, and only its horns remain alongside a plant symbol.

3. In the process of abstraction, the ibex and sacred plant motif integrates with other symbols or is replaced by similar symbols. Consequently, new motifs are created that, despite not having significant visual resemblance to previous motifs, retain the symbolic characteristics of their constituent elements.

It should be noted that in each period from prehistory to the late

Sasanian era, all three methods were employed in the depiction of the ibex and the Tree of Life. For instance, in Sasanian art, this motif exists in three forms: realistic, simplified and abstracted, and evolved. The earliest ibex depictions are carved realistically on stones and cave walls. The oldest among them appear to be on the Timareh rock carvings, which contain the earliest human-designed spirals in the form of the ibex's winding horns (Fig. 1). This looks great! The translation captures the nuances of the original Persian text, especially the scholarly tone and the specific terminology. I've aimed to maintain the flow and clarity, ensuring that the symbolic meanings and research methodology are accurately conveyed in English.

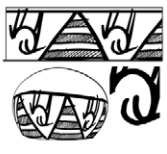


◄ **Fig. 1: Iranian Ram Carvings, Timareh Rock Art, Estimated Age Approximately 40,000 Years (Authors, 2024).**

The significance of the ibex motif lies in its horns. Consequently, an emphasis on horns is evident in carvings from prehistoric and historical periods. Table (1) provides a general overview of selected examples of this motif across different eras of Iranian art. Images (A), (B), and (C) depict ibexes rendered in prehistoric artifacts, where the emphasis on horns is a common characteristic. Image (B) features stylized ibexes positioned on either side of a triangular shape, serving as an abstract, vegetal symbol for agricultural lands. This recurring motif alludes to the story of the Asurik tree and the protective ibex. Image©, from the collection of Shush goblets, exhibits a greater degree of stylization than the preceding examples. The hallmark of this motif is its long, spiraling horns that conform to the geometric principle of the Abbasi (logarithmic) spiral. Frequently, the horns of the ibexes on Shush goblets encircle a plant symbol, rather than being depicted in isolation. Image (D) is an example from the Jiroft civilization, engraved on soapstone vessels. In Jiroft artifacts, the ibex is consistently depicted alongside the Asurik tree. Although their design style is naturalistic, the rendering of the lines as delicate curves guides the motif towards ornamentation. Image (E) shows seals and buttons engraved with a naturalistic depiction of an ibex, where its horns seem to guard a plant symbol. Images (F) and (G), from the Elamite and Luristan civilizations

respectively, also reference the story of the Asurik tree with protective ibexes. These motifs are more stylized than their predecessors. A significant point is that the rendering of the ibexes approaches a vegetal form, while the depiction of the trees of life tends towards an animalistic quality. Despite their visual convergence, they retain their symbolic characteristics. The narrative of the ibex and the plant continues into the Achaemenid period (Image: T). Achaemenid and Parthian rhytons were often crafted with ibex heads or heads of animals conceptually substitutable for the ibex. The crescent-shaped cylinder of the rhyton refers to the moon, a symbol associated with the ibex. Concurrently, it serves as a vessel for sacred plant essences consumed by kings and nobles, underscoring and reiterating the story of the ibex and the plant with the aforementioned mysteries, codes, and meanings. The hilt of an Achaemenid sword (Image H) conveys a similar narrative, with two ibexes flanking a hilt shaped like a lotus flower (the Achaemenid rosette), providing guardianship. The lotus flower (flower of Anahita) symbolizes love and femininity and is an Achaemenid emblem, regarded in Achaemenid culture as a symbol of purity (Pārsāzādeh, 1394: 264), peace, and life (Moadarresi, 1401: 959). The Asurik ibex and the guardian ibex motif appear in various forms in Sasanian art – naturalistic (Images K and L), stylized, and abstract (Table Six). The importance of this motif is such that it is incorporated into the crowns of some Sasanian kings. In the depiction of Khosrow Anushirvan (Image K), two spiraling horns are positioned on either side of a moon symbol. What distinguishes Sasanian art from other ancient periods is the combination, synthesis, and substitution of motifs and symbols, leading to the creation of new designs that have gradually become abstract. The result of this process is the creation of motifs that, while unique, encapsulate several significant ancient symbols, preserving their vital elements within their unity. This is akin to the interpretation of "multiplicity in unity" discussed in the context of Islamic art.

Table 1: Examples of ibex horn motifs in Iranian art, from prehistory to the Sasanian period (Authors, 2024). ▶

		
A: Types of Depicted Ibexes, Bakun (Taheri, cited in: Alizadeh, 2017: 168)	B: Ceramic Bowl from Tepe Shahrīār (4800-5200 BCE, National Museum 3545)	C: Motif from Shush I Pottery (Pope & Ackerman, 1938: 220)
Emphasis on horns in the ibex depiction and various designed horns.	Ibex and plant symbol (agricultural lands represented by a triangle).	Simplified (stylized) ibex, with an emphasis on exaggerated horn design.

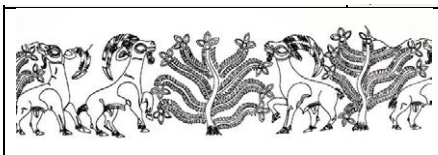
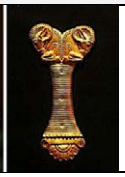
 	 
D: Ibex Motif Flanking the Tree of Life (Referencing the Asurik Story), (Majidzadeh, 2003: 28)	E: Various Seals, Tepe Giyan, Nahavand (Herzfeld, 1941: Plate XVI)
Depiction of the Asurik tree and ibex story in a realistic style with decorative elements.	Realistic depiction of ibex and sacred plant motifs.
 	 
F: Engraved Motifs, Elamite Seals (Porada, 1975: 73)	G: Engraved Motifs, Luristan (Herzfeld, 1941: 171)
Two ibexes flanking the Tree of Life (referencing the Asurik story). The ibexes approach a vegetal form, and the sacred plant approaches an animalistic form.	
 	 
H: Achaemenid Sword Hilt (Taheri, 2007: 191), Reza Abbasi Museum; T: Achaemenid Rhyton (Taheri, 2017: 190), 5-4th Centuries BCE	K: Depiction of Khosrow Anushirvan on the Saint-Denis Crystal Dish (Herzfeld, 1941: 325); L: Gilded Plaster Fragment, Chal Tarkhan, Sasanian (Taheri, 2017: 45), National Museum Archive
Two ibexes and a rosette (lotus flower) in the center and at the end of an Achaemenid sword hilt, referencing the Asurik story. Golden rhyton in the shape of an ibex head; its body serves as a vessel for plant essences, referencing the ibex's guardianship of the plant.	Horns positioned on either side, resembling the moon, a symbol associated with the ibex, replacing the sacred plant. Realistic depiction of the Asurik tree and ibex story in the gilded plaster fragment.

Table Two: presents examples of ibex motifs with exaggerated horns, emphasizing this feature. Based on the motifs in Table 1 and the current table, it appears that floral symbols were abstracted earlier than animal symbols.

• A: The vegetal symbol consists of two concentric circles and curved lines surrounding the horns. The horns themselves are also designed in a delicate manner, resembling plant forms.

• B: The vegetal symbol takes the form of an abstract sun or lotus flower.

• C, D, E, F: The horn designs resemble tree branches.

• D: A dog replaces the vegetal symbol.

• E: Horns resembling plant stems and leaves flank an abstract, cruciform motif representing the sacred plant.

• F (Tell Bakun pottery): The ibex with its branch-like horns stands on a crescent shape, likely to represent the moon (a symbol associated with the ibex). On either side, there are abstract vegetal motifs with a cruciform structure.

This table illustrates the simplification (stylization) and abstraction of motifs, particularly vegetal ones. It also demonstrates the early integration of ibex horns with vegetal forms, the juxtaposition of shared symbols such as the moon and the ibex, and the substitution of other symbols for the sacred plant.

Table 2: Evolutionary stages of the ibex motif (Authors, 2024). ▶

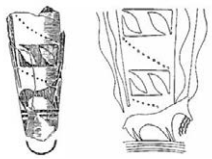
		
A: Cylinder seal impression, Susa (Herzfeld, 1932: Pl. XVII)	B :Prehistoric pottery motif, Sialk (Pope, Ackermann, 1938: 231)	C: Sialk pottery motif, Chalcolithic period, 3800-3700 BCE, Kashan (Taheri, 2017 :187)
The ibexes are simplified (stylized), but the vegetal symbols have become abstracted. Emphasis is placed on the ibex horns and the sacred plant symbol. The ibex horns have approached a vegetal structure.		
		
D, E: Tal-e Bakun, Persepolis, 4200 BCE (Herzfeld, 1932: 48)		B Tal-e Bakun, Persepolis (Herzfeld, 1932: Pl. VIII)
Abstraction of vegetal symbols, approximation of ibex horns to vegetal structures, and the replacement and/or coexistence of the ibex (or ibex horn) with other symbols.		

Table 3: As previously discussed, distinct categories of "animal" and "plant" motifs do not exist in ancient art and culture. Many designs are actually composites, blending human, vegetal, animal elements, and other symbols. This table highlights composite motifs that integrate the ibex symbol, or its horns, with other symbols, particularly vegetal forms and the cruciform.

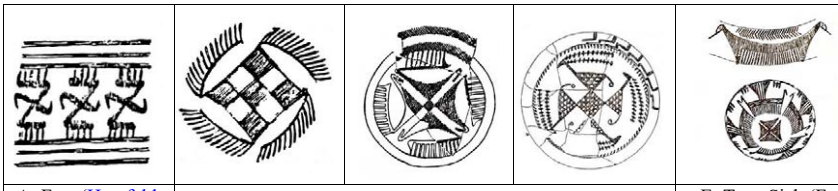
• Row 1 (Figures A-E): Here, the ibex and the sacred plant (likely palm leaves) are combined. This is reminiscent of the myth of the zu bird and the tree. The composite designs are arranged to form one or more cruciforms. The cruciform is constructed from the rotational symmetry of golden, Shah Abbasi (logarithmic), and Archimedean spirals, and is associated with the horn and moon symbols. Attention is also paid to the crescent shape of the horns, especially in figures A, D, and E. An interesting detail in figure E is the depiction of juxtaposed ibexes, which also form a vegetal symbol. The ibex horns are rendered separately and in a cruciform manner, placed centrally and along the rim of the plate.

• Row 2 (Figure F): The motifs described in this row represent the abstraction of these composite designs of horns, plants, and cruciforms.

• Row 3 (Figures G-I): This row showcases another example of the synthesis of three valuable symbols from ancient culture and art. The exaggeration and enlargement of the horn symbol, due to its semantic importance, along with the reduction in the size of the ibex body, are characteristic features of these motifs.

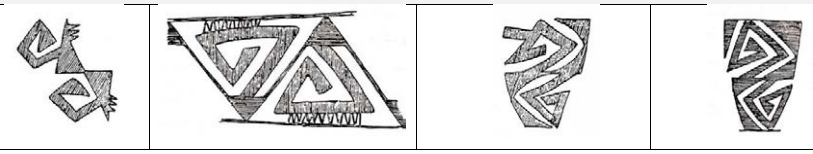
• Figure G: Depicts two ibexes viewed from the front in a stylized manner. The spiral horns of the two ibexes form a cruciform. Additionally, vegetal symbols are placed between the horns of each ibex, and a solar disk symbol is positioned between the horns of the two ibexes.

• Figures H and I: Portray the ibex in profile. The horns, drawn from the base of a symmetrical spiral that thickens at the midpoint of the curl, encircle and guard vegetal symbols.



A: Fars (Herzfeld, 1932: 34) | B, C, D: Tepe Rigi (Fars), (Herzfeld, 1932: 23) | E: Tepe Siah (Fars), (Herzfeld, 1932: 22)

Fusion of the Cross, Ibex (or its Horns), and Plant (Referencing the Tale of the Asurik Tree and the Guardian Ibexes): A: The fusion of the horns of two ibexes, forming a cross in the center. B: Horns shaped like plant leaves (possibly palm), simplified ibexes, ibex bodies designed as a cross, or a cross formed from four ibexes. C: Ibex bodies shaped like palm leaves, a cross formed from ibex horns in the center of the design, with each horn referencing a lunar symbol. D: Possesses all the aforementioned characteristics but rendered in a completely abstract design. E: The placement of four ibexes in a cross formation, where each form is composed of the fusion of two conjoined ibexes and the vegetal symbol of a date palm leaf. The horn symbol is shaped like a cross and appears separately in the center of the design



F: Combined and Abstract Motifs from the Fusion of Ibex Horn Symbols, the Cross, etc. Tal-e Bakun (Fars), (Herzfeld, 1932: 35)

All four designs are abstract and fused forms of the ibex horn, plant symbols, and the cross.

G - Tal-e Bakun, Marvdasht (Herzfeld, 1932, Plate XII)
H, I - Susa (Alvarez-Mon, 2020: 80)

Fusion of the Ibex/Ibex Horn with the Cross and Plant Symbol Between the Horns or at the Center of Each Horn: G: Placement of two ibexes with exaggerated symmetrical horns in the form of a cross. H & I: Placement of three ibexes in profile in the form of a cross, cross symbols in the center of the spiral of each horn and between the horns.

◄ **Table 3: Simplification (stylization) and abstraction of the ibex and sacred plant motif, and its fusion with other motifs and symbols (Authors, 2024).**

Table 4: The Step-by-Step Evolution and Abstraction of the Motif In the gradual process of evolution and abstraction, the body of the goat is progressively omitted, and all its associated concepts are manifested solely within its horns. This condensation is not limited to the zoomorphic symbol but also extends to the botanical emblem. As evident in figures (A, B, and C), the designer has entirely removed the goat's body or reduced it to a minimal form (the triangular shape in figure C). Figure (A) comprises alternating crescents, linked to the lunar symbol, which encompass the sphere of Mithra. Figure (D) depicts a realistic ornament in the form of an ibex head. However, in the ornaments of figures (E and F), the goat is eliminated, and its horns are integrated with the sacred plant, with both abstracted into symmetrical Archimedean spirals.

Table 4: Elimination of the ibex body, retaining the horn spiral and vegetal symbol (Authors, 2024). ▶

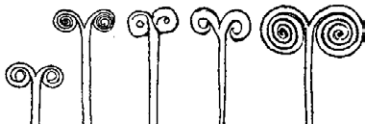
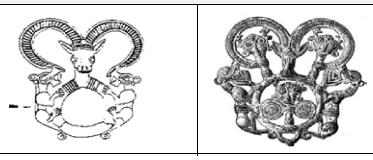
		
A: Motif from prehistoric Susa ceramics (Pope, Ackerman, 1387: 1); Prehistoric Susa ceramic (Pope, Ackerman, 1399: 20).	**B**: Motif from prehistoric ceramic, Susa I (Pope, Ackerman, 1387: 220)	**C**: Ceramic goblet, Tepe Buhlan, Khuzestan, 4300-4000 BCE, National Museum 2419
Elimination of the Ibex Limbs and Abstraction of the Horn Motif into a Moon-Related Symbol, Alongside the Sacred Plant Motif.		
		
D: Gold ornaments, ibex head, Tepe Hissar Damghan, Philadelphia University Museum (Pope, Ackerman, 1387: 20), Authors. **E, F**: Earrings, silver, Tepe Giyan, 2200 BCE, Herzfeld Collection (Pope, Ackerman, 1387: 287).		
Integration of the Abstracted Horn and Sacred Plant into a Symmetrical Spiral Symbol (Archimedean). According to the aforementioned content, these types of ornaments were used for protection against the evil eye and similar threats.		

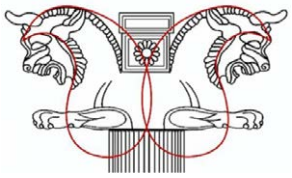
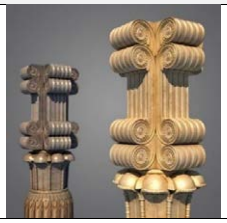
Table 5: The Abstraction of Mythological Motifs Over time, the fusion of these two mythological motifs transitions from a concrete representation to an abstract process. In artwork (A), the body of the bull is depicted as two horns, with the botanical symbol placed at its center. In this image, the distinct forms of the horn and the plant are still discernible. However, motif (B) presents two abstract horns rendered with a botanical quality, and the plant symbol, shaped like a triangle, is positioned in its center. A fusion of the horn spiral and the plant in the lower part of the motif creates an ornamental and abstract composition of the two symbols.

The second row of the table references motifs from Lorestan art depicting composite creatures—fusions of human, animal, and plant elements. Motif (C) consists of a goat and a ring, signifying the sphere of Mithra, flanked by two protective composite beings. Motif (D) shows the same structure with greater complexity, where the horns of the goats protect the composite human-animal-plant figures. Within the ring, two horn spirals guard the composite human-animal-plant being. Image (E) is a fusion that has become more simplified and abstract than images (C) and (D). Image (E) also represents a combination and fusion of horn, bird wing, and sacred plant motifs, which, through the process of abstraction of composite motifs (image Z), have been summarized into two geometric shapes: a spiral (symbolizing the horn) and a triangle (symbolizing the plant).

Achaemenid art, too, is a collection of repetitions and sequences of combinations and fusions of ancient symbols that, in its unique style and manner, undergoes a process of evolution and development towards abstraction and condensation. Achaemenid columns are clear examples emphasizing, repeating, and sequencing the narrative of the Asurik tree and the mythological goat protecting the lotus flower (the Achaemenid symbol). This is manifested in composite creatures of goats, bulls, and horses flanking the Achaemenid rosette flower (lotus) (thumbnail image). Furthermore, these two figures are placed above and on the sides of the column, which symbolizes the lotus flower, and are designed in a way that resembles a Boteh jegheh structure (symbolizing the horn), protecting it (image H). The column's decorations are also made of symmetrical Archimedean spirals, which symbolize the protective goats revolving around the lotus flowers of life (image K).

	
A: Elamite silver necklace, circa 3100-2900 BCE, Kew Pittings.	**B**: Necklace, Ziwiye, Tehran Museum (Ghirshman, 1346: 311); and an arabesque, part of the necklace ornamentation.
The body of the bull in the form of two horns and as a *boteh-jegheh* spiral, with the sacred plant in its center.	Composite creatures in Luristan art in abstract form: **E** - fusion of ibex, plant, and bird wing; **F** - abstract fusion of ibex, plant, and composite creatures.
	

◀ **Table 5: The evolution of the horn motif from the Elamite period to the Achaemenid era (Authors, 2024).**

C: Luristan bronze standards, 6th century BCE, Collection of Ms. Christine R. Holmes (Pope, Ackerman, 1387: 328).	**D**: Luristan bronze standards, Iron Age, Reza Abbasi Museum (Talaei, 1387: 67).	**E**: Luristan (Herzfeld, 1381: 160).	**F**: Luristan (Herzfeld, 1381: 160), compared with example (A) in Table 4.
Composite creatures in Luristan art, repetition and sequence of the ibex motif and plant, replacement of the sacred plant with composite human-plant creatures.		Composite creatures in Luristan art in abstract form: **E**: fusion of ibex, plant, and bird wing; **F**: abstract fusion of ibex, plant, and composite creatures.	
			
G: Regular or symmetrical spiral, decorations on the central relief of the North Staircase of the Apadana, Xerxes seated on the throne, Persepolis, National Museum.			
The motif of the Assyrian tree and guardian ibexes in an abbreviated form, symmetrical (Archimedean) spiral: the horns of the ibexes and the triangle between two spirals: the sacred Tree of Life.			
			
H: Achaemenid capital.	**I**: Achaemenid capital (Pouyanou, 2017), (URL4), design by Authors.		
Composite creatures with a structure based on the *boteh-jegheh* (ibex horn) on either side of the Achaemenid rosette flower (sacred Tree of Life).	Repetition and sequence of the motif of the Assyrian tree and guardian ibexes in Achaemenid columns, two composite creatures on either side of a lotus-shaped column (Achaemenid symbol), and also the Achaemenid rosette flower (lotus) in the center of the two composite creatures.		
			
K: Water lotus within a regular spiral, Achaemenid, Persepolis (Taheri, 1396: 93).			
Decorations of Achaemenid columns: the symmetrical spiral (ibex horn) revolving around the lotus flower (sacred Tree of Life).			

Sasanian Period

The Sasanian era inherited the cultures, traditions, and arts of previous periods in Iran, incorporating millennia-old structures, symbols, and motifs. This period marks a pivotal turning point in the evolution and development of the goat motif and its horns in ancient Iranian art. The motif of the goat and the tree of life, which had been combined, fused, stylized, or abstracted in various forms, now merge with bird wings during this period. While examples of this fusion exist in pre-Sasanian art, particularly in Lorestan, it became a fundamental symbol in the art and culture of the Sasanian era. The visual manifestation of this fusion sometimes inclines towards botanical structures, sometimes towards zoomorphic forms, or at other times, a completely abstract motif. Nevertheless, these motifs can never be considered purely botanical or zoomorphic, nor can one claim them to be a plant, a goat's horn, or a bird's wing.

Table 6: Image (A) presents a fusion of three symbols (goat's horn, bird's wing, and the sacred tree of life) with a cross, which are compared with the motifs discussed in the preceding tables for clarity and a better understanding of the evolution of the goat horn motif. In motif (A3), the spiral of the swastika, like a labyrinth, culminates in and embraces a botanical symbol, which is the very spiral of the goat's horn revolving around the flower (the tree of life). In Sasanian stucco designs, there is no positive and negative space; the area between motifs is often the shadow of the main motif. This superimposition further develops in the Islamic period, especially in the stucco motifs of Samarra.

Image (B) illustrates the repetition and alternation of the open Sasanian wing motif, decoratively carved on the wall of a Sasanian palace. The fusion of the three symbols (goat's horn, tree of life, and the wing of a mythical bird) are positioned on either side of a pomegranate-like plant (Image B, numbers 2 & 3). This same structure is maintained in the space between the motifs (the so-called negative space), both representing the repetition and alternation of the ancient guardians of the sacred tree of life from previous millennia. A wide range of diverse designs of this structure exist in Sasanian motifs.

In deciphering Sasanian motifs, we encounter examples that appear botanical, but with careful attention to detail and knowledge of the motifs' historical background, we arrive at different conclusions. For instance, the motif we today call Laleh Abbasi (a type of tulip) is likely the Sasanian open wing motif, formed from the fusion of the three symbols and placed on either side of a botanical symbol (Images C and D). In reality, the so-called Laleh Abbasi is a type of composite creature from ancient myths that has evolved into a beautiful and decorative motif. In this process, not only have the vital elements of its constituent motifs and symbols not been lost, but designers have skillfully preserved their mythical characteristics within the structure of the motif.

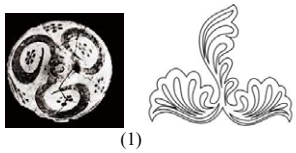
Laleh Abbasi motifs embedded in the positive and negative space of the stucco carving (C) consist of two Boteh jegheh forms, which could be the horns of two goats, botanical symbols, or two flying wings guarding the abstracted botanical symbol in the center. The amalgamation of three symbols, although creating a new motif, is designed in such a way that it remains definable by each of its constituent symbols. Motif (D) is designed with the same structure, although at first glance, it appears botanical. Motifs (E) and (Z) are other types of fusion of the three

symbols and their condensation into a spiral form, placed on the sides and beneath the botanical symbol.

The geometric design of image (T) is drawn from the repetition of an interlocking cross-like pattern, which is the same composite motif of the three symbols and refers to the protective creatures and the Asurik system. The evolution of motif (H) is summarized solely in the repetition and sequence of the symmetrical spiral (symbolizing the protective goat's horn) that envelops the botanical symbol. This motif retains its original and ancient structure, still resembling prehistoric motifs from Susa and Sialk, with the difference that it involves repetition and alternation. However, in image (K), the three fused symbols have evolved and transformed into an abstract form. In both motifs (H) and (K), the sequence of Archimedean spirals is drawn at the base of the alpha spiral, which can repeat and continue infinitely in every direction. This means they have no beginning or end, thus being eternal.

The path that the goat motif with its twisting horns traversed in the Sasanian period develops in two directions. First, it includes motifs of symmetrical spirals revolving around the sacred plant, encompassing early Khatayi designs. Second, it leads to the creation of early and incomplete Eslimi designs, which are the result of the fusion and combination of three important ancient symbols: the goat's horn, the sacred tree of life, and bird wings in a general sense. Furthermore, the interpretation of the above motifs shows that this composite motif repeats and alternates based on the geometric rule of the symmetrical spiral (Archimedean) and the cruciform movement structure (rotational symmetry of the spirals).

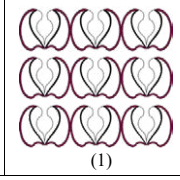
Table 6: The evolution of the ibex and ibex horn motif in the Sasanian period (Authors, 2024). ▶



(1)

(2)

A: Plaster fragments from a round column, Chaleh Tarkhan (Eshghabad), Rey, National Museum (No. 2602).

1, 2: Fusion of the three symbols: ibex horn, Tree of Life, and bird wings. 3: Fusion of ibex horn, broken cross (swastika/gammadion), and sacred plant.

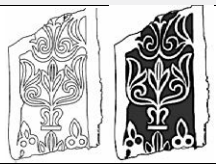
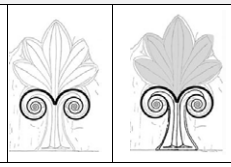
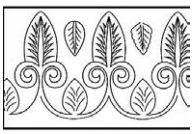
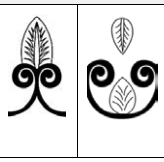
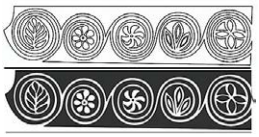
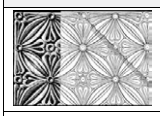
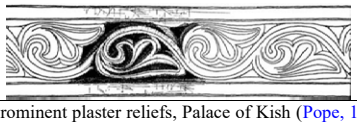


(1)

(2)

(3)

B: Quadrangular panels (Kroger, 1378: No. 75) and analysis of the recurring motif.

The Tree of Life at the center of the recurring motif, ibex horns and open wings on either side of the sacred plant in positive and negative space (positive and negative design), referring to the Assyrian Tree composition.

	 (1)	 (2)	 (3)
C: Wall background with alternating Abbasid tulip flower composition (Kroger, 1378: No. 93), Authors. **C2**: Arabesque headband in red and turquoise colors.			
The Abbasid tulip flower is a composite creature, a fusion of the three symbols: ibex horn, sacred plant, and bird wings. The negative space is shaped like an Abbasid tulip flower, resulting in an overlapping surface plaster motif.			
			
D: Part of a plaster relief, Hajiabad, Fars, 4th century CE, National Museum No. 4673.		**E**: Frieze, Palace of Kish (Pope, 1387: 769).	
The motif includes a composite form of the three symbols: ibex horn, sacred plant, and bird wings on either side of the sacred plant.		The motif includes a composite form of the three symbols on either side and below the sacred plant.	
			
Z: Plaster fragment, Kharg Island, late Sasanian – early Islamic period, National Museum (No. 3305).		**H**: Plaster fragment, Kharg Island, late Sasanian – early Islamic period, National Museum (No. 3306).	
The motif includes a composite form of the three symbols on either side and below the sacred plant.		The ancient Archimedean spiral motif (symbolizing the ibex horn) revolving around the Tree of Life, with its repetition and alternation based on the scroll (alpha) spiral.	
	 		
T: Facade covering, prominent plaster reliefs, Palace of Kish (Pope, 1387: 767).		**K**: Prominent plaster reliefs, Palace of Kish (Pope, 1387: 776).	
Repetition and alternation of the composite motif of the three symbols based on the cross (gammadion).		The motif includes a composite form of the three symbols: ibex horn, sacred plant, and bird wings, with its repetition and alternation based on the scroll (alpha) spiral.	

The Islamic Period

The artistic motifs, symbols, and structures of the Sasanians largely continued into the Islamic period, gradually being re-created in conjunction with Islamic culture. Through their integration with Islamic concepts and the growth and development of sciences such as mathematics, astronomy, and philosophy from the second to the seventh centuries AH, these inherited arts flourished, evolving and developing further. The early Khatayi and Eslimi patterns gradually achieved a higher level of sophistication during the Islamic era. However, in the early stages of this period, they did not yet possess distinct structures separate from each other. In fact, within the spiraling movement of a single motif, early Eslimi and Khatayi patterns branched off from one another. Today, in traditional design, while Khatayi and Eslimi coexist,

they have entirely separate structures, and a Khatayi flower or leaf would never sprout from an Eslimi pattern.

Table 7: The analyzed motifs in the stucco artwork (A), from number (1) to (4), demonstrate the repetition and sequence of the composite and evolved motif of the three symbols, or the early Eslimi patterns, positioned on either side of the tree of life. These motifs can never be attributed to just one of the symbols: the goat, the tree of life, or bird wings. Rather, they embody a comprehensive form and meaning derived from all three. The process of sequential repetition of these early Eslimi patterns, based on the scroll spiral (Alpha) rule, formed the band of elementary Eslimi patterns (A – number 5), which bear a strong resemblance to Sasanian stucco work (Image B). Other similar works found in the stuccoes of Samarra appear to be copied from Sasanian works. The combination of the symmetrical spiral's rotation around a plant (early Khatayi) also, following this process, formed the band of early Khatayi patterns (Image A – 6). A color analysis of the work indicates that the spirals' rotation is drawn based on a circular rule and still differs significantly from contemporary Khatayi patterns.

Table 7: Continuation of the evolution of the ibex horn into early arabesques (eslimi) and khata'i during the Islamic period (Authors, 2024). ▶

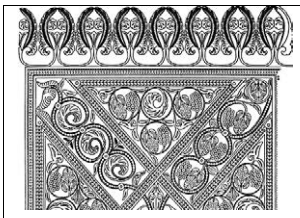
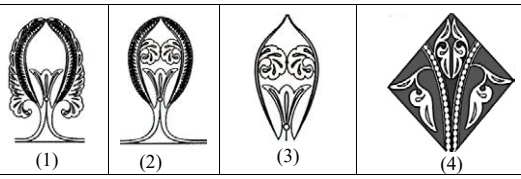
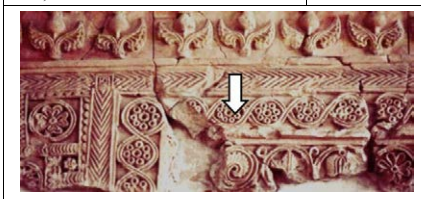
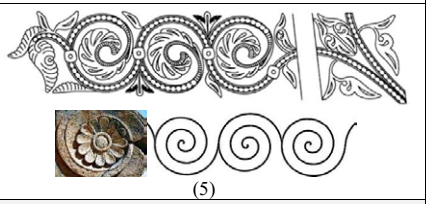
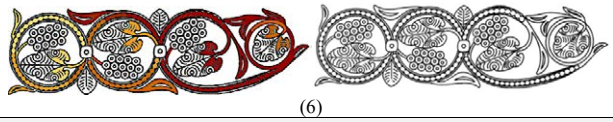
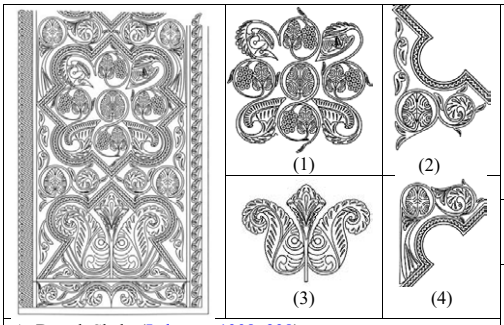
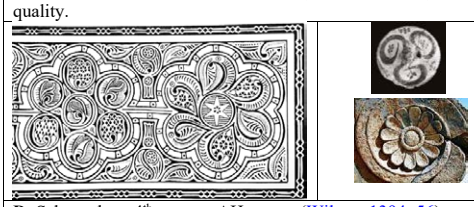
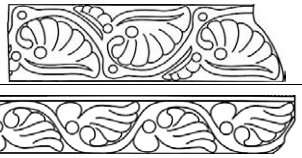
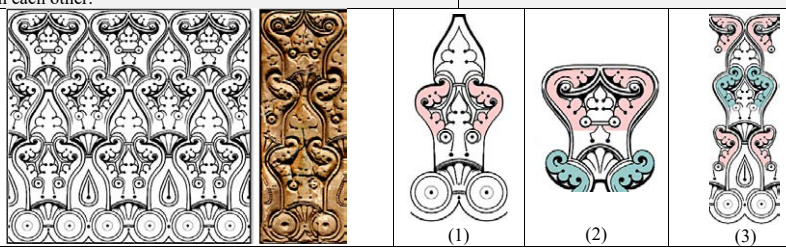
<table>
<tr><td rowspan="2"> 
A: Darreh Shahr (Lakpour, 1398: 213).</td><td colspan="4"> 
(1) (2) (3) (4)
Early *eslimi* (arabesque) motifs, resulting from the combination and fusion of the three symbols (ibex horn, sacred plant, bird wings), which guard the plant symbol of life from the sides.</td></tr>
<tr><td> 
B: Sasanian stucco found in Damghan (Zamani, 1390: 139).
Comparison with a similar Sasanian example.</td><td colspan="4"> 
(5)
Repetition and sequence of early *eslimi* motifs, resulting from the combination and fusion of the three symbols (ibex horn, sacred plant, bird wings) based on the scroll (alpha) spiral.</td></tr>
<tr><td colspan="5"> 
(6)
Repetition and sequence of early *khata'i* motifs, resulting from the combination of the ibex horn symbol rotating around the sacred plant, based on the scroll (alpha) spiral.</td></tr>
</table>

Table 8: Image (A) and its analyses in images (1) to (4) display various beautiful Eslimi and Khatayi patterns within the design. However, at this stage, Eslimi and Khatayi patterns still originate from one another and do not possess separate structures. In the course of evolution and transformation, the animalistic identity is still emphasized in some motifs, and semi- Eslimi patterns appear as effigies of hybrid animals (Image: A-1). These effigies are frequently seen in other works from Dareh Shahr, the stuccoes of Samarra, Chāl Tarkhan, and generally in the decorative motifs of the early Islamic period (Image F). As the structure of motifs tends towards abstraction in later periods, the iconic properties of Eslimi and Khatayi gradually disappear, and they emerge in a separate structure known as Tash'ir.

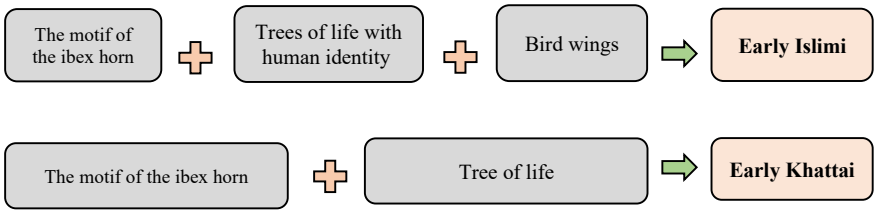
Image (D) is a fusion of rotational spiral symmetry (cross-like) and early Eslimi patterns. In the design of this stucco, the Eslimi patterns are placed within one medallion (or seal), and the Khatayi patterns within another, thus separated from each other. The evolution of this fusion process with the cross-like geometric structure in later centuries leads to a transformation in the spiral structure of Eslimi patterns. A significant point here is the fusion of the meanings of the medallion/seal, including light, radiance, and life, with the meanings of the constituent symbols of the Eslimi patterns. Image (E) is a continuation and evolution of Image (A-5 in Table Seven). In Image (F), the story of Eslimi patterns resulting from the fusion of the three ancient symbols flanking the tree of life is repeated.

In the analyses of motifs (1) to (3), the thought and perspective of Samarra artists in creating early Eslimi patterns through the fusion of Sasanian and ancient Mesopotamian art are evident (Nazari-Arshad, Ghazizadeh, and Heidari: 1403). A characteristic feature is the creation of design structures that overlap the wall surface. Of course, the initial form of this structure was examined in Sasanian art and the preceding tables. This structure, combined with compositions based on geometry, astronomy, and philosophy, gradually forms the pillars of traditional Iranian-Islamic design. The difference between traditional Iranian-Islamic design and that of other Islamic lands lies in the masterful use of this structure to convey profound concepts of Islamic mysticism, which, due to the limitations of the present text, cannot be further elaborated.

Table 8: Continuation of the evolution of the ibex horn into early arabesques (eslimi) and khata'i in the Islamic Period (Authors, 2024).▶

<table>
<tr><td colspan="2"> 
(1) (2) (3) (4)
A: Darreh Shahr (Lakpour, 1398: 238).</td><td> 
B: Darreh Shahr (Lakpour, 1398: 275).</td><td> 
C: Darreh Shahr (Lakpour, 1398: 273).</td></tr>
<tr><td colspan="2">Types of early eslimi and khata'i that have branched out from each other, with some motifs having an iconic (figurative) quality.</td><td colspan="2">Early eslimi (arabesque) motifs (a fusion of ibex horn, sacred plant, and bird wing motifs); early eslimi is a combination and fusion of the ibex, the Tree of Life, and bird wings, preserving the vital characteristics of the ibex horn and other symbols despite their evolution into early eslimi.</td></tr>
<tr><td colspan="2"> 
D: Sabzpushan, 4th century AH stucco (Wilson, 1394: 56).</td><td colspan="2"> 
E: Darreh Shahr (Lakpour, 1398: 343).</td></tr>
<tr><td colspan="2">Fusion of early eslimi and khata'i with rotational spiral symmetry (swastika or "Mehr" wheel); eslimi and khata'i have separated from each other.</td><td colspan="2">Evolutionary process of early eslimi that repeat and alternate based on the scroll (alpha) spiral.</td></tr>
<tr><td colspan="4"> 
(1) (2) (3)
F: Samarra, Iraq stucco, caliph's residence, Friedrich Sarre and Ernst Herzfeld, 1911-1913, alamy.com</td></tr>
<tr><td colspan="4">Creation of Samarra stuccos with overlapping motifs; the design consists of the repetition and alternation of early eslimi placed on either side of the sacred Tree of Life; analysis of early eslimi (a fusion of ibex or ibex horn symbols and Sasanian wings) with color differentiation of the motifs.</td></tr>
</table>

Based on the discussions and analysis of the tables:



Early Eslimi patterns, resulting from the fusion of animal motifs with sacred plants that possess human identities (such as: Mashy and Mashyaneh, Cypress, Asurik, etc.), are presented in the aforementioned diagram. Despite having different forms from the initial symbols that constitute them, the fundamental structure of none of these symbols has been lost. Consequently, contrary to the views of archaeologists and

scholars of Islamic art (Ghirshman, Pope, Dieulafoy, Wilber, etc.) who introduce Eslimi as a plant-like entity branching from the Tree of Life (Pope, 1959: 173-174); Eslimi is a composite entity with an animalistic-human structure, whose roots lie in ancient mythologies and whose meaning has been recreated in each era.

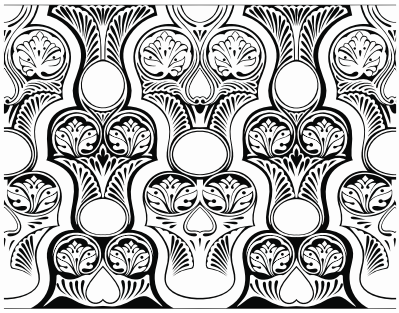
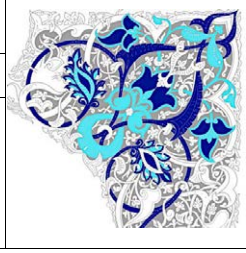
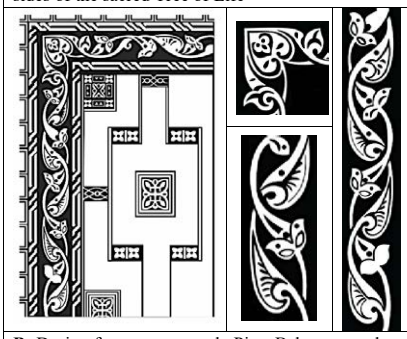
Khatayi patterns are also formed from the fusion of the sacred Tree of Life with a symmetrical spiral, which signifies the goat's horn, and its plant-like structure, alongside the horn spiral, is still preserved. In the process that has occurred, the horn spiral tends towards becoming plant-like, with horns and leaves growing from it, so that Khatayi patterns become more symbolic of the sacred Tree of Life.

At this stage, after thousands of years, we again encounter two symbols, each of which is an ancient myth with millennia-old meanings and life. Eslimi with an animalistic identity and Khatayi with a plant-like identity. Motifs and symbols in new periods and cultures insist on preserving their form and meaning. Therefore, to maintain their existence, they are constantly combined or fused with other symbols, or they replace symbols with similar meanings. The protective goat horn reappears in Eslimi to continue its life, and it always circles and guards the ancient Asurik tree, which is manifested in Khatayi patterns.

Further research and studies are needed regarding the evolution of the meaning of the protective goat and the Asurik tree with the form of Eslimi and Khatayi. However, it might be said that the nightingale's love for the rose in classical Persian poetry and texts, and the art of "Gol o Morgh" (Flower and Bird), are among their semantic and visual manifestations.

Table 9: In image (A), early Eslimi patterns are placed on either side of the Tree of Life, similar to protective goats. This same structure is maintained at the base of the scroll spiral (alpha). The Eslimi band (in the protective role) moves through the Khatayi band, sometimes to one side of the flower and sometimes to the other, embracing both sides of the flower in each corner. The stucco work at the entrance of Pir-e Bakran repeats and sequences Eslimi and Khatayi patterns at the base of the evolved symmetry of the 'Medallion of Light' (Mehr) and its fusion with the ancient Tree of Life. This is the manifestation and essence of motifs, symbols, and ancient myths that have been recreated with Islamic concepts.

Table 9: The Formation of early Iranian-Islamic design structures, Eslimi and Khataei Motifs (Authors, 2024). ▶

	
A: Design from stucco work, Tepe Sabzpushan, Nishapur, 4th century A.H., National Museum (Islamic).	**C:** Design from stucco work, Pir-e Bakran complex, Isfahan, 703-712 A.H.
Repetition and sequence of early Eslimi motifs on both sides of the sacred Tree of Life	
	The continuation of the ever-protective goat horn's presence in the emergence of Eslimi, which always revolves around and guards the ancient Asurik tree manifested in Khataei motifs.
B: Design from stucco work, Pir-e Bakran complex, Isfahan, 703-712 A.H.	
Evolution of early Eslimi and Khataei tendrils, integration of Eslimi and Khataei at the base of the scroll spiral (alpha), the continued life of the ever-protective goat horn in the appearance of Eslimi, which always revolves around and guards the ancient Sarv (cypress) tree manifested in Khataei motifs, at the base of the scroll spiral.	

Conclusion

The motif of the goat in the prehistoric and ancient periods of Iran held considerable significance, embodying themes of fertility, rainfall, water-seeking, and protection. This motif represents one of the oldest symbols of the ancient world and is associated with the moon and the swastika. The goat motif maintains a close connection with the constellation of the Asurik tree, and thus, in most depictions, the goat or its horns are shown as guardians of the sacred Tree of Life. In the visual representations of this myth, the goat and the plant are rendered in realistic, stylized, and abstract forms. In many prehistoric motifs, particular emphasis is placed on the goat's horns, which are often combined with rotational spiral symmetry (the symbol of the swastika) and the broken swastika (svastika or hook-cross), thereby integrating the symbols of the moon and the Tree of Life. On the other hand, the goat defends itself or others using its horns rather than its body. Therefore, the significance and identity of the goat reside

primarily in its horns. Consequently, in the process of abstraction, its body is gradually omitted, leaving only the horn or horns, which are consistently positioned adjacent to or revolving around the plant symbol. This motif is evident in Elamite and Luristan art as composite animals, appears in the capitals of the Achaemenid period as two-horned composite creatures guarding a lotus-shaped column, and is repeatedly sequenced in decorative reliefs.

In ancient civilizations, motifs were not categorized according to plant or animal types, and composite creatures were prevalent in historical designs and patterns. For ancient people, the existence and symbolic significance of a motif were paramount, rather than whether it depicted a plant or an animal. Consequently, many combined motifs were created from animals, plants, and humans; these motifs were gradually abstracted over time and simultaneously fused with other symbols. The fused motifs then underwent further abstraction and fusion. This iterative process continued until the motifs fully evolved. During the Sasanian period, this process culminated in the fusion of the goat motif and the sacred plant with the symbol of bird wings, creating a unified emblem. The evolution of this emergent motif, derived from the goat's horn in the Sasanian period, can be traced across a wide spectrum and categorized into two groups:Early semi-Islimi patterns emerged from the fusion of the goat's horn, the sacred Tree of Life, and the Sasanian spread wings, and from their subsequent evolution.

Early Khatayi patterns gradually developed from the combination of the goat's horn and the sacred plant arranged in a symmetrical (Archimedean) spiral revolving around the plant, following the same evolved structural principles.

From the fusion of early Eslimi patterns (resulting from the fusion of the three ancient symbols) with the scroll spiral (alpha), the early Eslimi bands are formed. From the fusion of early Khatayi patterns (resulting from the combination of the goat's horn and the sacred plant), early Khatayi bands are formed. And from the fusion of early Eslimi and Khatayi patterns with the rotational symmetry of the swastika or the 'Medallion of Light' (Gir-do-gardoun-e Mehr), the initial geometric structures of Eslimi and Khatayi take shape. These structures, with the growth and development of mathematics, astronomy, philosophy, and Islamic mysticism in the middle Islamic centuries, evolved to ultimately achieve the coherence of Iranian-Islamic design art (traditional design).

Although the abstract form of Eslimi originates from the evolution of the goat motif and its horns, combined and fused with the sacred plant and the wings of mythical birds; it has preserved the vital elements of its constituent symbols throughout its evolution. Eslimi is a form that can be attributed to any of its constituent symbols, while being neither a goat's horn, nor a plant, nor a bird's wing. Eslimi is an animalistic composite (mythological) entity—even though one of its roots is botanical, the sacred plant refers to plant myths with human identities—and Khatayi patterns have a plant-like identity. Since ancient symbols continue to exist through combination, fusion, or replacement with symbols that have similar meanings; the mountain goat symbol is manifested in Eslimi patterns and always revolves around Khatayi patterns (as a replacement for the Tree of Life). Consequently, Iranian-Islamic design (traditional design) is the repetition and sequence of the Asurik tree constellation and its guardian goats, which have been recreated in Islamic art.

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We extend our profound gratitude to the distinguished Professor, Dr. Yaqub Mohammadifar, an eminent specialist in the Sasanian period, whose gracious and generous support and guidance were invaluable throughout the entirety of this research.

Observation Contribution

The authors hereby declare their adherence to publication ethics in citations and affirm the absence of any conflict of interest with any individual or governmental body.

Conflict of Interest

The Authors, while observing publication ethics in referencing, declare the absence of conflict of interest.

Endnote

1. Source: (Dooštkhah, 2013: 703). The Vendidad, or originally Vidēvdāt, deriving from the Aveštan term vī-daēva-dāta meaning "laws against demons or evil," is one of the five nasks of the present Aveśta. Its primary content constitutes the penal law of ancient Iran. The Vendidad is among the most deep-rooted and fundamental motifs of Iranian religious mythology, comprising 22 fragards (chapters), (Dooštkhah, 2013: 646).

2. Source: (Bahar, 2016: 81). The "Bundahishn" or "Frab-i dādagih" is one of the most prominent historical and religious texts of Zoroastrianism, written in the Middle Persian (Pahlavi) language. This work was composed in the late Sasanian period and redacted by "Farhang Dadagih" in the 3rd century

AH. The "primordial creation" or "foundation" is what the "Bundahishn" signifies, with the book's content divided around three axes: the initial creation, the description of creations, and the genealogy of the Kayanian dynasty (Bahar, 2006: 5-6).

3. Source: (Dooštkhah, 2013: 435). "The Bahram Yasht is considered the fourteenth Yasht of the Aveśta. This Yasht has been composed in celebration and praise of 'Bahram,' the great god of victory and warfare, the vanquisher of aggressors. 'Bahram' appears in Pahlavi texts as 'Warharan' or 'Warhram,' and in Aveśtan, as 'Verethraghna.' The Bahram Yasht is considered one of the martial sections of the Aveśta, and its precise translation is considered a difficult task by many researchers" (Moradi Ghiasabadi, URL3).

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۴۵ پژوهش‌های باستان‌شناسی ایران

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پژوهشی در تکوین و تحول نگارهٔ کهنِ بز در نقوش تزئینی هنر ایران (از دوران باستان تا قرون میانهٔ اسلامی)

خشایار قاضی‌زاده[I]، رضا نظری ارشد[II]، نفیسه حیدری[III]

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چکیده

نقش‌مایهٔ بزکوهی از قدیمی‌ترین نقوش کاربردی در هنر جهان باستان به‌شمار می‌آید و جایگاه ویژه‌ای نیز در هنر ایران داشته و در بیشتر صخره‌نگاره‌ها و غارنگاره‌های باستانی و آثار پیش‌ازتاریخ در اشکال واقع‌گرا، تلخیص‌یافته و انتزاعی دیده می‌شود. بی‌تردید چنین نقشی که حاوی معانی حیاتی زایندگی، زندگی و حفاظت بوده و تا پایان دورهٔ ساسانی هم‌چنان پرتکرار است؛ در دوران اسلامی نیز تداوم می‌یابد. پژوهش‌های بسیاری دربارهٔ انواع نقش بز در مناطق مختلف و دوره‌های تاریخی انجام شده، اما در هیچ‌یک روند پیدایی، تحول و یا تطوّر آن بررسی نشده و هنوز نقوش حاصل از تطوّر آن در دوران اسلامی مشخص نیست. این مهم که سیر تکوین و تطور نقش بز و شاخ‌های مؤکد آن در هنر ایران باستان چه روندی داشته و دارای چه مضامینِ هنری بوده و بازآفرینی آن در هنرهای دوران اسلامی چگونه تداوم‌یافته و دارای چه مفاهیمی بوده است؟ و کدام‌یک از نقوش دوران اسلامی حاصل این تطور و دگردیسی هستند؟ از مهم‌ترین پرسش‌هایی است که در پژوهش حاضر سعی‌شده به آن‌ها پاسخ داده شود. روش تحقیق توصیفی، تحلیلی و براساس تطبیق نقوش است. نمونه‌های انتخابی از نقش‌های بز و شاخ‌های آن و نقوش تزئینی در هنر ایران باستان تا دوران میانهٔ اسلامی موردمطالعه، ترسیم و تحلیل قرار گرفتند. نتایج به‌دست آمده از تحلیل و تطبیق نقوش نشان می‌دهد نقش بز که همواره در کنار درخت مقدس زندگی (اشاره به منظومهٔ درخت آسوریک) قرار دارد، ابتدا در شاخ مارپیچی آن خلاصه شده و سپس با گیاه مقدس زندگی یگانه می‌شود. این تلفیق به مرور با بال‌های پرندگان نیز می‌آمیزد. نقش تلفیقی حاصله از نمادهای سه‌گانهٔ شاخ بز، گیاه مقدس و بال‌های پرندگان در دورهٔ ساسانی، اسلیمی‌ها و ختایی‌های اولیه را به‌وجود آورده‌اند. شبه‌اسلیمی‌ها و شبه‌ختایی‌ها با ساختارهای هندسی تقارن چرخشی مارپیچی گردونهٔ مهر(چلیپا) تلفیق‌شده و در دوران اسلامی به‌صورت اسلیمی و ختایی تکامل می‌یابند.

کلیدواژگان: نگارهٔ بزکوهی، شاخ بز، اسلیمی و ختایی، نقوش تزئینی، ایران باستان.

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A Comparative Study of the Spatial-Physical Structure of Prominent Qajar Urban Caravanserais in the Historical Bazaar of Kermanshah (Case Study: Vakil al-Dowleh, Nou, Kashani, and Hamedani Caravanserais)

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Abstract

The urban caravanserais of Kermanshah Bazaar, as semi-open spaces and breathing nodes, were located in the core of the covered market fabric and were considered places for economic interactions, commodity exchanges, and the settlement of caravans. During the Qajar period, the boom in production and commerce in Kermanshah led to the expansion of the historic bazaar along the city's main caravan route and the coherent formation of urban caravanserais as integral physical elements of the bazaar structure. The importance of the present study lies in the fact that, despite the prominent position of the bazaar and urban caravanserais of Kermanshah during the Qajar period, no independent research has so far been conducted on them. Therefore, the aim of this research is to understand the spatial organization and examine the elements and patterns of the physical structure of these urban caravanserais during the Qajar period. The present study was conducted using a descriptive-analytical approach. Four urban caravanserais were selected as case studies and their history of emergence was investigated through library research. Then, using the fieldwork, and based on the research objective, their physical-spatial characteristics were analyzed and examined. The results show that the most important factors in the formation of these urban caravanserais were the provision of security infrastructure for caravans, the city's location on the Baghdad–Kermanshah trade route, the establishment of British, Russian, and Ottoman consulates in the city, and the migration of merchants from surrounding towns. This is reflected in the physical structure of the caravanserais, which simultaneously employed local architectural traditions, Qajar-period architecture, and elements derived from Western styles. In examining the physical-spatial structure of the four urban caravanserais it was also observed that the design of the various parts of the buildings was influenced by their caravan-commercial function.

Keywords: Urban Caravanserai, Historical Bazaar, Physical-Spatial Structure, Kermanshah, Qajar period.

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Introduction

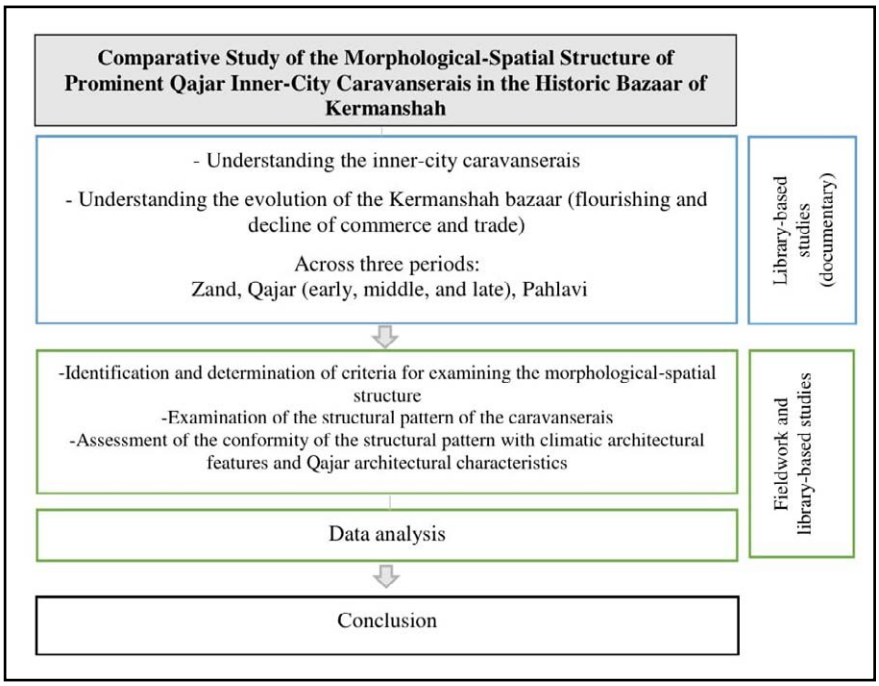
One of the most important architectural monuments in Iran is the caravanserai, including the urban caravanserais, which developed from ancient times and, over many centuries, evolved into multifunctional complexes serving commercial, religious, and social purposes. The term "caravanserai" itself is derived from two Persian words: "caravan," meaning a group of travelers, and "sara," meaning a house or place (Hadizadehkakhki, 2014: 60). The tradition of caravanserai construction in Iran dates back to the Achaemenid period and continued through the Parthian and Sasanian eras. From the Sasanian period, a limited number of examples have survived, among them the Darvazeh-ye Gach Caravanserai (Gach Gate Caravanserai) and the Robat-e Anushirvani (Anushirvani Caravanserai) (Farshchi and Haji Zamani, 2018: 62). During the Seljuk era, with the expansion of political and commercial networks, numerous caravanserais were built, drawing inspiration from the models of pre-Islamic Iran. In the Ilkhanid period, greater emphasis was placed on the regularization of roads, while in the Timurid period, the growth of trade stimulated the construction of caravanserais with a four-iwan plan, richly decorated with tiles. With the rise of the Safavid dynasty and the consolidation of Islam, both the number and importance of caravanserais increased significantly. The height of prosperity was reached in the Safavid era, particularly under Shah Abbas I. Construction activity continued into the Qajar period, during which trade and commerce once again flourished (Abedi *et al.,* 2022: 614). Caravanserais can generally be divided into two categories—urban and extra-urban—depending on their function and location. The urban caravanserais, also known as "sara," primarily served as centers of trade and transactions and were often directly linked to bazaars (Ehsani, 2011: 84).

Kermanshah urban caravanserais have historically held great importance because of their location within the commercial fabric of the city's bazaar. The Historic Bazaar of Kermanshah had gained considerable fame due to the city's strategic position—which for centuries lay along one of the most important trade and caravan routes that connected the western Zagros Mountains to their eastern regions. During the Qajar period, this market expanded extensively along the same route, extending from the west (Sar Ghabr Agha Gate) to the east of the city (Chiya Sorkh Gate) (Hashemi, 2012: 100). The urban caravanserais of the bazaar, in addition to functioning as central nodes of commercial activity, have consistently

served as important venues of interaction among different cultural groups, and these cultural exchanges have in turn contributed significantly to the enrichment and enhancement of their architectural values. Over the course of time, some of these bazaar-based urban caravanserais in Kermanshah have been abandoned and fallen into ruin, while others—despite retaining much of their original physical integrity—have nevertheless been subjected to a variety of alterations. Unfortunately, numerous inappropriate restorations and reconstructions, often carried out in ways that were inconsistent with their original architectural design, have gradually resulted in a decline in their former historical and cultural values. For this reason, under the present circumstances, identifying the design principles and spatial concepts embedded within these urban caravanserais, and extracting the architectural strengths that define them, can provide a valuable framework for guiding future restorations and revitalization projects. Such an approach would ensure compatibility with the original spatial-physical structure of the urban caravanserais, while also offering practical models for the design of new commercial spaces within the bazaar context. Therefore, the primary aim of this research is to study and interpret the spatial organization of the historical urban caravanserais of Kermanshah, and to examine in detail the elements and patterns of their physical structure, with a particular emphasis on both the architectural features characteristic of the Qajar period and the climatic conditions specific to the Kermanshah region.

Research Questions and Hypotheses: What are the most important factors affecting the formation of the historical urban caravanserais of Kermanshah's bazaar during the Qajar period? How were the structural characteristics and physical-spatial elements of the urban caravanserais in the Historical Bazaar of Kermanshah defined during the Qajar era? The first assumption of the present research is that, in the Qajar era, significant developments such as the establishment of road security and the expansion of international trade provided the foundation for the growth and siting of caravanserais. In addition, consideration of Kermanshah's climatic conditions and the impact of Western architectural elements, introduced through international trade, were also influential in the formation and construction of these buildings. The second hypothesis of the study suggests that the structure of the examined urban caravanserais was derived from a central layout pattern—an introverted design employing a four-iwan scheme—while their physical-spatial elements were shaped by the influence of surrounding neighborhood contexts and adjacent structures.

Research Method: The method employed in this research is characterized by its objective and descriptive-analytical nature, utilizing a case study strategy as its primary approach. Initially, the researcher reviews the background and theoretical foundations pertinent to the subject matter. In the theoretical segment, the research explores the emergence and subsequent changes—including both the periods of prosperity and decline—of the Kermanshah bazaar and its urban caravanserais throughout three distinct phases of the Qajar period: early, middle, and late. Following this, four urban caravanserais in Kermanshah, differentiated by their size, accessibility, and function during the middle and late Qajar periods (noting that those from the early period have been destroyed), were selected for analysis using the case study method. Given that comprehending these concepts aids in recognizing the architectural patterns and elements of the past, the research concurrently investigates the spatial-physical structure of these urban caravanserais, alongside specific architectural characteristics of the buildings and their connection to both the Qajar era and the climatic conditions of Kermanshah. The diagram presented below (Fig. 1) illustrates the comprehensive research framework and process.



◀**Fig. 1: Research Process (Author, 2024).**

Research Background

Numerous studies have been conducted on caravanserais and urban caravanserais. Among these, Piri & Afshari Azad (2015), in their research titled "A Study of Urban Caravanserais of the Qajar Period in Hamedan: Case

Study of Haj Safarkhani Caravanserais," examined this urban caravanserai in terms of the region's climatic conditions, the decorative characteristics of the Qajar era, and local architectural features. The building was constructed under the combined influence of Hamedan's climatic conditions and the architectural characteristics of the Qajar period. Moshabaki Esfahani (2018), in a study entitled "A Comparative Analysis of Architectural Space of Safavid Era Caravanserais with a Physical Approach," examined eight extra-urban caravanserais of the Safavid period based on four components: solid and void spaces, the position of the courtyard and garden in relation to the caravanserai building, the physical location of the courtyard, and the main axis. These features were considered to be influenced by the power and wealth of the ruling authority, as well as the climatic conditions of different regions.

Vahdatpour *et al.* (2018), in a study entitled "A Comparative Study of Isfahan's Urban and Extra-Urban Caravanserais in the Architecture of Physical Space," compared factors such as geometric proportions, spatial organization, and patterns of movement in both urban and extra-urban caravanserais of Isfahan. They argue that the construction and location of these buildings, influenced by the site and the design of various architectural elements according to the needs of the people, constitute fundamental principles in the design of Isfahan's urban and extra-urban caravanserais. Pouriani (2019), in a study titled "Study and Understanding of Urban Caravanserais in Mazandaran Province; Case Study: Sari and Babol Cities," examined the characteristics of caravanserais in temperate and humid regions, their location, the architectural features of Qajar caravanserais, the architectural characteristics of Pahlavi buildings, the materials used, and the occupations associated with the caravanserais of Sari and Babol. He states that the architecture of these caravanserais is influenced by the temperate northern climate and the architectural features of the Qajar period.

Molaei & Sabermand (2019), in a study titled "Characteristics and Archetypes of the Central Courtyard in the Iranian Historical Bazaar: Case Study: the Urban Caravanserais of the Historical Bazaar of Tabriz," examined twelve urban caravanserais of the historical bazaar of Tabriz based on typological criteria across physical, economic, social, cultural, and environmental dimensions, and state that in the historical bazaar of Tabriz, a diverse range of urban caravanserais have been used from the past to the present, both physically and economically. Sekhavat-Doost &

Soltan-Zadeh (2019), in a study titled "The Role of the Type of Function and the Social and Political Position of the Founders in the Formation of the Physical Structure of Caravanserais and Urban Caravanserais in Qazvin," state that the type of function (reception, loading, commercial activities) has influenced the physical structure of the urban caravanserais, and that the social and political status of the founders also determined the quality and extent of open, closed, and semi-open space decorations, the diversity of service and commercial spaces, and consequently, the commercial prosperity of urban caravanserais.

Mohaymeni & Nabavi (2021), in a study titled "Investigation of the Physical-Spatial Structure of Caravanserais along the Abrisham Road in Greater Khorasan," examined four structural factors—mass-space, spatial hierarchy, and solid and void spaces—which form the basis of the physical-spatial structure, in four extra-urban caravanserais located in different periods. They note that caravanserais were accompanied by a four-iwan plan during the Seljuk period. They also consider the Safavid period as the golden age of caravanserai construction, with the Qajar period representing a continuation of Safavid architectural patterns.

Regarding the bazaar and caravanserais of Kermanshah, we can also cite the research of Mirzaei *et al.* (2012), entitled "Meaning in Place and the Creation of Identity; Case Study: Kermanshah Bazaar", which identified the bazaar as playing a key role in the formation of collective memory, cultural values, and, subsequently, collective identity. Hashemi (2013), in a study titled "The History of the Construction of Kermanshah Bazaar with a Look at the Supporters and Founders of Its Buildings", analyzed the construction history of the bazaar and explored how it was shaped by its founders. Sajjadzadeh *et al.* (2019), in a study titled "Enhancement and Organization of the Structure of Traditional Bazaar Rows with Emphasis on Spatial Configuration and Connectivity; Case Study: Kermanshah Bazaar", while examining spatial configuration and interconnection, argue that creating greater integration within the spatial organization of cities is effective both for revitalizing the old fabric and for addressing the disorganization of contemporary urban fabrics. Rahromehrbani & Nouri (2022), in a work entitled "Comparative Analysis of Safavid Era Caravanserais in Kermanshah Province from a Typological Perspective in Order to Present Influential Physical Components", examined three extra-urban Safavid caravanserais in Kermanshah from a typological perspective, analyzing the components of solid–void space density, quantitative and

formal proportions, quantitative spatial distribution, and the skyline. Among these, the index of solid–void space density was identified as the most influential factor in the extra-urban caravanserais of Kermanshah during the Safavid period.

Based on previous studies, the innovative aspect of the present research lies in the fact that most prior work has focused primarily on understanding caravanserais and urban caravanserais (sara) as well as architectural issues, whereas no research has yet addressed the urban caravanserais of Kermanshah's historical bazaar in the Qajar period. As noted, only the extra-urban caravanserais of Kermanshah from the Safavid period have been studied previously.

Urban Caravanserais (Sarā)

The urban caravanserais, also known as khān or sarā, held great importance in the commercial sector, ranking immediately after religious buildings in contributing to the expansion and development of the bazaar. In addition to providing security and accommodation for merchants, their spaces were also used as venues for the sale of goods (Sekhavat-Doost & Soltan-Zadeh, 2010: 71). Typically, urban caravanserais were situated along the main streets of the bazaar owing to their commercial function, and their layout and physical form, like most caravanserais, followed a central courtyard plan. The urban caravanserai (sarā) functioned as a commercial hub where wholesalers and merchants from one or two specific trades established shops. Ethnic and local origins often led to the concentration of merchants from the same trade within a single urban caravanserai. Across different bazaars, urban caravanserais (sarā) were named after cities or provinces, such as the Qazvini Sarā in Tehran and the Kāshi Sarā in Isfahan Bazaar, or after their founder, owner, or the type of goods sold. The sponsors of an urban caravanserai were usually one or two merchants; however, the lifespan of these structures often far outlasted their patrons, as they were designed to endure for centuries (Taronyeh, 1957: 387).

Although the overall form of urban caravanserais resembled that of most caravanserais, notable physical differences arose due to their distinct functions. A caravanserai was an inn located outside the city, whereas an urban caravanserai served as a commercial center. Accordingly, urban caravanserais generally lacked stables, and their ancillary spaces were usually placed at the rear of the building or in underground levels for goods storage. Furthermore, because of limited space and high land

values in bazaars, urban caravanserais were most often constructed as two-story buildings. In addition, unlike caravanserais, which were generally independent and detached from surrounding structures, urban caravanserais were fully integrated, both physically and functionally, into the fabric of the bazaar (Ghobadian, 2013: 199). Tim and Timcheh also played a role similar to that of the urban caravanserai and shared comparable characteristics. These two types of spaces were often designed and built in combination. The principal distinction between an urban caravanserai and a Tim or Timcheh lies in the roof structure: urban caravanserais generally lack vaulted roofs, whereas Tims and Timchehs feature one or several tall vaults over the central courtyard. The overall plan of urban caravanserais was usually square or rectangular, while the plan of Timchehs was predominantly rectangular (Kiani & Kleiss, 1989: 3).

The plan of a few urban caravanserais—such as the Haj Karim and Mokhless caravanserais in Isfahan—followed a four-iwan layout, while in some cases a two-iwan scheme was employed. In fact, many urban caravanserais did not include deep and grand iwans because of functional or economic constraints. In certain instances, the chambers located along the main axes were arranged in a way that suggested a two- or four-iwan plan. Additionally, the construction of upper floors above the ground level produced varied and diverse layouts. In many urban caravanserais, the upper floor was slightly recessed compared with the ground floor, creating a mezzanine or arcade in front that provided access to the chambers on that level (Soltanzadeh, 2001: 73).

From a climatic perspective, it can be observed that Tims, Timchehs, and urban caravanserais—whether vaulted or non-vaulted—were built in both cold and hot-arid regions. Vaults proved effective in moderating temperatures in both climatic conditions. Additionally, the height of the vaults and the size of their openings were generally greater in hot-arid areas than in cold regions. In cold regions, the materials used in these commercial centers, similar to those in other market buildings, were primarily masonry, and the vaults were mostly constructed as domes or arches. In these areas, some commercial centers also included basements, which served mainly for goods storage and, in certain cases, as resting places where shop owners could benefit from their relatively moderate temperatures (Ghobadian, 2013: 202).

The Historical Bazaar of Kermanshah and Its Urban Caravanserais

The Kermanshah Bazaar, as one of the main components of the city's historical fabric, has a history of approximately two hundred years and can be examined across three historical periods: Zand, Qajar, and Pahlavi periods (Fig. 2).

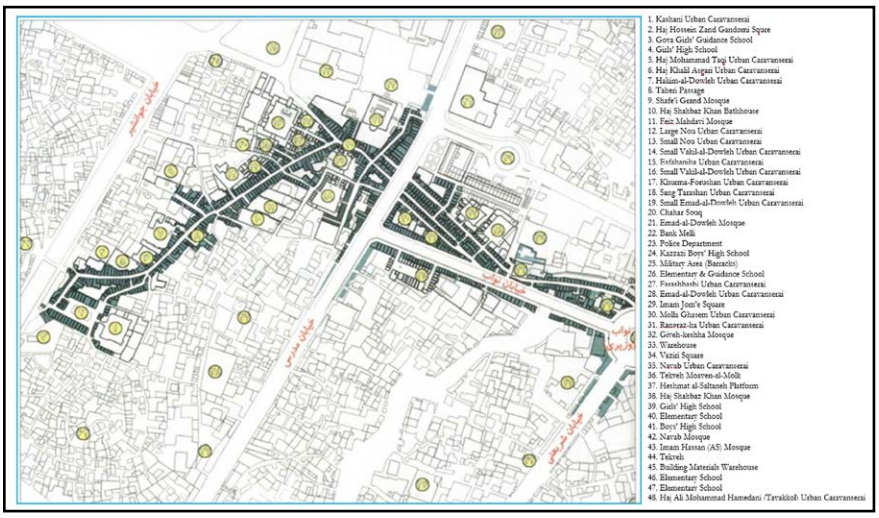


Fig. 2: The extent of the Historical Bazaar of Kermanshah (Archive of Kermanshah Province Cultural Heritage, Handicrafts, and Tourism Organization, 2008). ▶

Kermanshah Bazaar during the Zand Period

During this period, due to the security of roads and the provision of infrastructure, commerce was promoted; however, trade in Kermanshah was local and modest, with limited connection to the international network (Olivier, 1992: 176). The Zands constructed a bazaar called "Tarikeh Bazaar" in the Feyz-Abad neighborhood, which was small and local, and during the Qajar period it became a place for goods exchange. This section of the bazaar has been largely destroyed in recent years, and the only remaining trace is the passage that once formed the covered row of the bazaar (Hashemi, 2013: 99).

The Bazaar of Kermanshah during the Qajar Period

The interest of European countries in trade coincided with the rise of Mohammad Ali Mirza Dowlatshah, the eldest son of Fath-Ali Shah, and his attempts to establish stability and encourage commerce. For a period of 100 years (1807–1906 CE / 1186–1285 SH), peace and security largely prevailed in the region. Conflicts with the Ottoman Empire decreased, resulting in a century of relative peace. Necessary infrastructure—such as roadside caravanserais, road security officers, fair customs regulations, the rulers' support for trade, the presence of British and Russian consulates,

and the Ottoman commitment to sustaining commerce—all contributed to the flourishing of trade in Kermanshah (Isavi, 1983: 236). Consequently, England, the Ottoman Empire, and Russia became active in Kermanshah through the involvement of non-Kurdish merchants. At the same time, the prosperity of Kermanshah's commerce attracted migrants from many parts of Iran, particularly from Isfahan, Kashan, Shiraz, Shushtar, Yazd, Tehran, Tabriz, Hamadan, and Arak (Grothe, 1990: 99).

During the Qajar period, the Kermanshah Bazaar took shape as a traditional bazaar. It began at the "Sar Ghabr Agha" Gate in the west of the city, crossed the Abshuran River, and extended to the "Chiya Sorkh" Gate in the east. The bazaar itself served as the main route for caravan movement and functioned as the central hub of trade, flanked on both sides by urban caravanserais. The bazaar axis was considered a major commercial center along the main Tehran–Baghdad route (Hashemi, 2013: 100). The development and evolution of the bazaar during the Qajar period can be divided into three chronological stages:

Initial Stage (1747–1801 CE / 1120–1180 SH)

During this period, Dowlatshah [the governor of Kermanshah province] played a prominent role as a merchant and supported trade insofar as his own interests were not at risk. He was fully aware of Kermanshah's strategic position for commerce and actively promoted the construction of its bazaar. Consequently, large bazaars that were spacious, well-lit, wide, vaulted, and constructed of brick were built during this time (Buckingham, 1830: 179). According to the map (Fig. 3), seven bazaars from this period can be identified, including the Shahi Bazaar and the Chal Hassan Khan Bazaar, both commissioned by Dowlatshah and his mayor, Hassan Khan. Other structures, such as the Haj Shahbaz Khan Mosque and Bath, the Navab Aliyeh Mosque, and his caravanserai, were also constructed during this period. The caravanserai was later demolished with the construction of Rashid Yasemi Street, whereas the mosques have remained intact (Hashemi, 2013: 103).

Middle Stage (1851–1881 CE / 1230–1260 SH)

During this period, trade—and consequently the bazaar—expanded significantly. Commercial activities extended westward along the Chal Hassan Khan and Qeysariyeh Bazaar rows, transforming the bazaar into the city's main commercial artery and economic center. At this time,

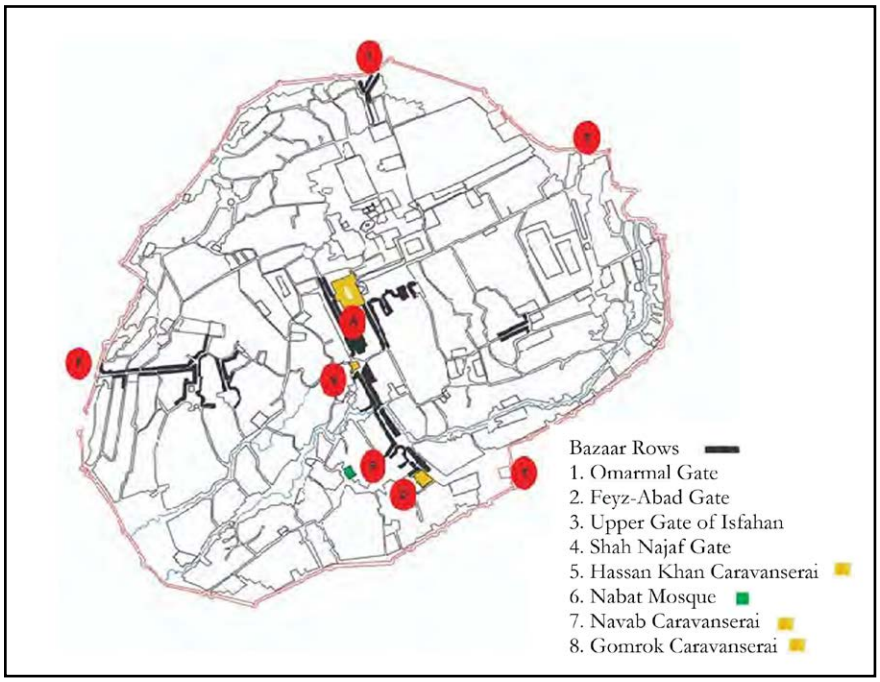


Fig. 3: The condition of the Kermanshah Bazaar in 1850 CE / 1229 SH (Mehryar, 2008). ▶

numerous mosques, urban caravanserais (saras), Tims, bazaar rows, and Chahar Souqs were constructed, all contributing to the continuous growth of the bazaar (from the Bazaz Khaneh and Jewish Bazaar to the terminus of the Vakil al-Dowleh complex). The Vakil al-Dowleh urban caravanserai, Emad al-Dowleh urban caravanserai, Molla Ghasem urban caravanserai, Isfahani urban caravanserai, and Khorma-Furushan urban caravanserai were all built during this era (Fig. 4), (Hashemi, 2013: 110).

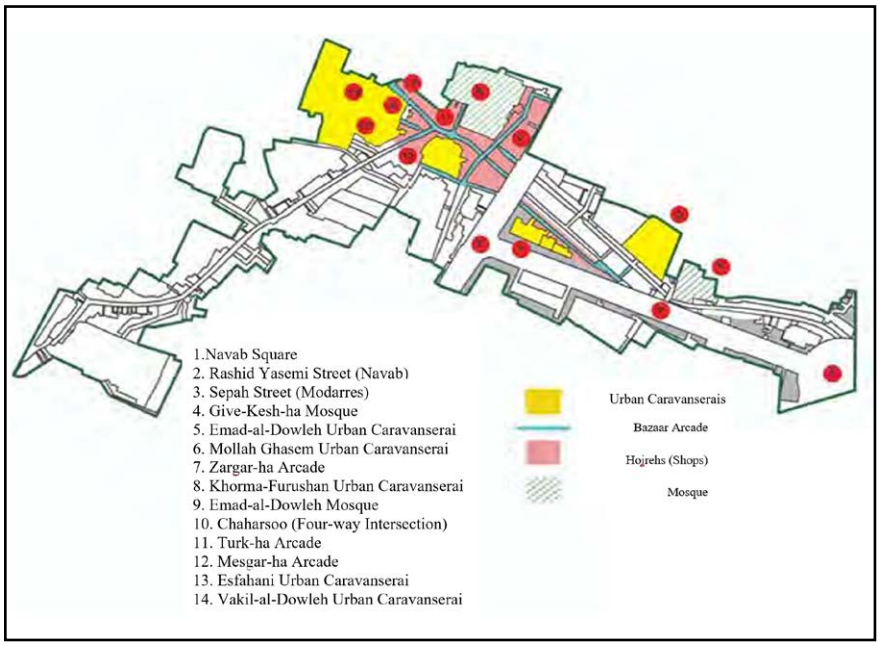
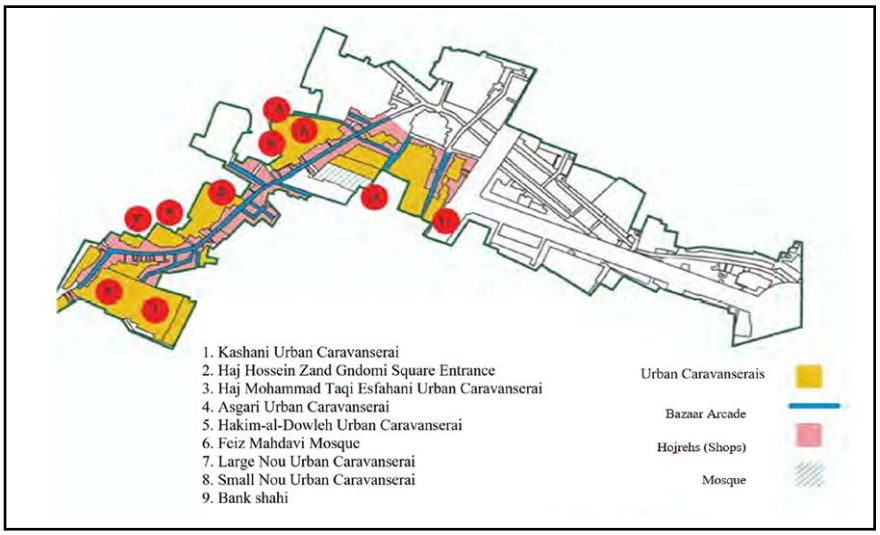


Fig. 4: Expansion of the Kermanshah Bazaar during the Middle Period (1230–1260) (Clark & Clarke, 1969). ▶

Final Period (1881-1925 CE / 1260-1304 SH)

During this period, the economic and social conditions of the country and the Kermanshah province were unfavorable, as the Kermanshah Bazaar primarily functioned as a hub for the transfer of goods and operated according to its own internal logic. This logic was centered on meeting the needs of the central countries rather than serving local relationships. The British and Ottoman governments worked to ensure the security of the trade routes, which sustained the bazaar and prevented its decline, while merchants played a significant role in the construction of market buildings. During this time, the bazaar expanded eastward and westward. On the western side, it extended from the Vakil al-Dowleh complex toward ‘Allaff Khaneh Square and Darb Tavileh. On the eastern side of ‘Allaff Khaneh Square, a large caravanserai known as the Kashani Caravanserai was constructed (Keshavarz, 2003: 771). The Rasteh-e-Turks was bounded on the east by the Rasteh-e-Serraj-ha and on the west by the beginning of the Rasteh-e-‘Allaf Khaneh. From there, the Rasteh-e-‘Allaf Khaneh extended westward until it reached the ‘Allaf Khaneh Square. Along this route, several structures were built, although no surviving evidence clarifies their date of construction or patrons. Among these were the Hakim al-Dowleh urban caravanserai, the Nou urban caravanserai—consisting of a small caravanserai and a larger one with the Imperial Bank located at its center—and finally, the ‘Allaf Khaneh Square, marking the present westernmost end of the Kermanshah Bazaar (Fig. 5), (Hashemi, 2013: 112).



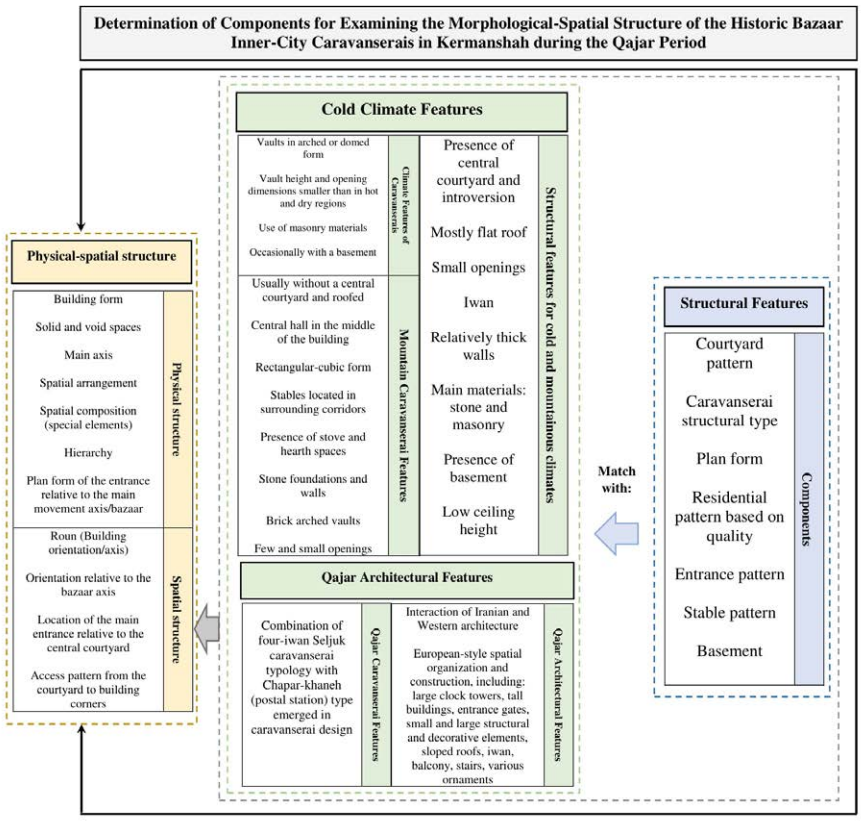
◀**Fig. 5: The growth and development of the Kermanshah Bazaar (western section) during the final period (1260–1304 SH / 1881–1925 CE), (Clark & Clarke, 1969).**

After this period, the situation of the Kermanshah market deteriorated, leading to its gradual decline. Among the factors

contributing to the decline of commerce and the relocalization of the Kermanshah market were, first, the upgrading of production tools and transportation infrastructure, which required substantial foreign and domestic capital. Consequently, neither the British, Ottoman, and Russian governments nor domestic and foreign merchants were willing to invest in this sector. Second, tribal nobility and lord-serf relations presented serious obstacles to capital accumulation (Fouran, 2013: 37). The construction of the national railway also contributed to the diminishing commercial significance of Kermanshah. With the outbreak of World War II, Kermanshah's commerce became further restricted, and in the subsequent years, no recovery occurred, eventually reverting the market to a primarily local function (Pashazadeh, 2012: 61). Furthermore, during the Pahlavi era, with the construction of several streets, including Sepah Street (currently Modares) and Javanshir Street, the Kermanshah Bazaar was intersected at multiple points, and gradually, sections of it suffered significant damage or were destroyed (Hashemi, 2013: 100). The studies conducted relied on existing evidence and documents, which can be supplemented if new sources are discovered, because many of the palaces were built during the Qajar period, but no evidence exists regarding the exact dates of their construction. Based on the theoretical section of this research, the author has determined the criteria and influential characteristics for examining the urban caravanserais of the historical Kermanshah Bazaar during the Qajar period, in line with the research objectives (Fig. 6).

Research Sample

Based on the discussion presented in the theoretical section of the research regarding the historical Kermanshah Bazaar during the early, middle, and late Qajar periods, no caravanserais from the early period have survived. According to the available records, the caravanserais of this period were demolished, and the remaining urban caravanserais in Kermanshah date to the middle and late Qajar periods. Therefore, the objective of this research is to examine the caravanserais that were considered significant during the middle and late Qajar periods in terms of accessibility, size, and function. The selected caravanserais had multiple access points to accommodate both pedestrian and pack-animal entrances, operated as cohesive complexes in terms of size, and held considerable importance during the Qajar era with regard to their caravan-trading functions.



◄Fig. 6: Research operational model (Author, 2024).

Based on the available evidence, during the middle period, the Vakil al-Dowleh complex, which includes the Vakil al-Dowleh urban caravanserai, two open Timchehs, and the Khorma-Furush-ha urban caravanserai, functioned as an interconnected unit. In terms of accessibility, it had one entrance from the bazaar and one from the Khorma-Furush-ha caravanserai, facilitating the entry and exit of caravans with pack animals. In the final period, the Nou urban caravanserai complex, consisting of a large caravanserai, a small caravanserai, and the Imperial Bank located within the large caravanserai, had three access points: two from the bazaar and one from the current Javanshir Street, also allowing for the movement of caravans with pack animals.

The Kashani urban caravanserai, located to the east of ‘Allaf Khaneh Square, was connected to both the bazaar and the square, with access available from ‘Allaf Khaneh Square. Access to the square itself was possible from three directions: the bazaar, Javanshir Street, and an alley. The Hamedani (Tavakkol) urban caravanserai, whose exact date of construction is unknown, is identified as a Qajar-era building and noted for its significance based on records held by the Kermanshah Cultural

Heritage Organization (Rashidi, 2014) and interviews with long-time local residents. This caravanserai was highly important due to its commercial-caravan function, its thriving activity, and its other uses, which included serving as a Russian barracks and a traditional school (Maktabkhāneh). Table 1 introduces the urban caravanserais examined in this study.

Table 1: Introduction of the urban caravanserais studied in the historical Bazaar of Kermanshah during the Qajar period. (Author, 2024). ▼

Caravanserai Name	Historical Period	Typology	Plan Geometry	Architectural pattern	Building Feature	Size and Spatial Composition	Access	Number of Entrances		
								Total	Primary	Secondary
Vakil al-Dowleh urban caravanserai	Qajar period	Urban	Rectangular and its Variations	Central courtyard (introversion) Two-Iwan	Vakil al-Dowleh urban caravanserai it has two floors (ground floor, first floor) and a basement.	A complex consisting of: Vakil al-Dowleh urban caravanserai (commercial-caravan), two open Timchehs (commercial), Khorma-Furush-ha urban caravanserai (commercial), with stable	With 2 accesses: one from the bazaar (for pedestrians), one from the Khorma-Furush-ha urban caravanserai (for pedestrians and pack animals)	2	1	1
Nou urban caravanserai	Qajar period	Urban	Rectangular and its Variations	Central courtyard (introversion) small urban caravanserai: with two-Iwan; large urban caravanserai of various plans	large urban caravanserai has two floors (ground floor, first floor); small urban caravanserai with one floor, without basement	A complex consisting of: Nou Small urban caravanserai (commercial), Nou Large urban caravanserai (commercial-caravan), Imperial Bank of Persai (Shahanshahi Bank) in the large caravanserai, with stable	With 3 accesses: two from the bazaar (for pedestrians), one from Javanshir Street (for pedestrians and pack animals)	3	1	2
Hamedani urban caravanserai (Tvakol)	Qajar period	Urban	Rectangular and its Variations	Central courtyard (introversion); various plans	With two floors (ground and first) and basement	Urban caravanserai (caravan-commercial), with stable	With 2 accesses: one from the bazaar (for pedestrians) and one from Rashid Yasemi Street (for pedestrians and pack animals)	1	1	-
Kashani urban caravanserai	Qajar period	Urban	Rectangular	Central courtyard (introversion); Single-Iwan	With one floor and without basement	Urban caravanserai (caravan-commercial) connected to Allaf Khaneh Square, with stable	With 3 accesses via Allaf Khaneh Square: one from the bazaar (for pedestrians), one from the alley, and one from Javanshir Street (for pedestrians and pack animals)	1	1	-

Vakil-al-Dowleh Urban Caravanserai

Haj Agha Hassan Vakil-al-Dowleh, who served as the British commercial and economic representative in Kermanshah between 1297 and 1310 SH,

established a complex in the Kermanshah Bazaar known as the Vakil-al-Dowleh Complex. This complex included the Vakil-al-Dowleh Urban Caravanserai, the Khorma-Furush-ha Urban Caravanserai to the west, and two Tīmchehs to the east of the main caravanserai. Based on the endowment document, it can be inferred that the Vakil-al-Dowleh Complex was constructed shortly before 1308 SH (Hashemi, 2013: 107).

This urban caravanserai is located at the intersection of the Mesgar Bazaar route (running west–east) and the Turk Bazaar route (running south–north), which converge near the large central square of the bazaar. The main entrance to the complex lies within the Turk Bazaar, flanked by chambers on both sides; beyond this passage is the gateway leading to the main courtyard. In the past, the courtyard was paved and contained a central pond and trees, elements of which no longer remain. It is currently surrounded by two-story chambers. To the west, behind the central courtyard, lies the Khorma-Furush-ha Urban Caravanserai, constructed in the same style as the Vakil-al-Dowleh Urban Caravanserai. The difference is that, due to the natural slope at its entrance, the Khorma-Furush-ha Caravanserai was built as a three-story structure overlooking the Vakil-al-Dowleh Caravanserai. It is also connected to the Isfahani Urban Caravanserai to the south, and the northern side of the complex includes a basement.

This caravanserai was officially registered as one of the national monuments of Iran in 1386 SH (Archives of the Cultural Heritage, Handicrafts and Tourism Organization of Kermanshah Province, 2010). Historically, the Vakil-al-Dowleh Urban Caravanserai served a commercial-caravan function. According to interviews with long-time market owners, it was previously used for residential purposes, while the Khorma-Furush-ha Caravanserai and the tīmchehs were primarily commercial. Today, however, the Vakil-al-Dowleh Caravanserai is largely used for storage. The chambers have been renovated, and the first-floor vaults that once functioned as corridors providing access to residential spaces have been closed and converted into windows. Both open-air chambers remain active, with rooms now used for artistic activities such as painting and weaving. Unfortunately, many of the rooms in the Khorma-Furush-ha Urban Caravanserai are damaged and require restoration.

Figs. 7, 8, and 9 present the plans and images of the Vakil-al-Dowleh Urban Caravanserai, while Table 2 provides an analysis of its structural characteristics in comparison with the climatic and architectural features of the Qajar period.

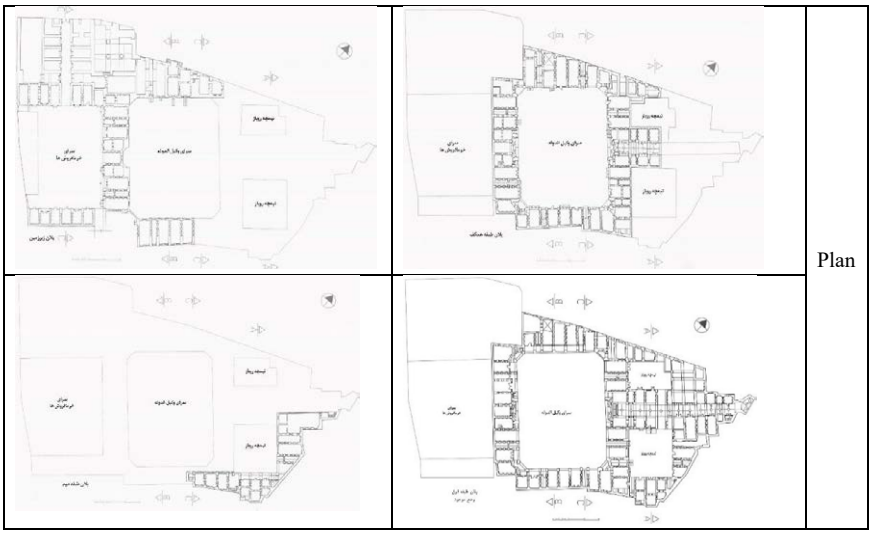


Fig. 7: Floor plans (ground floor, basement, first and second) of the Vakil-al-Dowleh urban caravanserai (Archives of the Cultural Heritage, Handicrafts and Tourism Organization of Kermanshah Province, 2010). ▶

Fig. 8: Vakil-al-Dowleh Urban Caravanserai; A: Entrance porch and eastern facade; B: West facade porch (opposite the entrance porch); C: South facade (closing the first-floor arches and converting them into windows); D: View of the open Tīmcheh of Vakil-al-Dowleh Urban Caravanserai (Author, 2024). ▶

The Urban Caravanserai of Nou

The Nou urban caravanserai is situated in the Feyz-Abad neighborhood, recognized as one of the oldest and most historically significant areas of Kermanshah, within the confines of the city's historical bazaar. This structure originates from the late Qajar period, although specific details regarding the exact year of its construction remain unclear (Hashemi, 2013: 112). The urban caravanserai features a central courtyard, a corridor that runs along the east–west axis of the courtyard, and an angular courtyard located in the southeast corner. It is linked to the market square via a short corridor or hallway, although the entrance to this corridor is not particularly conspicuous. An additional entrance to the urban caravanserai is accessible through a passage that begins from the alley to the east of the complex, leading to the central opening of the eastern façade. Given that the axis

Table 2: The structural features of the Vakil-al-Dowleh Palace, and its comparison with the climatic and architectural features of the Qajar period (Author, 2024). ▼

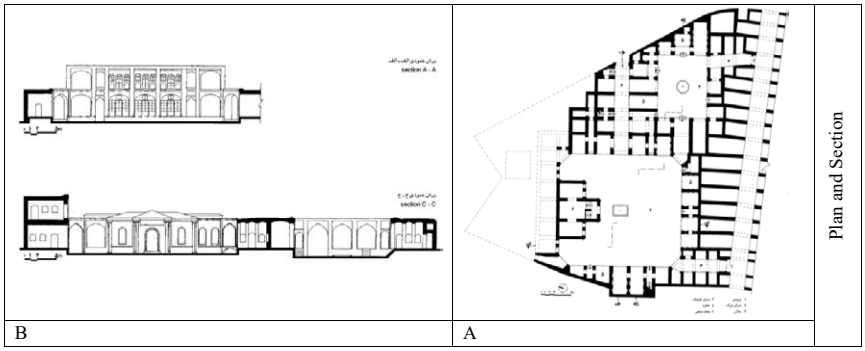
Feature of Qajar Architecture	Climatic feature	Comparison with climatic and architectural characteristics of the Qajar period:	Structural Features		
*Modeled after the 2-iwan design with a central courtyard of the Qajar era (Fig. 8a and b) *Entrance Iwan with decorations (Fig. 8a) *Semicircular arches in the small Iwans and chambers (Fig. 8) *The small Iwans on the first floor were connected to each other and functioned like a portico (now removed and closed by windows)	*Central courtyard pattern and introversion *Using curved covering (pointed and oval arches) and arches in the Roman, rabbi and lapoush methods *Using a veranda *Using a basement to regulate temperature *Using an arch to regulate temperature *Using brick materials (in walls, lintels and arches) - stone materials (foundation, kerb-tile and plinth) and wood (in doors and windows) *Small openings (now the openings have been enlarged by removing the verandas and converting them into windows) (Fig. 8 b and c)		*Central courtyard *Rectangular with beveled corners *Two-Iwan		**Yard pattern**
			Based on the model of a Two-Iwan caravanserai		**Structural type of Urban caravanserai**
			Irregular rectangle		**Plan form**
			*Location of rooms around the central courtyard on 4 sides *With four rooms on each side of the entrance hall *Location of two rooms on each side of the Iwans *With a room on the northern side of the basement	**The Cell**	**Residential Pattern Based On Quality**
			*Location of residential spaces on the first floor *With independent small Iwans * The small Iwans had access to each other and acted as an arcade on the first floor, which is now closed and turned into windows (Fig. 8 b and c) *Access to the first floor via staircases in the corners of the western facade	**Residence**	
			*The main entrance is located on the eastern facade and has an entrance hall and no vestibule *It has an entrance porch on the eastern facade of the central courtyard (Fig. 8a) *The height of the porch is two stories *It has two arches on the arms on both sides of the entrance porch		**Input pattern**
			The stables were located in the Khorma-Furush-ha urban caravanserai because the entrance for horses was possible from the Khorma-Furush-ha urban caravanserai and the caravansers entered the Vakil al-Dowleh urban caravanserai through the corridor (Fig. 9).		**Stable pattern**
			Located on the northern front of the Vakil-al-Dowleh urban caravanserai - connected to the basement from the central courtyard by four staircases		**Basement**

▲ Fig. 9: The Khorma-Furush-ha Urban Caravanserai; Entrance to the Vakil-al-Dowleh Urban Caravanserai), (Author, 2024).

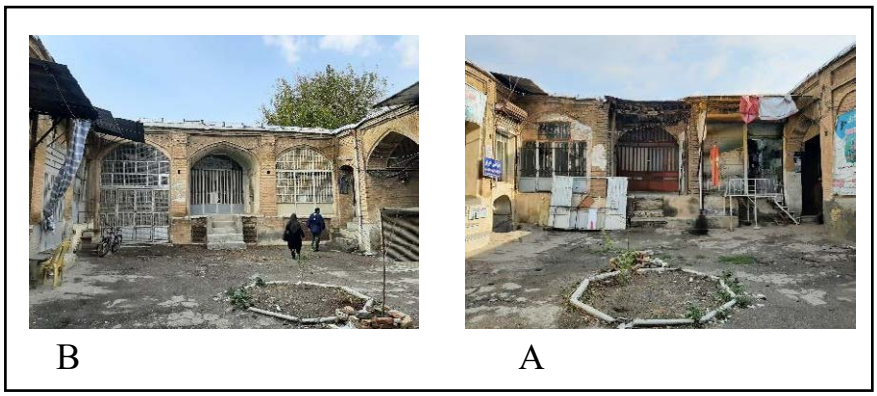
of this entrance is perpendicular to the sides of the main courtyard and faces the two-story façade opposite it (the western façade), it seems that this corridor functioned as the primary entrance to the urban caravanserai, facilitating direct access for caravans to the building.

The configuration of the chambers encircling the courtyard is based on a symmetrical layout, yet the design of each side is distinct from the others. The eastern facade presents a more proportionate arrangement, with divisions set in odd numbers. In contrast, the divisions of the western facade bear resemblance to those of the eastern side, although its two-story height changes its overall character. On the northern edge of the main courtyard is the Shahenshahi Bank (Imperial Bank of Persia), a structure that stands apart from the rest of the complex. Its asymmetrical yet balanced volume juts into the courtyard's center, disrupting the otherwise consistent geometry of the space. This building was likely constructed during the late Qajar or early Pahlavi period and showcases a Western architectural influence. A smaller urban caravanserai is situated in the southeast corner of the complex, featuring a simple, one-story rectangular courtyard with basic geometry. The overall ground plan of this urban caravanserai is quite irregular (Archives of the Cultural Heritage, Handicrafts and Tourism Organization of Kermanshah Province, 2011). In earlier times, this urban caravanserai served dual purpose of commerce and caravan accommodation, with ground-floor rooms allocated for trade and the upper floor designated for lodging. At present, the smaller urban caravanserai's rooms are used for tailoring, while the larger one is utilized for fabric storage. The residential section on the first floor of the larger urban caravanserai is in a state of disrepair and requires restoration. Fig. 10 displays the plan, Figures 11–13 include photographs of the Nou urban

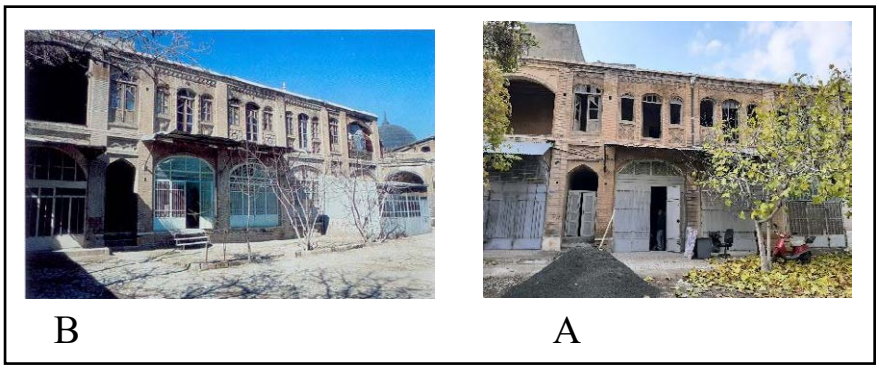
caravanserai, and Table 3 compares its structural characteristics with the climatic and architectural traits of the Qajar period.



◄ Fig: 10. The Nou urban caravanserai; a) Plan of the larger and smaller caravanserai; b) Section of the Nou urban caravanserai (Archives of the Cultural Heritage, Handicrafts and Tourism Organization of Kermanshah Province, 2011).



◄ Fig. 11: The Nou urban caravanserai; A: Eastern facade of the smaller caravanserai (Iwan in the middle of the facade); B: Western facade of the larger caravanserai (Iwan in the middle of the facade opposite the eastern facade), (Author, 2024).



◄ Fig. 12: Western facade of the Nou caravanserai (A: Archive of Cultural Heritage, Handicrafts and Tourism of Kermanshah Province, 2011; B: Author, 2024).

◄ Fig. 13: Northern facade of the Nou caravanserai; (A: Archive of Cultural Heritage, Handicrafts and Tourism of Kermanshah Province, 2011; B: Author, 2024).

Table 3: Study of the structural features of the Nou caravanserai, and comparison with climatic and architectural features of Qajar period (Author, 2024). ▼

Features of Qajar Architecture	Climatic Feature	Comparison with climatic and architectural characteristics of the Qajar period:	Structural features		
General plan: *Modeled on the two-Iwan plan with a central courtyard of Qajar caravanserais (Fig. 11) *Use of Iwan *Brick decorations on the arch and window lintels (Fig. 12) *Use of semi-circular arches above the door and windows (Fig. 12) *Brick designs based on plant designs above the window lintels  Shahanshahi Bank (Imperial Bank of Persia): Use of Western architectural style of the Qajar period including use of gable roof, roof ridge, corner half-columns, entrance canopy, location of stairs inside the building, decorations around doors and windows, facade divisions (Fig. 13) 	*Central courtyard pattern and introversion *Using arch and pediment covering *Using a veranda *Using building materials (mainly brick-plaster and lime, soil and lime mortar) *Using stone materials (intersection of the Chinese seat and the floor of the space, the floor of the stairs, the entrance to the Shahanshahi Bank) *Using wood in the window and door frames		Large Urban caravanserai: square with beveled corners	Central courtyard	**Yard pattern**
			Small corner courtyard: *Rectangular shape *Two-Iwan		
			Taken from Caravanserai Plan Miscellaneous	Big Urban caravanserai	**Structural type of urban caravanserai**
			Taken from the 2-Ivani Caravanserai	Small Urban caravanserai	
			Irregular rectangle		**Plan form**
			*Around the central courtyard on the eastern, southern, western fronts *Around the entrance corridors	Big Urban caravan serai	the cell	**Residential pattern based on quality**
			*Around the central courtyard on four sides *Around the entrance corridors	small Urban caravan serai	
			*First floor of the west facade of the Grand urban caravanserai * Access to the first floor via a staircase located on the west facade		residence
			*Location on the northern side of the main courtyard, which caused the geometric structure of the main courtyard to break * Taken from Western (French) architecture		Shahanshahi Bank (Imperial Bank of Persia)
			*Location on the eastern facade *With entrance hall *No vestibule *With entrance hall *Entrance set back from the facade		original	**Input pattern**
			Located on the southern front of the bazaar - has an entrance hall - no vestibule - no front door		sub
			The courtyard of the sara was used to keep livestock.		**Stable pattern**
			No basement		**Basement**

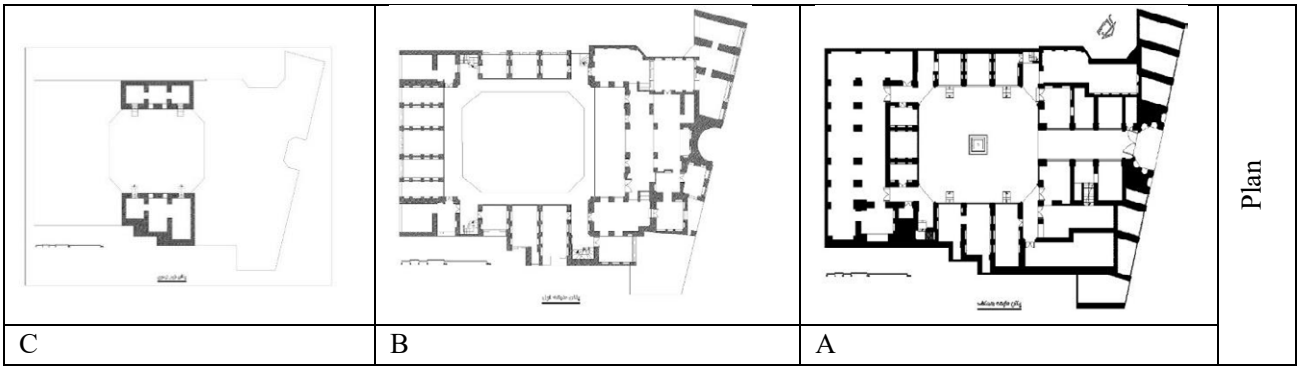
Hamedani Urban Caravanserai

The Haji Ali Hamedani urban caravanserai was built during the Qajar period in the Feyz-Abad neighborhood, one of the oldest historical districts of Kermanshah, and was founded by Haj Ali Mohammad Hamedani. During its peak of prosperity, the building functioned as both a commercial hub and caravanserai, linked with the Tarikeh Bazaar and the Jolo-Khan Passage. It served as a place for distributing goods required by local residents and fostered trade and cultural connections with other cities by hosting and accommodating merchants. Over time, this urban caravanserai has had different functions; it was at one point occupied by Russian soldiers and used as a barracks, and for a period it also served as a school. The urban caravanserai features a central courtyard in the shape of an octagon. On the western side of the courtyard is the entrance hall, which opens onto an alley with a relatively steep slope (known as the Tarikeh Bazaar during the flourishing period of the old Kermanshah bazaar). The entrance of the building is adorned with elaborate tiling and knotwork. Flanking it are rooms that were connected to the Molabashi Bazaar. On the ground floor, there are three rooms on the north, south, and east sides, and two rooms on the west side. The entrances to some of these rooms open onto the corridors, while others face directly into the courtyard.

The entrance of the chambers also open into the courtyard. There are basements on the northern and southern sides, which were connected by two staircases descending from the courtyard; today, one staircase remains on each side. The entrance to the stables is located in the northern corridor, while the entrance to the prayer room lies in the southern corridor. On the western front of the first floor are a series of interconnected rooms, which were used to accommodate and entertain merchants arriving from other cities. In front of these first-floor rooms is a wooden portico supported by columns with decorative capitals (Rashidi, 2014). In more recent times, the building was used as a warehouse and distribution center for Kermanshahi oil, but it is now abandoned and in need of restoration. Fig. 14 presents the plan, Figures 15 and 16 show images of the Hamedani urban caravanserai, and Table 4 outlines its structural features and compares them with the climatic and architectural characteristics of the Qajar period.

Kashani Urban Caravanserai

On the eastern side of Allaf Khaneh Square (Gandomi Square) stands a large palace known as the Kashani urban caravanserai. Precise information



▲Fig. 14: The Hamedani urban caravanserai (Tavakkol); a) Ground floor plan; b) First floor plan; c) Basement plan (Rashidi, 2014).

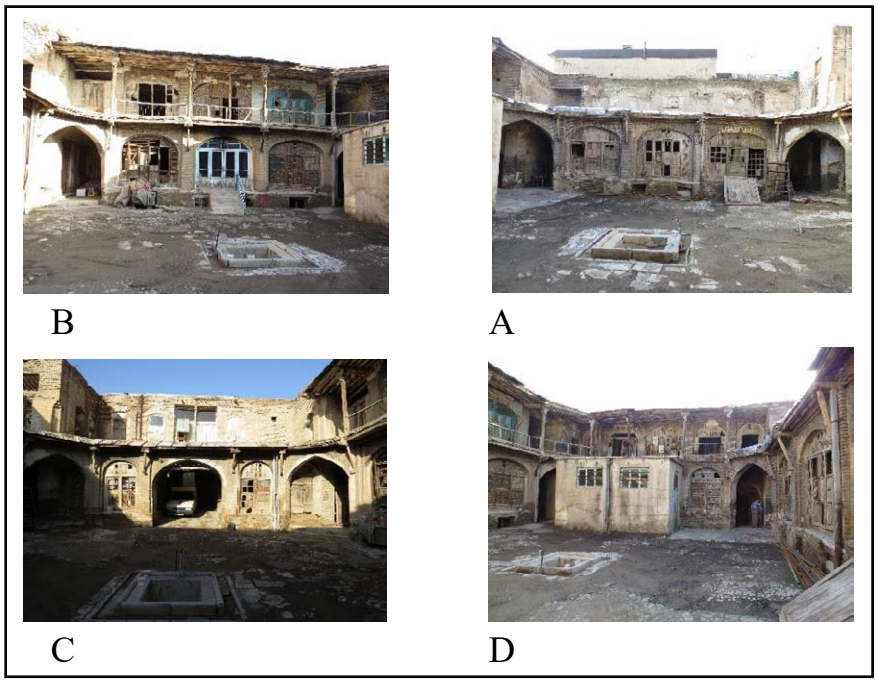


Fig. 15: Hamedani urban caravanserai; A: The northern facade of Hamedani caravanserai; B: Southern facade of the caravanserai; C: Western facade of Hamedani caravanserai; D: Eastern facade (Author, 2024). ▶

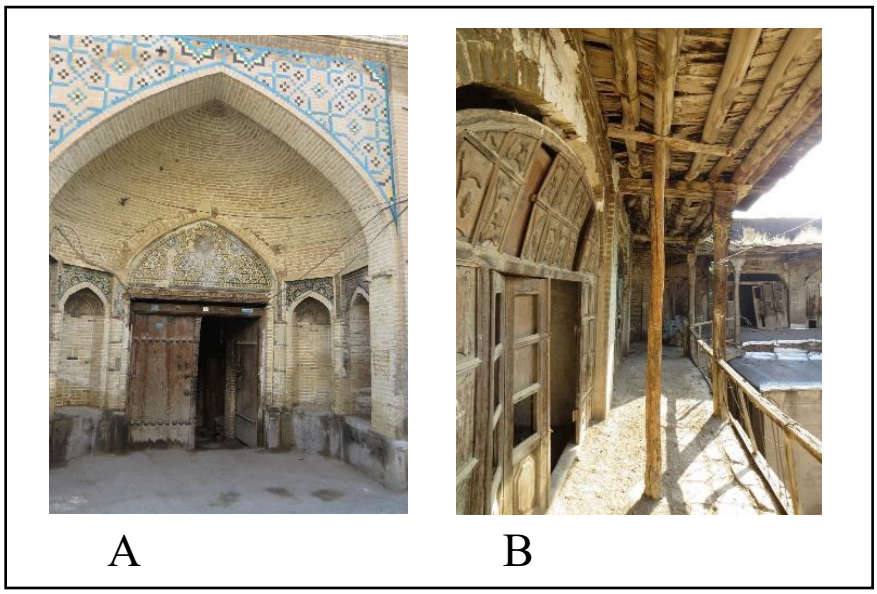


Fig. 16: Hamedani urban caravanserai; A: Main entrance; B: Columned portico on the first floor (Author, 2024). ▶

Table 4: Study of the structural features of the Hamedani caravanserai (Tavakkol), and its comparison with the climatic and architectural features of the Qajar period (Author, 2024). ▼

Characteristics of Qajar Architecture	Climatic feature	Comparison with climatic and architectural characteristics of the Qajar period:	Structural features		
*Modeled after the single-Iwan design with a central courtyard of the Qajar era *Entrance hall with decorations (Fig. 16a) *Columnized porch with wooden capitals (Fig. 16b)  *Semicircular arches above doors and windows (Fig. 15 A and B) *Using designs and patterns on wooden doors and windows  	*Central courtyard pattern and introversion and rectangular plan *Use of curved covering (singular vault, quadripartite vault, and three types of flat vault) *Use of basement for temperature regulation *Use of stables as a buffer space *Use of brick materials and stone and wood foundations *Use of awnings for ground floor rooms (dock = columned porch in front of ground floor rooms)		*Central courtyard *Octagonal in shape		**Yard pattern**
			Taken from the single-porch pattern		**Structural type of urban caravanserai**
			Irregular rectangle		**Plan form**
			*Has three rooms on the northern, southern and eastern sides of the central courtyard *Has two rooms on the western side of the central courtyard *Has three rooms on the northern and southern sides of the basement *Has a columned portico in front of the rooms on the first floor (northern and eastern sides)	the cell	**Residential pattern based on quality**
			*Nested rooms on the west side of the first floor *Access via a staircase in the entrance hallway	residence	
			*Location of the main entrance on the western facade - with a front porch and entrance hall *Retreat of the main entrance relative to the facade *Has a half-domed entrance hall		**Input pattern**
			Location on the eastern front - connection through the corridor on the northern front of the central courtyard		**Stable pattern**
			Located on the north and south fronts - connected by two staircases from the central courtyard		**basement**

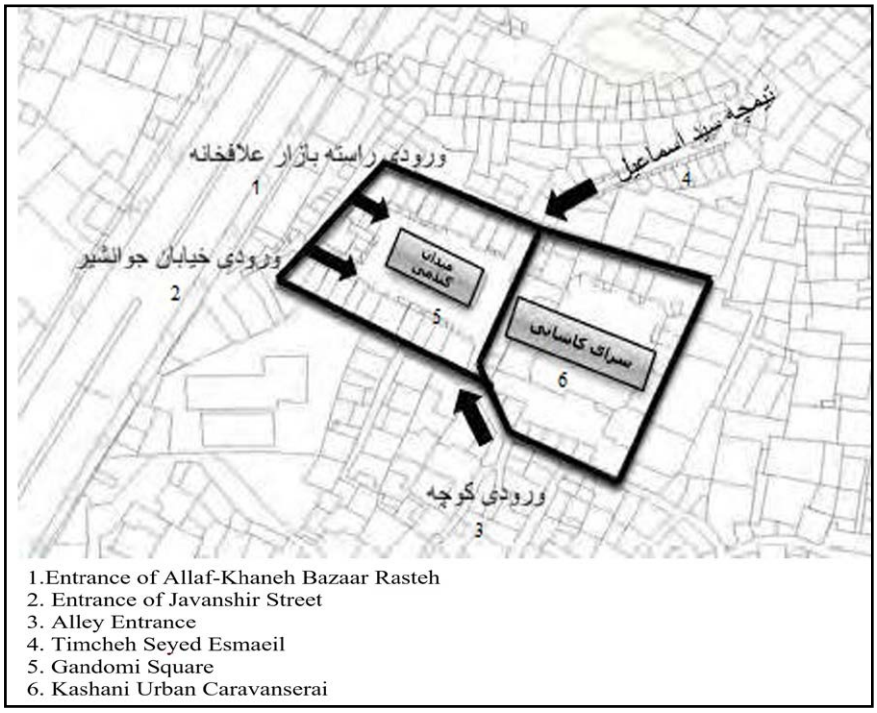
about this palace and its founder is lacking; the only documentary evidence concerning the building's history is a deed of endowment issued in 1349 SH in the name of Mehdi Kashanian.

According to the endowment certificate, the urban caravanserai is recorded as the property of Mohammad Mehdi Kashani, not as a building he constructed. Because this document does not mention the building's construction or its founder, and in the absence of other evidence, it is not possible to determine the date of its construction; however, it is probable that this building, like other structures in this part of the bazaar, dates back to the late Qajar period (Hashemi, 2013: 111). The urban caravanserai was constructed on a single storey, with a central courtyard and a single porch; its function was to provide lodging for travelers who frequently visited the city for trade and commerce. The entrance to this urban caravanserai is on the southern façade, and, after passing through the vestibule and corridor, one reaches the building's main courtyard.

Chambers are arranged around the central courtyard on the northern and western sides and are accessed from the courtyard; additionally, there are five chambers flanking the entrance that open onto Allaf Khaneh Square. The eastern front of the central courtyard comprises vacant land, behind which seven rooms are accessed via an alley. According to the current plan, the passenger accommodation spaces lie behind the rooms on the northern front. The stable areas occupy the northeastern corner of the central courtyard, with access to them provided via the courtyard and a vestibule-like space (Archives of the Cultural Heritage, Handicrafts and Tourism Organization of Kermanshah Province, 2012). Unfortunately, the building is presently abandoned and requires reconstruction and restoration owing to its dilapidated and damaged condition. Figures 17 and 18 illustrate the location and plan of the Kashani urban caravanserai; Fig. 19 presents photographs of the palace, and Table 5 summarises the structural features and compares them with the climatic and architectural characteristics of the Qajar period.

Research Findings

To analyse the selected urban caravanserais of the historical Bazaar of Kermanshah during the Qajar period, we extracted physical-spatial structure criteria based on an operational research model (Fig. 6). To characterize the physical structure of the urban caravanserais, we examined criteria including building form, solid–void relationships, main axis, spatial



◄ **Fig. 17: Aerial map of Kashani urban caravanserai and Alafkhaneh Square (Gandomi Square), (Author, 2024).**

◄ **Fig. 18: Kashani urban caravanserai; a) Plan; b) Section of Kashani urban caravanserai (Archives of the Cultural Heritage, Handicrafts and Tourism Organization of Kermanshah Province, 2012).**

◄ **Fig. 19: Kashani urban caravanserai; A: South Front; B: West Front; C: North Front (Author, 2024).**

Table 5: Study of the structural features of Kashani urban caravanserai, and its compatibility with the climatic and architectural characteristics of the Qajar period (Author, 2024). ▼

Characteristics of Qajar Architecture	Climatic Characteristics	Comparison with climatic and architectural characteristics of the Qajar period:	Structural Features		
*Modeled after the single-iwan design with a central courtyard of the Qajar period * With an arch next to the entrance porch in the central courtyard (Fig. 19 A)	*Pattern of central courtyard and introversion *Use of veranda *Use of arch and vault covering *Use of dome covering for the entrance vestibule *Use of building materials mainly brick *Use of rectangular plan shape		*Central courtyard *Rectangular with beveled corners		**Yard pattern**
			*Taken from the single porch pattern		**Structural model of the urban caravanserai**
			*Rectangle		**Plan form**
			*Location of the chambers on the northern, eastern and western sides of the central courtyard *Five chambers on each entrance arm and access to them from the Allaf Khaneh Square (Gandomi Square) *Seven chambers on the eastern side and access to them from the alley	the cell	**Residential Pattern Based On Quality**
			*Residential spaces behind the chambers of the northern facade *Located in the middle of the western facade of the central courtyard	residence	
			Located on the southern side of the central courtyard - has a corridor and vestibule - has an entrance Iwan in the central courtyard - has two arches in the arm of the entrance porch (Fig. 19 A)		**Input pattern**
			*Located in the northeast corner of the central courtyard - has a vestibule-like space to connect the central courtyard with three stable spaces *In the northwest corner are also spaces similar to the stable pattern, which are now destroyed and are likely to be stables		**Stable pattern**
			No basement		**basement**

arrangement, spatial composition, hierarchy, and the shape of the entrance plan relative to the movement path.

Table 6, 7 and 8 summarizes the physical structure of the selected study centers. In all four of the studied urban caravanserais, the building plan is rectangular and introverted around a central courtyard, and the spatial arrangement of the main elements has developed around the central space (central courtyard); furthermore, depending on the function and characteristics of the design field, they have been complemented by other service organs (stables and storage) and communication organs (entrances and accesses). All four urban caravanserais of Vakil-al-Dowleh, Nou, Hamedani and Kashani had a commercial-caravan function. The largest portion of space is allocated to the chambers, with commercial chambers located on the ground floor in all four urban caravanserais. Also, the small iwans, as intermediate communication spaces between the chambers and the mezzanine, are shaped by the form of the chambers. Residential spaces are located on the first floor in the three urban caravanserais of Vakil-al-Dowleh, Nou, and Hamedani, and on the ground floor in the Kashani urban caravanserai; the share of residential space in the Vakil-al-Dowleh urban caravanserai is greater than in the other urban caravanserais. Given the commercial-caravan function of each of the four urban caravanserais, access to the stable space in the Hamedani and Kashani urban caravanserais is provided via the corridor and vestibule. In the Vakil-al-Dowleh urban caravanserai, owing to its connection with the Khorama-Furusha-ha urban caravanserai and its convenient street access for livestock entry, the stable space is located at the entrance to the Khorama-Furusha-ha urban caravanserai. In the Nou urban caravanserai there was no dedicated stable area and, likely based on evidence in the central courtyard (where elements for tying livestock occur), the courtyard itself was used to keep animals.

The share of stable space in the Hamedani urban caravanserai is larger than in the other buildings. The entrance and access spaces in these urban caravanserais are designed to serve communication and trade with the various sections of the bazaar and its ancillary spaces, and the main axis in these urban caravanserais coincides with the principal entrance axis. The movement path also acts as a connecting element between the interior and exterior spaces of the building, as the analysis of these urban caravanserais shows. The hierarchy of porch–doorway–vestibule–hallway–porch is established along the linear entrance sequence in the urban caravanserais under study. Also, regarding the entrance shape relative to the movement

path, the three urban caravanserais Nou, Hamedani, and Kashani display a set-back entrance form in the design to emphasise the entry and improve legibility, whereas the Vakil-al-Dowleh urban caravanserai presents an entrance aligned with the body of the bazaar.

Table 6: Analysis of the physical layout of the historical bazaar urban Caravanserais located in Kermanshah (Author, 2024). ▶

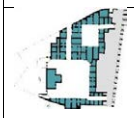
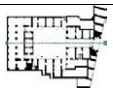
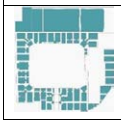
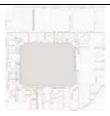
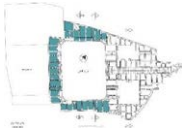
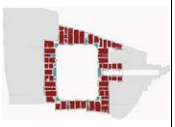
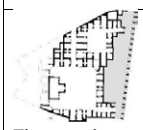
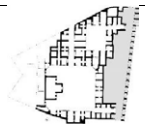
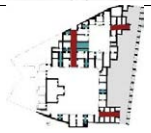
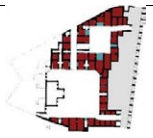
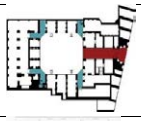
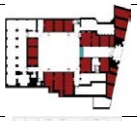
Spatial Arrangement	Main axis	Solid and void space	Building Form	Name
				Vakil-al-Dowleh
				Nou
				Hamedani (Tavakkol)
				Kashani

Table 7: Analysis of the physical layout (Spatial Composition) of the historical bazaar urban Caravanserais located in Kermanshah. (Author, 2024). ▶

Spatial Composition (special elements)				Name
Stable	Residential space	Entry and Access	Iwan and Veranda (*Ivanche*)	
				Vakil-al-Dowleh
 The central courtyard is used for keeping livestock.	 First floor, west front (plan not available)			Nou
				Hamedani (Tavakkol)
				Kashani

In examining the spatial organization of the urban caravanserais, criteria including orientation, relationship to the bazaar, entrance placement in relation to the mezzanine, and forms of access to the building's corners were analyzed. The spatial organization of the urban caravanserais within the historical bazaar of Kermanshah is based on a central arrangement.

The shape of the entry plan relative to the main movement path / market	Hierarchy		Name
	Path Shape	Access Arrangement	
Sitting Back	Linear	Porch - Doorway - Hallway	Nou
Parallel	Linear	Porch - Doorway - Hallway - Porch	Vakil-al-Dowleh
Sitting Back	Linear	Front Porch – Porch - Doorway - Hallway	Hamedani (Tavakkol)
Sitting Back	Linear	Porch - Doorway - Vestibule - Hallway - Porch	Kashani

◄ **Table 8: Continuation of the physical organization (Hierarchy and the shape of the entry plan) of the urban Caravanserai of historical bazaar of Kermanshah (Author, 2024).**

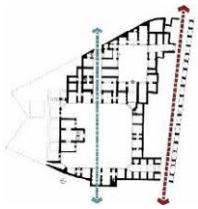
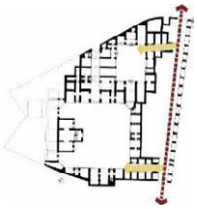
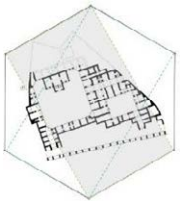
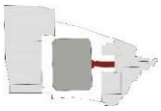
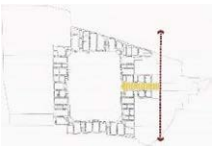
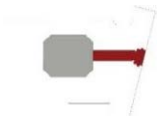
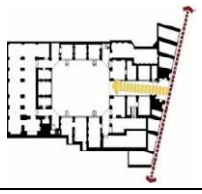
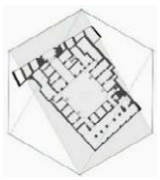
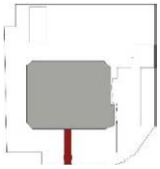
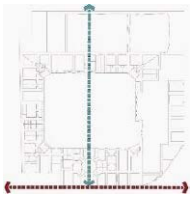
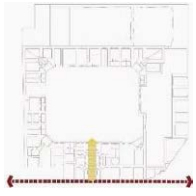
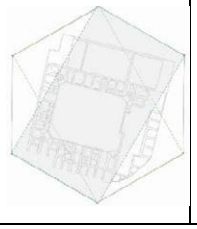
The Nou caravanserai contains two central courtyards connected by a linear axis of access. In identifying the Rons of the palaces, all four urban caravanserais—Nou, Vakil-al-Dowleh, Hamedani, and Kashani— adhered to the principles of the Ron. In examining the orientation of the entrance axis and the longitudinal axis of the urban caravanserais under study with respect to the main movement path or market line, two methods—perpendicular and parallel—were employed. Regarding the position of the main entrance relative to the mezzanine and the form of access from the mezzanines to the corners of the building, it can be observed that all examples, taking into account the surrounding neighbourhoods and the form of the straight movement path, provide access to the mezzanine through entrances aligned with perpendicular axes. Otherwise, the entrance is rotated relative to the mezzanine's main axis and placed at its corner. Access to the corners of the building was generally rectangular, sometimes with bevelled or octagonal corners, while the secondary accesses were rectangular. Table 9 presents the spatial structure of the selected urban caravanserais included in this study.

Discussion

In general, the factors influencing the formation of urban caravanserais in the traditional market of Kermanshah during the Qajar period can be classified into two groups: internal and external factors. During the Zand period, although trade was emphasized, commerce in Kermanshah remained local and underdeveloped, with only limited connections to international trade. In the 13th century, the Iranian economy became dependent on the emerging global economy and international markets through the initiatives of Western investors and Iranian merchants, and the city of Kermanshah also benefited from this development.

During the reign of Dowlat Shah, trade flourished in Kermanshah due to essential infrastructure such as roadside caravanserais, road security, trade agencies, and the presence of British and Russian consulates,

Table 9: Analysis of the spatial organization of the urban caravanserais in Kermanshah's historical bazaar (Author, 2024). ▼

The form of access to the corners of the building		Entrance (main) to the intersection	Market orientation		Ron	Name
Sub	Original		main axis	Input axis		
Rectangle	Rectangle With Beveled Corners	Main: Middle - Sub: Corner 	Parallel 	Vertical 	Isfahani 	Nou
-	Octagonal	The Middle 	Vertical 	Vertical 	Rasteh 	Vakil-Al-Dowleh
-	Rectangle with Beveled Corners	The Middle 	Vertical 	Vertical 	Isfahani 	Hamedani (Tavakkol)
-	Octagonal	The Middle 	Vertical 	Vertical 	Rasteh 	Kashani

along with the interests of the Ottomans. As a result, both Britain and the Ottoman Empire sought to expand their share in the Kermanshah bazaar, strengthen their financial networks, and facilitate commercial exchange. Consequently, the Baghdad–Kermanshah trade route gained great importance during the Qajar period as a central hub for Iran's needs and exerted significant influence on both the country and the city of Kermanshah. These factors provided the foundation for the expansion and consolidation of the Kermanshah bazaar during the early, middle, and late Qajar periods and constituted the most important elements in the formation of urban caravanserais.

Findings from the study of four major urban caravanserais of the Qajar period in the traditional bazaar of Kermanshah (examined in

terms of access, size, and function) indicate that Vakil-al-Dowleh, Nou, Hamedani, and Kashani shared broadly similar architectural forms and fulfilled combined commercial and caravan functions. Their general structure is introverted, organized around a central courtyard. The Vakil-al-Dowleh and Nou urban caravanserais employ a two-iwan layout, while the Kashani and Hamedani urban caravanserais use a single-iwan design. The iwans of the Vakil-al-Dowleh urban caravanserai are more elaborate than those of the other three, both in decoration and height (two stories) (Fig. 8A & B), while the porches of the other three complexes are closer in form to simple arches.

The rooms in all four urban caravanserais are arranged on the ground floor around the central courtyard, with residential spaces located on the first floor (except in the Kashani urban caravanserai, where residences are on the ground floor). In the Vakil-al-Dowleh urban caravanserai, part of the first-floor residential spaces on the northern façade, distinguished by its gable roof, appears not to have been constructed simultaneously with the other sections, as arches were used on the remaining façades of this urban caravanserai. From the perspective of cold-climate adaptation, all four complexes employed arches (to regulate temperature) and locally available building materials, while in the Vakil-al-Dowleh and Hamedani urban caravanserais, basements were also incorporated for thermal regulation.

The presence of verandas in the Vakil-al-Dowleh urban caravanserai and the small iwans in the Hamedani urban caravanserai (a similar feature can be observed in the urban caravanserai of the Hamedan Bazaar), in addition to their communicative function, served to protect against rain and regulate direct sunlight, although the verandas of the Vakil-al-Dowleh urban caravanserai have now been enclosed and converted into large windows, which is not consistent with cold-climate considerations (Fig. 8B & C). In addition, the inclusion of elements such as the gable roof (a characteristic of Russian architecture) in part of the Vakil-al-Dowleh urban caravanserai and the Shahanshahi Bank (Imperial Bank of Persia) building in the Nou urban caravanserai; semicircular arches above the doors and windows in the Vakil-al-Dowleh, Nou, and Hamedani urban caravanserais; arches (also associated with Russian architectural influence) in the Kashani urban caravanserai; and brick motifs derived from plant-based designs above the doors and windows in the Nou and Hamedani urban caravanserais all demonstrate the stylistic features

of Qajar architecture, which was influenced by Western, particularly Russian, architecture in Kermanshah.

The results obtained from the physical-organization studies also indicate that the form of the buildings in these four urban caravanserais is derived from a rectangular plan. The solid-to-void ratio in the Nou, Vakil-al-Dowleh, and Kashani urban caravanserais is approximately two to one, while in the Hamedani urban caravanserai it is about four to one. The spatial arrangement in each of the four urban caravanserais follows a central organization, and the functions of these complexes have influenced the characteristics of specific design elements as well as the relationships among their constituent parts.

Thus, in the Nou urban caravanserai and Vakil-al-Dowleh urban caravanserai, due to their commercial function, the largest share of space is allocated to the rooms, while in the Hamedani urban caravanserai and Kashani urban caravanserai, the greatest share of space after the rooms is dedicated to living areas, stables, and storage spaces. The entrances and circulation routes of these urban caravanserais are determined according to their commercial role and their level of connection to the market square. The Nou urban caravanserai has three entrances (one main entrance and two secondary ones), whereas the other urban caravanserais each have a single main entrance aligned with the primary axis of the complex. The hierarchy of entrances in the urban caravanserais follows a sequence of front porch – doorway – vestibule – hallway – porch, arranged in a linear layout. The entrance plan is set back from the circulation path to enhance legibility in the three urban caravanserais of Nou, Hamedani, and Kashani, while in the Vakil-al-Dowleh urban caravanserai it is aligned with the order of the bazaar.

The results of the analysis of spatial organization further indicate that all four urban caravanserais examined conform to the principles of Ron. The Vakil-al-Dowleh and Kashani urban caravanserais are oriented according to the Rasteh Ron, while the Nou and Hamedani urban caravanserais are oriented according to the Esfahani Ron. Regarding the orientation of the entrance axis in relation to the traffic route (bazaar route), in all four urban caravanserais the entrance is perpendicular to the traffic route. The main axis is also perpendicular in the Vakil-al-Dowleh, Hamedani, and Kashani urban caravanserais, whereas it is parallel to the bazaar traffic route in the Nou urban caravanserai. The climatic orientation (east–west extension of the building) and the presence of adjacent functional spaces

along the bazaar route can be identified as influential factors in whether the design expanded vertically or parallel to the traffic route. Concerning the location of the main entrance, all four urban caravanserais feature a central access form leading to the mezzanine, and the mezzanine accesses located at the corners of the buildings employ a rectangular configuration with beveled and octagonal corners. Table 10 presents a comparative summary of the structural characteristics and the physical–spatial organization of selected urban caravanserais in the historical bazaar of Kermanshah during the Qajar period.

Conclusion

In response to the initial research question, "What were the factors influencing the development of Kermanshah's bazaars and urban caravanserais during the Qajar era, and what impact did they have on the physical structure of the buildings?" it can be observed that among the internal factors were the weakness and lack of prosperity of Kermanshah's local trade and market during the Zand period, which facilitated the establishment of the necessary infrastructure for international trade during the Qajar period. Among the external factors was the establishment of British, Russian, and Ottoman consulates in Kermanshah, which significantly contributed to the flourishing of bazaar trade in the city, particularly in the late Qajar period, when the British and Ottomans endeavored to maintain the bazaar's prosperity. Another internal factor was the influx of merchants from neighboring cities such as Isfahan, Kashan, Shiraz, Shushtar, Yazd, Tehran, Tabriz, Hamedan, and Arak to Kermanshah. All these factors were crucial in the development and expansion of Kermanshah's bazaars and urban caravanserais.

This has resulted in the incorporation of historical, political, cultural, and local elements into the physical design of significant structures. Additionally, an internal factor was the influx of merchants from nearby cities such as Isfahan, Kashan, Shiraz, Shushtar, Yazd, Tehran, Tabriz, Hamedan, and Arak into Kermanshah. Collectively, these elements were crucial in the development and expansion of Kermanshah's bazaar and urban caravanserais, particularly regarding their size, accessibility, and functionality. Consequently, the inward-looking urban caravanserais, characterized by a central layout, traditional design, and climatic adaptations, are a product of the artisans' preference for local architectural styles. Furthermore, the impact of Western architecture, particularly

Russian influences, evident in the decorative elements, gable roofs, porches, arches, and semicircular arches, reflects the builders' attraction to Western architectural trends that were prominent in Kermanshah during that period.

Upon analyzing the physical composition of the unique elements throughout the entirety of these structures, it is demonstrated that the proportion of filled to unfilled space in the three urban caravanserais—Nou, Vakil-al-Dowleh, and Kashani—stands at a ratio of two to one. Within these urban caravanserais, the predominant allocation of space is primarily designated for the chambers, followed by residential areas, storage facilities, and stables.

In each of the four urban caravanserais, the areas designated for communication, such as entrances and access points, have expanded to facilitate smoother commercial interactions and traffic flow. This expansion is also influenced by the dimensions of the caravanserais themselves; notably, small iwans do not constitute a primary feature of these structures and, at times, may be entirely absent due to spatial constraints. Regarding spatial circulation, the configuration of the linear pathways in all four caravanserais is shaped by the pre-existing movement routes, specifically the market row, and is oriented perpendicular to it. Furthermore, the design of the entrance to the urban caravanserais is either recessed for enhanced spatial emphasis and clarity or aligned with the movement path, as it integrates into the market framework and is constrained by the narrowness of the rows.

The recognition of the spatial arrangement of the studied urban caravanserais indicates that the design and orientation based on climate (Ron), was a fundamental principle in the construction of these structures. Additionally, the Rasteh and Esfahani Rons were incorporated into the architectural design of the buildings. The positioning of the entrance in relation to the mezzanine is also determined by the building's function, with the primary entrances situated at the center of the mezzanine. Furthermore, the configuration of the main mezzanine's access to the building's corners illustrates that, in each of the four urban caravanserais, considerations such as diverse designs and the potential for access to service areas (including stables and storage spaces) were implemented.

Table 10: Summary and comparison of structural and spatial organization characteristics of the urban caravanserais in Kermanshah's historical bazaar during the Qajar period (Author, 2024). ▼

Kashani urban Caravanserai	Hamedani Urban Caravanserai (Tavakkol)	Vakil-al-Dowleh urban Caravanserai	Nou urban Caravanserai	Criteria	
Single-Iwan introversion - rooms around the central courtyard - with living space and stables - main entrance from the Allaf Khaneh Square and with a vestibule and entrance Iwan - no basemen	Introversion derived from the single-Iwan design - rooms around the central courtyard - residential space on the first floor with stables - main entrance from the bazaar and with a front Iwan, vestibule and entrance Iwan - with a basement -	Introversion: 2-iwan; rooms around the central courtyard - no stables - main entrance from the bazaar and with an entrance Iwan from inside the building - with a basement	Large introverted urban Caravanserai with a different plan/Small introverted urban Caravanserai with 2-iwan; Rooms around the central courtyard-No stables or basement/Has one main entrance and two secondary entrances from the bazaar	**Structural features**	**structural**
match	match	match	match	**Structure adapted to climatic characteristics**	
match	match	match	match	**Structure consistent with Qajar architecture**	
rectangle	Irregular rectangle	Irregular rectangle	Irregular rectangle	**building form**	**Physical organization**
The arena is four times solid and void	The arena is twice as solid as it is void	The arena is twice as solid as it is void	The arena is twice as solid as it is void	**Solid and void space**	
Matches the main input	Matches the main input.	Matches the main input	Matches the main input	**main axis**	
central	central	central	central	**Spatial arrangement**	
Cellars, storages, lodgings and stables	Cellars, storages, lodgings and stables	The highest share of cells	The highest share of cells	**Spatial composition (special elements)**	
Porch - Doorway - Vestibule – Hallway - Porch Linear Path	Front porch - porch - doorway - hallway Linear route	Porch-Dormitory-Hallway-Iwan Linear Path	Archway - Doorway - Hallway Linear Path	**Hierarchy and shape of the movement path**	
sitting back	sitting back	aligned	sitting back	**The shape of the entry plan relative to the market**	
Rasteh	Isfahani	Rasteh	Isfahani	**Ron**	**Spatial organization**
vertical	vertical	vertical	vertical — Input axis	**Market orientation**	
vertical	vertical	vertical	parallel — main axis		
the middle	the middle	the middle	the middle	**The main entrance location relative to the intersection**	
octagonal	Rectangle with beveled corners	octagonal	Rectangle with beveled corners	**The shape of the access to the corners of the building from the middle**	

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Conflict of Interest

The Author declares that there is no conflict of interest while observing publication ethics in referencing.

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چکیده

سراهای درون‌شهری بازار کرمانشاه، به‌عنوان فضاهای نیمه‌باز و گره‌های تنفسی، درمیان بافت سرپوشیدهٔ بازار قرار داشتند و محل تعاملات اقتصادی، مبادلات کالا و استقرار کاروانیان به‌شمار می‌آمدند. شکوفایی این سراها در دورهٔ قاجار مرهون ایجاد امنیت، گسترش ارتباطات با انگلستان، روسیه، حکومت عثمانی، و توسعهٔ تجارت داخلی و خارجی بود. در همین دوره، رونق تولید و بازرگانی در کرمانشاه سبب گسترش بازار تاریخی در امتداد مسیر اصلی کاروان‌رو شهر -که غرب زاگرس را به شرق آن پیوند می‌داد- و شکل‌گیری منسجم سراهای درون‌شهری به‌عنوان عناصر کالبدی در ساختار بازار شد. اهمیت پژوهش حاضر از آن‌جهت است که باوجود جایگاه برجستهٔ بازار و سراهای درون‌شهری کرمانشاه در دورهٔ قاجار، تاکنون پژوهش مستقلی دربارهٔ آن انجام نشده است؛ از این‌رو، هدف این پژوهش شناخت سازمان فضایی و بررسی عناصر و الگوی ساختار کالبدی سراهای بازار کرمانشاه در دورهٔ قاجار است. مطالعهٔ حاضر به روش توصیفی-تحلیلی و موردپژوهی انجام شده است. چهار سرای درون‌شهری به‌عنوان نمونهٔ موردی انتخاب شدند و تاریخچهٔ پیداش آن‌ها با استفاده از روش کتابخانه‌ای و اسناد تاریخی موردمطالعه قرار گرفت؛ سپس با روش میدانی، اطلاعات این سراها تکمیل گردید و براساس هدف پژوهش، ویژگی‌های کالبدی-فضایی آن‌ها تحلیل و بررسی شد. نتایج نشان می‌دهد که ازجمله مهم‌ترین عوامل شکل‌گیری بازار و سراهای درون‌شهری کرمانشاه، فراهم آمدن زیرساخت‌های امنیتی برای کاروانیان، موقعیت این شهر در مسیر بازرگانی بغداد-کرمانشاه، استقرار کنسولگری بریتانیا، روسیه و عثمانی در این شهر و مهاجرت تجار از شهرهای اطراف می‌باشد؛ که این عوامل، شکوفایی تجارت را به‌دنبال داشته و به رشد بازار و پیدایش سراهای درون‌شهری کرمانشاه در دورهٔ قاجار منجر شده‌اند. همین‌امر در ساختار کالبدی سراها به‌صورت بهره‌گیری هم‌زمان از ویژگی‌های معماری بومی، معماری قاجار و عناصر برگرفته از معماری غرب نمود یافته است. در بررسی ساختار کالبدی-فضایی چهار سرای وکیل‌الدوله، نو، همدانی و کاشانی نیز مشاهده شد که طرح اندام‌های گوناگون بنا متأثر از عملکرد کاروانی-تجاری و سامان بخشیدن به طبقات مؤثر و موقعیت بنا از همجواری‌ها تأثیر پذیرفته‌اند.

کلیدواژگان: سراهای درون‌شهری، بازار تاریخی، ساختار کالبدی-فضایی، شهر کرمانشاه، دورهٔ قاجار.

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