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## Diachronic Patterns of Lithic Raw Materials From the Middle to Epipaleolithic Periods Based on the Bawa Yawan Rock Shelter, Kermanshah, West-Central Zagros Mountains

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**Abstract**

The Bawa Yawan rockshelter and cave complex, located in the west-central Zagros region of Iran, stands out as a significant Paleolithic site due to its spanning the three periods of the Middle Paleolithic, Upper Paleolithic and Epipaleolithic. This site exhibits a wide range of lithic artifacts, which were used by Neanderthals and anatomically modern humans between ca. 83-13.4 kya (TU / OSL Dating). In this study, we present preliminary results from macroscopic analysis of approximately 1000 lithic artefacts. Our initial findings indicate that over 99% of the utilized raw stones materials belong to the micro-cryptocrystalline sedimentary rock category, primarily due to their widespread availability. Less than 1% of the material fall into other categories, such as metamorphic and igneous rocks. The main results of this research indicate that the Middle Paleolithic groups (Neanderthals) used a more diverse range of raw stone materials than later groups. In contrast to the Upper Paleolithic to Epipaleolithic periods, people (Homo sapiens) become more specialized in the use of higher quality resources. This finding shows a relative difference in lithic raw material procurement strategies among Neanderthals and Homo Sapiens in the study area.

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## 1. Introduction

Stone is among the most enduring remains found at archaeological sites, having been utilized by humans since deep antiquity. Unlike other raw materials such as wood and bone which rapidly decay stone resources are abundantly preserved in natural contexts. Beyond its durability, stone played a fundamental role in the cultural evolution of Paleolithic societies. However, the processes by which different hominin groups selected, extracted, and transported stone resources were complex and at times influenced by social and cultural factors. It is for this reason that anthropologists have long sought to understand the intricacies of these processes.

Although research on lithic raw material sources dates back to the 19th century CE (Matias, 2016), prior to the 1970s, studies on raw stone were largely limited to brief notes by archaeologists and geologists concerning the presence of chert at ancient sites. It was only after this period that such investigations gained momentum (Delage, 2003). While the Oxford Dictionary records the first printed reference to "flint" as early as CE 700, documented use of the term "chert" does not appear until 1679 (Luedtke, 1992). Nevertheless, extensive research on lithic raw materials especially chert has notably expanded since the 1970s, continuing robustly for roughly four decades. Understanding how hominins acquired both siliceous and non-siliceous raw stone was the initial step in reconstructing lithic reduction sequences. Grasping the nuances of these sequences, alongside factors such as selection, procurement, transport, and management of lithic raw materials, offers considerable potential for documenting cultural diversity and economic activities across past landscapes. This includes insights into land use strategies, the extent of trade networks, settlement patterns, mobility, and the technical-economic organization of lithic production (Andrefsky, 1994; Binford, 1979; Delage, 2003; 2007; Doronicheva et al., 2023; Yue *et al.,* 2020).

Stone thus provides invaluable information on human presence and landscape dynamics from the distant past to the present. It preserves evidence of human interactions with their ecosystems and of the technologies employed in lithic tool production (Delage, 2007; Inizan et al., 1992), while also archiving geographic and anthropological dimensions such as the likely locations of stone sources, the distances traveled to acquire them, preferences in material selection, and the discernment of source quality.

Among the most critical areas of study for reconstructing spatial distribution patterns and hominin site selection behavior has been understanding how hominins accessed and used stone the most basic raw material of all. While natural and environmental factors such as geological structures, elevation, and climate fundamentally shape the distribution and location of archaeological sites (Brooks, 1982; Heydari, 2004), lithic raw material sources themselves also played an essential role in shaping Paleolithic settlement systems through to the end of the Neolithic.

Numerous questions surround lithic raw materials and their procurement in anthropological, archaeological, and geological research. As summarized by Inizan *et al.,* (2009), the following are regarded as fundamental questions that must underpin any such study:

- What is the geological context of occurrence? Is the raw material locally rare, or abundant?

- Is there only one sort of raw material, or are there several varieties ?
- Is the raw material easy, or on the contrary difficult, to collect or extract ?
- What is its quality, in what shapes and sizes does it occur ?
- Could it be easily transported in its original shape ? (Inizan *et al.,* 2009: 25)

Addressing such questions has prompted extensive studies across diverse global contexts (Slimak & Giraud, 2007; Spinapolice, 2012; Valde-Nowak & Cieśla, 2020). In Southwest Asia, particularly during the Paleolithic, the Levant remains at the forefront of such investigations, with more intensive research conducted there compared to areas such as the Zagros (Betts, 1983; Delage, 2007; Julig *et al.,* 2007). In contrast, studies specifically examining lithic raw material procurement and outcrops within Paleolithic archaeological contexts across the vast cultural and geographic expanse of the Zagros Mountains remain remarkably limited. Those few that do exist rely predominantly on surface collections and relative chronologies, and generally fall into the categories of macroscopic or microscopic analyses (Biglari, 2007; Heydari, 2004; Heydari-Guran & Ghasidian, 2020). This absence of systematic investigations grounded in absolute dating of Paleolithic sites concerning lithic raw materials not only affects our understanding of the Pleistocene but extends into the Holocene, thereby restricting researchers' ability to precisely reconstruct diachronic patterns of lithic consumption.

In light of these issues, through detailed macroscopic study of lithic raw materials utilized by Neanderthals and Homo sapiens over approximately 70 kay years of occupation at the Bawa Yawan Rockshelter an archaeological context with secure absolute dating we aim to: (1) classify the various lithic raw material types employed at the site; (2) elucidate diachronic changes in raw material use across the Middle Paleolithic, Upper Paleolithic, and Epipaleolithic periods; and (3) determine the geological sources of these raw materials in the surrounding region, thereby shedding light on land use patterns among Middle Paleolithic, Upper Paleolithic, and Epipaleolithic communities. Ultimately, these objectives will allow us to explore whether the economic behaviors of these successive prehistoric groups at Bawa Yawan can be effectively reconstructed through the study of lithic raw materials.

## 2. General Overview

### 2-1. Geology

A substantial body of evidence indicates that the complex topography of the Zagros Mountains has functioned as a humidity island (Oberlander, 1965), creating a region characterized by rich vegetation cover, abundant water resources, and plentiful lithic raw materials (Ghasidian & Heydari-Guran, 2018), thereby attracting both human communities and animal herds over millennia (Heydari-Guran & Ghasidian, 2020). The geological and geographical positioning of the Zagros, along with archaeological discoveries, demonstrates that this region held particular significance for the settlement of both Neanderthals and anatomically modern humans. The Zagros constitutes a macro-zone subdivided into four eco-zones (northern, west-central Zagros, central, and southern) based on geological formations, landforms, and hydrological conditions.

Structurally, it is also divided into three principal zones: the High Zagros (faulted or fractured), the Folded Zagros, and the Unfolded Zagros (Khuzestan Plain), (Heydari-Guran, 2014).

The fractured zone of the Zagros in the study area and its vicinity is further divided into three sub-units: (a) the southwestern sector, including Late Cretaceous limestone thrust sheets; (b) the northeastern sector, consisting of colored mélange masses composed of ophiolite and radiolaritic chert at tectonic contacts along the Late Cretaceous Urumieh–Dokhtar orogenic belt; and (c) the central sector of radiolaritic chert and detrital limestone (Brooks, 1989) situated within the thrust zone of the Zagros (Inner Zagros or High Zagros) and the folded-thrusted Zagros belt.

Within the High Zagros, the west-central Zagros region is itself divided topographically into four geographic zones A, B, C, and D in which several major groups of lithic raw material outcrops have been identified (Heydari-Guran & Ghasidian, 2020). Among these, the Kermanshah region, located in the west-central Zagros, is undoubtedly one of the key areas for Paleolithic research on the Iranian Plateau due to its significant prehistoric archaeological discoveries, large number of caves and rock shelters, and abundant lithic raw material sources. The numerous Paleolithic sites discovered here including open-air sites from the Lower Paleolithic, Neanderthal skeletal remains, and stratigraphic sequences ranging from the Middle to the Epipaleolithic attest to the area's attractiveness to successive human groups from the Middle to Late Pleistocene (Biglari & Shidrang, 2019; Coon, 1951; Ghasidian *et al.,* 2019; Hariri *et al.,* 2021; Heydari-Guran & Benazzi *et al.,* 2021; Heydari-Guran & Douka *et al.,* 2021; Heydari-Guran & Ghasidian, 2017; Yousefi *et al.,* 2020; Zanolli *et al.,* 2019).

Long-term paleoanthropological research worldwide has demonstrated that Paleolithic communities exploited a wide range of lithic raw material sources for tool production, encompassing sedimentary to igneous rocks. Among these, cryptocrystalline and microcrystalline siliceous rocks whether clastic or non-clastic commonly identified as flint, chert, or even radiolarite (Herrero-Alonso *et al.,* 2021), are among the most abundant in the west-central Zagros, particularly around Kermanshah. Geological investigations reveal that this region hosts an extensive bed of diverse lithic resources, with the renowned Kermanshah radiolarite belt (Fig. 1) standing out as one of the best, largest, and purest examples of such outcrops across the Zagros Mountains. This belt manifests in various forms depending on local geological conditions (Mohajjel & Biralvand, 2010) and has been thoroughly documented by scholars such as Broud (1987) and Brooks (1982).

The Kermanshah radiolarite belt constitutes part of an ophiolitic complex within the geological zone of the Zagros, oriented northwest-southeast across Kermanshah province (Broud, 1987). Radiolarite is a sedimentary rock primarily composed of the siliceous skeletons of radiolarians, which are marine micro-organisms. The radiolarite outcrops of Kermanshah are bounded to the north by the Bisotun fault and to the south by the Kuh-e Sefid fault (Abdi *et al.,* 2014). This siliceous unit extends over an area of approximately 35 kilometers, situated between the Bisotun limestone in the north and autochthonous Zagros deposits in the south (Abdi *et al.,* 2022). Parallel to this sedimentary complex and nearby to its east lies the Sanandaj-Sirjan metamorphic belt. This geological formation includes rocks such as schist, gneiss, and marble, which are significant in the

tectonic history of the region and provide valuable insights into geodynamic processes (Mohajjel *et al.,* 2003).

Evidence from archaeological contexts indicates that Paleolithic human communities in Kermanshah intensively exploited stones from the radiolarite belt (Biglari, 2004; 2007; Heydari, 2004; Heydari-Guran & Ghasidian, 2020). Although the Human Evolution in the Zagros Mountains (HEZM) research group has undertaken preliminary surveys on the lithic raw material resources used by humans from the Lower to the Epipaleolithic (Heydari-Guran & Benazzi *et al.,* 2021; Heydari-Guran & Douka *et al.,* 2021; Heydari-Guran & Ghasidian, 2017; 2020), the vast scale and profound significance of the Kermanshah radiolarite belt on early human behavior underscores the urgent need for more systematic studies employing state-of-the-art scientific techniques (Hariri, 2024a, Hariri, 2024b).

## 2-2. Lithology Related to Lithic Artifacts

This section provides an overview of stone phenomena with an emphasis on rocks and minerals employed in the production of lithic artifacts in the study region. Rocks are generally classified based on their formation processes into three primary categories: igneous, sedimentary, and metamorphic.

Igneous rocks form the foundational basis of all other rock types and are created through the cooling and crystallization of magma or lava, either at the Earth's surface or at depth. They are subdivided into two broad categories: extrusive (volcanic) and intrusive (plutonic) igneous rocks. Extrusive igneous rocks form when magma reaches the surface and cools rapidly. Among these, basalt is notable; basalts erupt across a wide range of tectonic settings on Earth and represent the most voluminous volcanic rock type (Gill & Fitton, 2022; Philpotts & Ague, 2009).

Metamorphic rocks result from the alteration of pre-existing igneous or sedimentary rocks due to the physical and chemical changes brought about by pressure and heat within the Earth's crust. This process occurs at significant depths over extended timescales, modifying the texture and structure of the original minerals without reaching melting point. Among such rocks is phyllite, a fine-grained, low-grade metamorphic rock exhibiting well-developed foliation (Bucher & Frey, 2002; Bucher & Grapes, 2011). According to the 1:250,000 scale geological map of Kermanshah, a belt of volcanic and metamorphic rocks runs parallel to the Bisotun-Shaho limestone block, approximately 25 km (direct distance) north of our study area.

Sedimentary rocks form through the deposition of mineral particles and biological detritus in aquatic environments, or via diagenetic processes such as compaction and lithification over time. These rocks are often characterized by layering and may contain fossils. Sedimentary environments include lakes, oceans, and deserts. They are typically divided by genesis into four principal groups:

(a) Clastic sedimentary rocks (e.g., sandstones, mudstones, siltstones);

(b) Chemical sedimentary rocks;

(c) Biogenic sedimentary rocks (e.g., limestones, marls, and cherts); and

(d) Volcaniclastic sedimentary rocks (tuffs), (Boggs, 2009; Tucker, 2001).

Among the clastic rocks, sandstone is composed primarily of sand-sized detrital grains, often quartz, feldspar, and lithic fragments. These grains are cemented by diagenetic processes into coherent rock. Sandstones are deposited in fluvial, shoreline, or desert settings and occur in a variety of colors. Mudstones encompassing shale, siltstone, and claystone consist of very fine mineral particles (<0.063 mm), mainly clay minerals and fine silt. These rocks make up a large portion of sedimentary sequences and generally form in low-energy environments (Tucker, 2011).

Among the biogenic sedimentary rocks, limestone is composed mainly of calcium carbonate (most commonly as calcite), forming in aquatic environments such as shallow marine carbonate platforms and lakes that support rich biotic communities. Three major components typically characterize most limestones: carbonate grains, a micritic matrix, and cement. Many limestones resemble sandstones, consisting of sand-sized carbonate grains reworked on the seafloor, while others are finer-grained, arising from lithified lime mud (micrite or calcareous mudstone), (Tucker, 2001; 2011). Marl is a sedimentary rock containing variable proportions of clay and calcium carbonate, bridging properties between claystones and limestones (Boggs, 2006; Tucker, 2011).

Silicification of carbonate rocks is a diagenetic process involving extensive replacement of carbonate minerals ($CaCO_3$) by siliceous minerals ($SiO_2$ phases including opal, quartz, and moganite), as well as minor silica cementation in voids. When these processes are volumetrically significant, the resulting siliceous minerals (chert and opal) produce non-carbonate outcrops that resist weathering more effectively (Bustillo, 2010).

Among the most renowned siliceous rocks are cherts, which may occasionally include macrocrystalline quartz but are primarily composed of microcrystalline quartz grains too small to discern with the naked eye. Technically, grains measuring 2-50 microns are microcrystalline, while those <1-2 microns are cryptocrystalline (Luedtke, 1992). Cherts are distinguished into bedded and nodular types, a feature critical in archaeological raw material sourcing. According to Tucker (2011), most bedded cherts occur in relatively deep-water sequences, displaying layering akin to modern siliceous radiolarian and diatomaceous ocean floor oozes. These layers range from a few centimeters to tens of centimeters in thickness. Some bedded cherts are associated with pillow lavas and form part of ophiolitic sequences, indicating volcanic processes. Conversely, chert nodules are common in limestones, formed by diagenetic replacement, sometimes nucleated around fossils (e.g., echinoids, sponges) or arranged regularly within certain horizons (Tucker, 2011). The term flint is popularly used for such nodular cherts, especially in reference to dark, high-quality cherts of Cretaceous chalk formations in southern England (Luedtke, 1992). In Paleolithic literature, "flint" is sometimes imprecisely employed to denote all lithic tools regardless of material.

Beyond rocks, certain minerals and mineraloids also served as raw materials for lithic artifacts. Several mineraloids are characterized by significant water content and weak crystal structures, often closely related to silica minerals. Collectively, these are termed opal, subdivided into

varieties such as Opal-A, Opal-CT, and Opal-C. Opal-A, for example, exhibits an amorphous glass-like structure (Luedtke, 1992). Chert-opal transformations refer to two distinct silica forms that may naturally interconvert; under specific geological conditions, opal can arise from chert through processes where silica-rich water gradually dissolves the silica in chert and reprecipitates it as amorphous silica, eventually forming opal (Liesegang *et al.,* 2018; Yanchilina *et al.,* 2020).

In general terms, the diachronic trajectory of lithic raw material preferences shows that earlier periods favored rocks such as basalt, limestone, dolomite, and sandstone, whereas the Middle and Late Paleolithic increasingly emphasized siliceous stones, reflecting evolving needs and recognition of material properties.

## 3. Materials and Methods

### 3-1. Materials

The Human Evolution in the Zagros Mountains Project was launched in 2009 (1388 SH) with the primary objectives of identifying the earliest hominin settlements, tracing late Pleistocene hominin occupations, and understanding the cultural and behavioral transition from the Middle to Upper Paleolithic in the Kermanshah region (Heydari-Guran, 2016; 2017; 2018; Heydari-Guran & Ghasidian, 2012; Ghasidian & Heydari-Guran, 2012; Heydari-Guran & Azadi, 2021; Heydari-Guran & Hariri, 2019; 2022; Hariri, 2021; Hariri *et al.,* 2021).

Within the framework of this project, intensive Paleolithic surveys were conducted in western Kermanshah Province during 2009 and 2010 (1388–1389 SH), including the Nawdarwan Valley (Fig. 1). These extensive surveys across the Kermanshah catchment resulted in the discovery of over 80 caves and rock shelters associated with the Paleolithic period, distributed along both sides of the Nawdarwan Valley, among which the Bawa Yawan cave and rockshelter complex stands out (Heydari-Guran & Ghasidian, 2020).

The Nawdarwan Valley, approximately 32 km long and varying between 5 to 15 km in width, contains 53 shelter sites. It represents one of the most strategic corridors linking the southeastern plain of Kermanshah with the Kamyaran plain to the northwest. The perennial Razawar River flows through the center of this valley from northwest to southeast. Significantly, this river originates from a completely different geological catchment, characterized by metamorphic and volcanic formations distinct from Nawdarwan.

Among the sites identified in this valley, the Bawa Yawan cave and rockshelter complex was selected for this research due to its exceptional stratigraphic and archaeological significance.

#### 3-1-1. Bawa Yawan Rockshelter and Cave Complex

The Bawa Yawan rockshelter and cave complex (34°38’23.93”N, 46°55’48.11”E) is situated approximately 35 km northwest of Kermanshah city, along the road to Kamyaran, nestled within the Nawdarwan Valley and adjacent to Yawan village (Fig. 1). The complex comprises a high, vertical rock wall that offers a naturally elevated vantage point with easy access over the Nawdarwan Valley (Fig. 2). The rockshelter itself is located on the edge of the Nawdarwan plain,

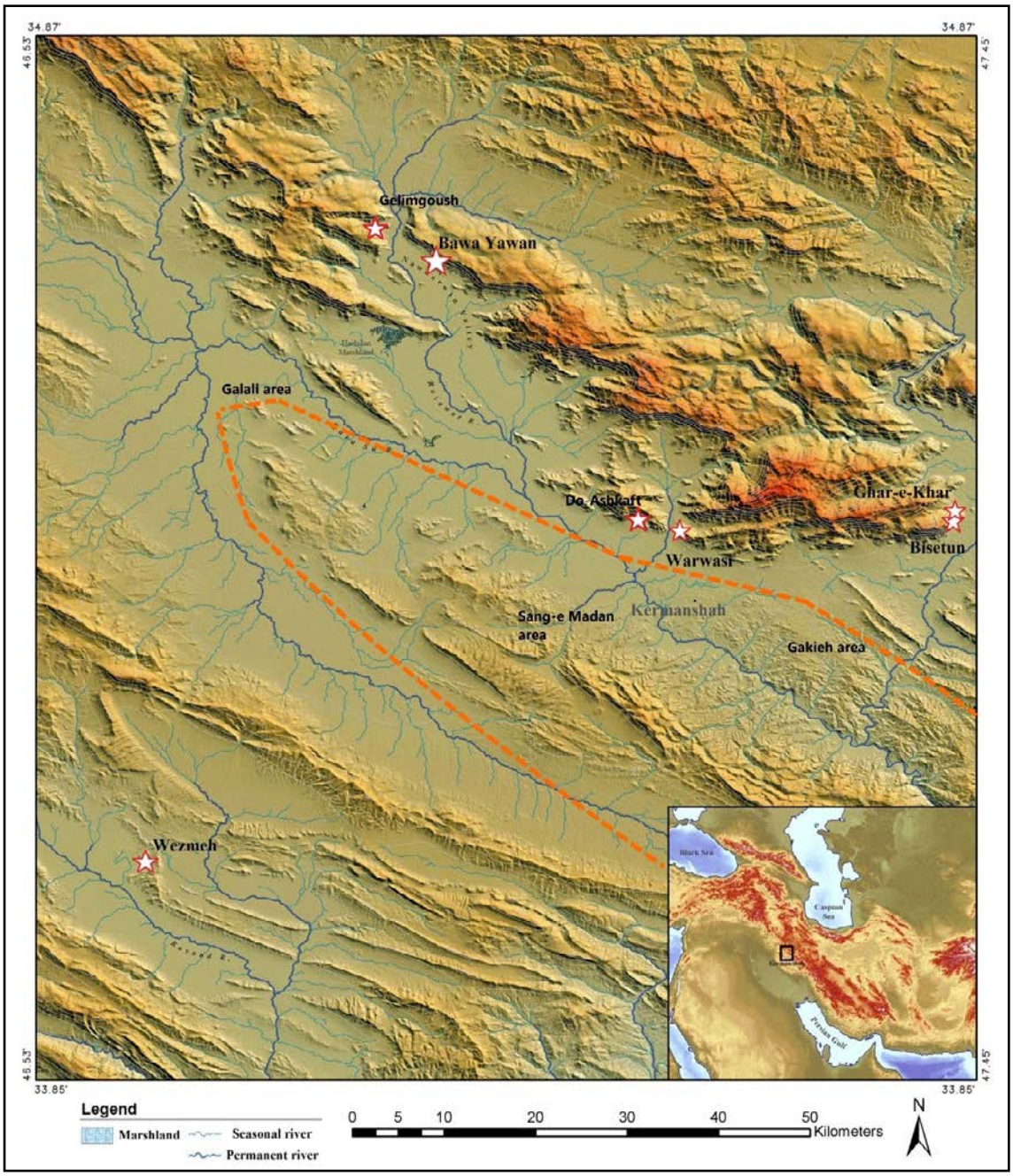


**Fig. 1: The study area includes the Kermanshah Basin, Radiolarite belt (orange dashed line), Nawdarwan Valley, Cave and rockshelter Bawa Yawan Complex (Map by S. Asiabani).**

about 10 meters above the valley floor. Additionally, a small karstic spring forming a pond is found approximately 70 meters southwest of the shelter.

Excavations at this site Started in early 2016 (1394 SH) and continued during 2017, 2018, and 2021 (1396, 1397, 1400 SH). Over the course of four excavation seasons, a total area of 25 m² was excavated across two main sectors, designated the western trench and eastern trenches (Fig. 3). Excavation squares reached depths ranging from 30 cm to 4.5 m, revealing five sedimentary layers associated with human occupation.

During the second excavation season, a Neanderthal tooth (BY1) was uncovered at the base of layer five. This find, dated by radiocarbon to approximately 45,000–40,000 BP and by TL/OSL to around 70,000–65,000 BP, is directly associated with Mousterian lithic artifacts, underscoring the exceptional significance of Bawa Yawan within the Paleolithic landscape of the Zagros.

Furthermore, the site preserves evidence of long-term human occupation, encompassing the Middle Paleolithic (layer five to early layer two), Upper Paleolithic (middle of layer two), and Epipaleolithic periods (upper layer two). Middle Paleolithic lithics primarily consist of Zagros Mousterian forms, such as convergent scrapers, side scrapers, Levallois cores and flakes. Upper Paleolithic assemblages are characterized by laminar technologies, including prismatic blade cores, blades and microblades, denticulates, notches, and burins. Finally, the Epipaleolithic toolkit is dominated by geometric microliths and backed microblades.

The quality and quantity of archaeological data retrieved (all layers were excavated in 3–5 cm thick spits) at Bawa Yawan make it possible to reconstruct diverse aspects of hominin economic behavior during the Late Pleistocene in the west-central Zagros. From this site alone, over 12,000 lithic artifacts have been recovered across four field seasons (including single finds and items recovered by both dry and wet sieving), representing a broad range of raw material types.

From the entire assemblage, approximately 10% or 1,159 lithic artifacts were selected for detailed study. These artifacts were recorded as single finds during the first, second, and third excavation seasons, meaning each has precise geospatial coordinates, was retrieved in situ, and measures at least 2 cm or larger, following established Paleolithic sampling standards (McPherron et al., 2005). This study sample encompasses cores, flakes, blades, tools, and debitage. Their distribution across geological layers and archaeological periods is summarized in Table 1.

**Table 1: Distribution of the number of lithic artifacts in geological layers and their archaeological periods (Authors, 2021).**

| Period | Count | % | Layer 2 | Layer 3 | Layer 4 | Layer 5 |
|---|---|---|---|---|---|---|
| Middle Palaeolithic | 658 | 56.8% | 106 | 82 | 78 | 392 |
| Upper Palaeolithic | 400 | 34.5% | 400 | 0 | 0 | 0 |
| Epipalaeolithic | 101 | 8.7% | 101 | 0 | 0 | 0 |
| Total | 1159 | 100% | 607 | 82 | 78 | 392 |

## 2-3 Methods

In general, studies of lithic raw material sources, their roles in the landscape, and their relationships with archaeological sites and lithic artifacts fall into two main categories: macroscopic (large-scale) and microscopic (small-scale) analyses. The first approach involves visual and field observations, followed by a comparative assessment between the geological raw stone and the lithic artifact raw materials (Ghasidian & Heydari-Guran, 2018; Namen & Cuthbertson *et al.,* 2022). The second approach, in addition to the previous method, incorporates quantitative laboratory-based analyses such as textural studies (using 3D microscopes, thin section petrography), mineralogical analyses (X-ray diffraction, XRD), and geochemical analyses (inductively coupled plasma optical emission spectrometry, ICP-OES) performed on stone materials (Doronicheva *et al.,* 2023; Herrero-Alonso *et al.,* 2021; Namen & Iovita *et al.,* 2022; Namen & Schmidt *et al.,* 2022).

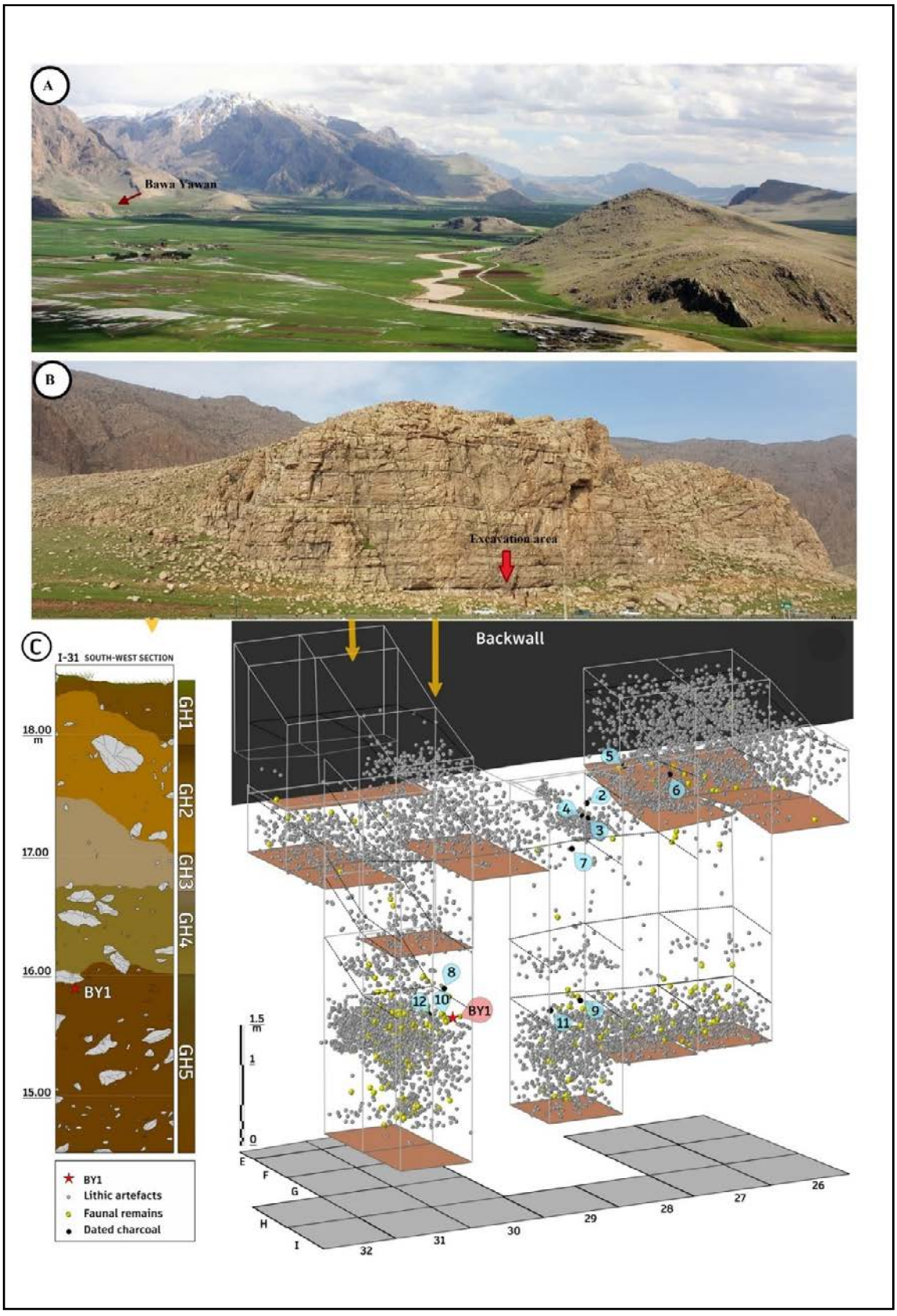


**Fig. 2: A: Nawdarwan Valley; B: Bawa Yawan rockshelter; and C: Geological layers along with a three-dimensional model of lithics (Heydari-Guran & Benazzi *et al.*, 2021).**

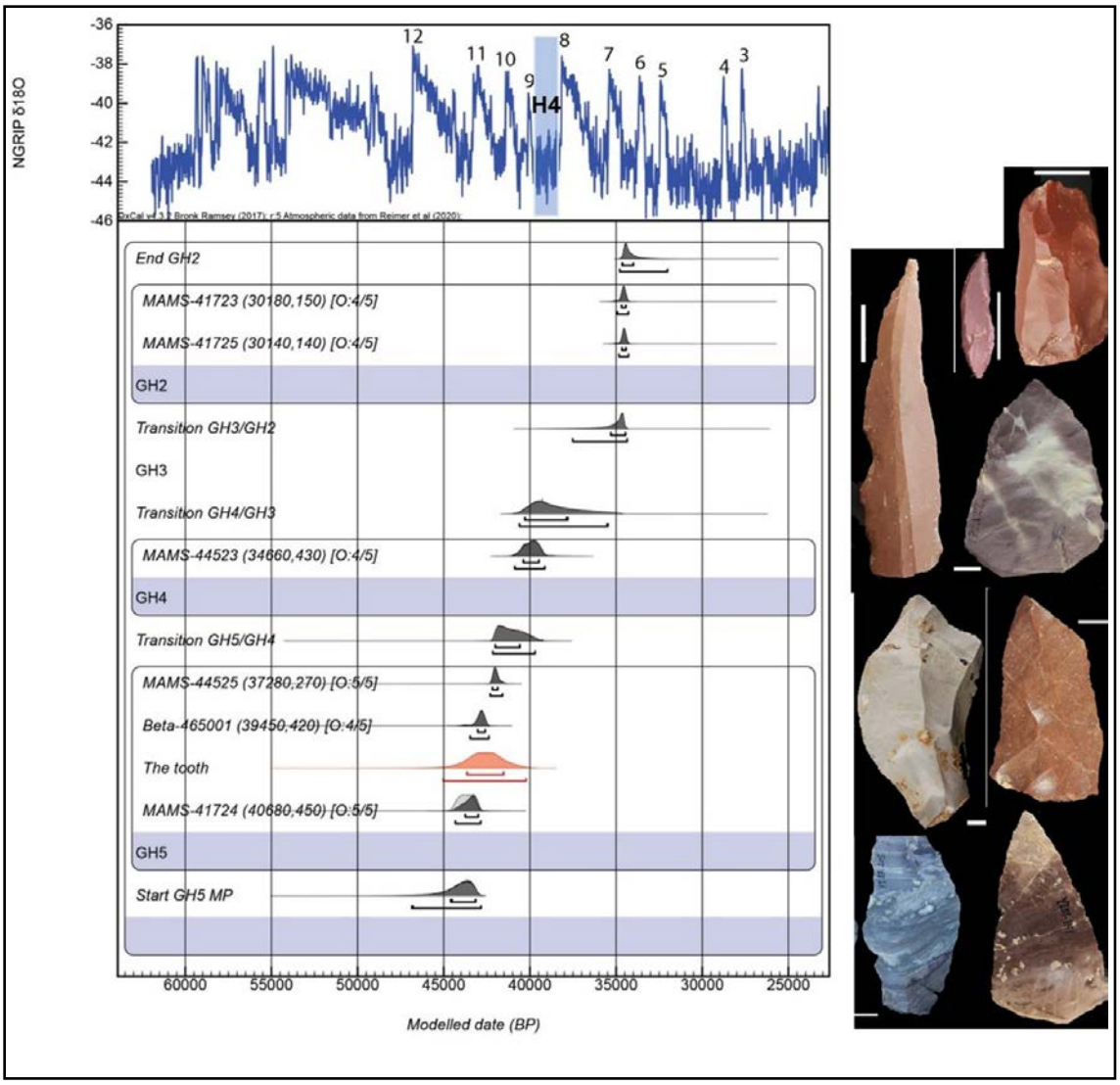


**Fig. 3: Left side: Bayesian model of the dating of the Bawa Yawan rock shelter; Right side: Sequence and variety of Bawa Yawan lithics from the Middle Paleolithic to the Epipaleolithic (Heydari-Guran & Benazzi *et al.*, 2021).**

In this research, we adopted the first approach (macroscopic study), using methodological references such as Delage (2007) and Suga et al., (2022), (Delage, 2007; Suga *et al.,* 2022). To this end, in addition to identifying the lithic raw material type for each artifact, we implemented three principal classifications for recording and documenting raw stone features in our database:

a) Textural grades: categorized as amorphous (non-granular), very fine-grained, fine-grained, medium-grained, coarse-grained, and very coarse-grained.

b) Luster Categories: vitreous (glassy), resinous, waxy, and dull.

c) Translucency Categories: transparent, highly translucent, moderately translucent, slightly translucent, and opaque.

For determining the internal and external colors of the stones, we employed the Munsell Color Chart specifically designed for rocks. Additionally, other characteristics such as the percentage of cortex and the degree of patination (low, medium, and high) were visually assessed and recorded.

## 4. Discussion

Preliminary macroscopic analyses of over one thousand single-find artifacts throughout the sedimentary sequence at Bawa Yawan Rockshelter indicate the utilization of three principal lithological groups: igneous, sedimentary, and metamorphic rocks (Fig. 4). Less than one percent of the lithic raw materials at Bawa Yawan consist of extrusive igneous rocks, specifically basalts, which were exclusively used during the Middle Paleolithic period (Fig. 4; Table 2). These basaltic materials most likely originate from the Sanandaj-Sirjan zone within the broader geological context of the region. Similarly, less than one percent of the lithic raw materials are metamorphic rocks, represented by phyllite (Fig. 4; Table 2), which were also only exploited during the Middle Paleolithic.

In stark contrast to the igneous and metamorphic rocks, siliceous sedimentary rocks constitute the overwhelming majority of the raw materials consumed at Bawa Yawan, accounting for approximately 99 percent of the total lithic assemblage. Clastic sedimentary rocks, including sandstones, mudstones, and siltstones, make up about 3.8 percent of all sedimentary stones used. Among these, sandstones (a single specimen from the Upper Paleolithic), as well as mudstones, were utilized during the Middle Paleolithic, whereas siltstones were exploited in both the Middle and Upper Paleolithic periods. None of these three types appear to have been used in the Epipaleolithic assemblage. Additionally, only a single sample of tuff classified as a pyroclastic sedimentary rock was recovered from the Middle Paleolithic layer (Fig. 4; Table 2).

Biogenic sedimentary rocks dominate the spectrum of consumed stones at Bawa Yawan, primarily comprising various grades of limestones and radiolarian cherts. The limestone category at this site includes multiple gradations of silicified limestone, marls, red pelagic limestones, and low to highly silicified carbonate rocks, collectively constituting nearly five percent of the studied assemblage (Fig. 4). Of these, only the highly silicified limestone appears across all three periods, while the remainder is exclusively found in the Middle Paleolithic (Fig. 4; Table 2).

Siliceous micro- to cryptocrystalline rocks, broadly termed "cherts," encompass multiple subtypes with differing definitions in the literature. For the sake of methodological consistency and future sourcing studies, we grouped these under the overarching concept of "chert," further subdividing them into categories such as radiolarian chert, chert nodules, flint, and chert-opal (Fig. 4). Approximately 92 percent of the lithic raw materials at Bawa Yawan fall within this extended chert group, with radiolarian chert being the most abundant and radiolarian-bearing siltstones the least.

Among the 907 pieces classified as radiolarian chert, 52 percent were exploited during the Middle Paleolithic, 38 percent during the Upper Paleolithic, and roughly 10 percent during the Epipaleolithic. Of the 37 radiolarian chert-siltstone artifacts, approximately 70 percent were used during the Middle Paleolithic, with the remaining 30 percent appearing in the Upper Paleolithic (Table 2).

In addition to a limited presence of pure opal, Bawa Yawan yielded materials representing transitional phases between radiolarian chert and opal, here categorized as "chert-opal." We

examined both opals and these transitional chert-opal varieties under the broader cryptocrystalline-microcrystalline category (Fig. 4). Among the 134 chert-opal artifacts, 67 percent date to the Middle Paleolithic, 28 percent to the Upper Paleolithic, and approximately 5 percent to the Epipaleolithic (Table 2).

**Table 2: Consumption of various types of raw material stone in different periods of the Bawa Yawan Rockshelter (Authors, 2021).**

| Type | Count | % | MP Count | MP % | UP Count | UP % | EPI Count | EPI % |
|---|---|---|---|---|---|---|---|---|
| Radiolarite chert | 907 | 78.1% | 472 | 52.1% | 348 | 38.3% | 87 | 9.6% |
| Radiolarite-opal chert | 134 | 11.5% | 90 | 67.1% | 38 | 28.3% | 6 | 4.4% |
| Radiolarite-siltstone chert | 37 | 3.1% | 26 | 70.3% | 11 | 29.7% | 0 | - |
| Highly silicified limestone | 46 | 3.8% | 36 | 80% | 2 | 4.4% | 6 | 13.3% |
| Moderately silicified limestone | 9 | 0.8% | 9 | 100% | 0 | - | 0 | - |
| Low silicified limestone | 2 | 0.1% | 2 | 100% | 0 | - | 0 | - |
| Limestone | 7 | 0.6% | 7 | 100% | 0 | - | 0 | - |
| Marl | 3 | 0.2% | 3 | 100% | 0 | - | 0 | - |
| Red pelagic limestone | 1 | 0.1% | 1 | 100% | 0 | - | 0 | - |
| Sandstone | 4 | 0.3% | 3 | 75% | 1 | 25% | 0 | - |
| Mudstone | 5 | 0.4% | 5 | 100% | 0 | - | 0 | - |
| Basalt | 2 | 0.1% | 2 | 100% | 0 | - | 0 | - |
| Phyllite | 1 | 0.1% | 1 | 100% | 0 | - | 0 | - |
| Tuff | 1 | 0.1% | 1 | 100% | 0 | - | 0 | - |
| Total | 1159 | 100% | 658 | - | 400 | - | 101 | - |

## 5. Conclusion

The geological characteristics of any region have a profound impact on the way human groups utilized stone resources (Kato 2017; Namen & Cuthbertson *et al.,* 2022). In some instances, these characteristics may directly influence human settlement patterns or even dictate raw material procurement strategies. At times, constraints in primary raw material availability can paradoxically create opportunities by pushing beyond accessibility barriers due to anthropological factors (Slimak & Giraud 2007). Thus, understanding the geological substrate forms the essential first step in studies of lithic raw materials and provenance analysis, a topic we have addressed here. The well-known radiolarite geological belt of Kermanshah has long been recognized from both geological and archaeological perspectives (Broud, 1987; Braidwood *et al.,* 1961; Biglari, 2004; 2007; Heydari, 2004). Although research on lithic raw materials for post-Neolithic periods is somewhat better developed (Darabi, 2013; Nezafati & Hesari, 2017; Young & Smith, 1966), this topic has yet to be systematically examined in a diachronic manner at a single Paleolithic archaeological site.

Kermanshah is recognized as one of the principal centers of Paleolithic occupation in the Zagros. Consequently, various hypotheses have been proposed in Paleolithic studies regarding the raw material sources used for tool manufacture. In this regard, Dibble suggested that continuous use of limited local raw materials in Mousterian sites such as Warwasi rockshelter impacted the

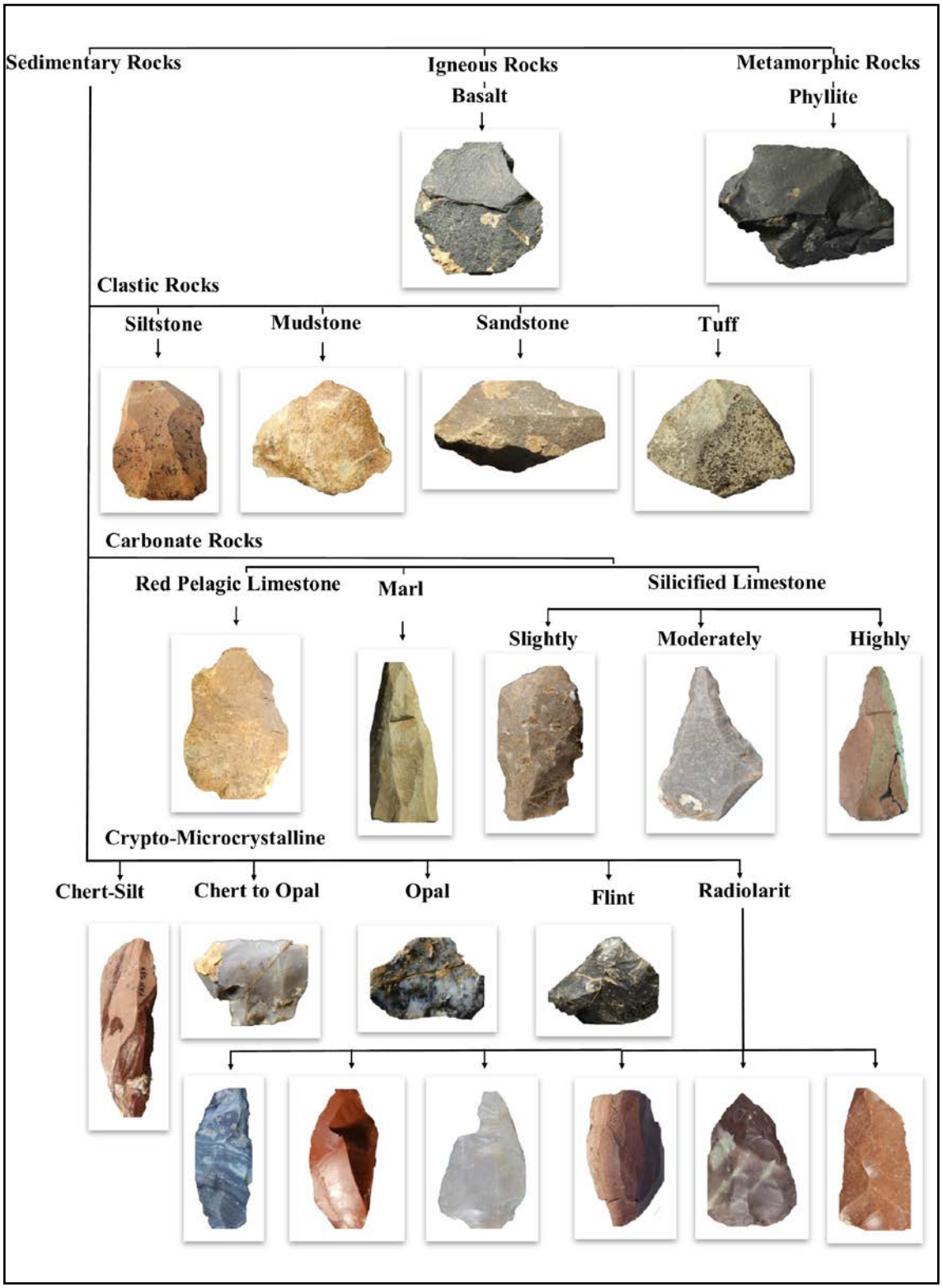


**Fig. 4: A general overview of the variety of raw materials used throughout the Paleolithic sequence at the Bawa Yawan rockshelter (Authors, 2021).**

typology of tools. He argued that the small size of available cobbles did not allow Neanderthal knappers to produce fresh flakes, thus leading them to repeatedly retouch pieces, which over time reduced the size of scrapers. Therefore, availability of raw materials should not always be assumed constant across repeated occupations of the same site (Dibble, 1991a; 1991b; Dibble & Holdaway, 1993).

Similarly, Biglari (2012) concluded that lithic raw materials used at the Middle Paleolithic site of Do-Ashkaft in Kermanshah were largely of local rather than regional origin, estimating a maximum procurement territory of less than 15 km around the site (Biglari, 2012). Shidrang and colleagues, based on their analysis of Mar Kheril cave (Donky cave), found that most raw materials across all stratigraphic layers were radiolarian chert, suggesting that Late Pleistocene occupants preferred high-quality radiolarian cherts from plains over the lower-quality local resources surrounding the site (Shidrang *et al.,* 2016).

More recently, other researchers (Adibzadeh & Vahedi-Nasab, 2016; Mokhtari *et al.,* 2022; Ghasrian & Mohammadi, 2017; Chehri & Vahedi-Nasab, 2020; Ghasrian *et al.,* 2017) based on surface collections from various Middle Paleolithic sites within the Kermanshah region, argued for the local use of raw materials and its role in shaping these Paleolithic sites.

Over the past decade, studies from the Lower Paleolithic through the Epipaleolithic in the Kermanshah region have increasingly addressed lithic raw materials (Heydari-Guran & Ghasidian, 2020). Heydari-Guran and Ghasidian (2020) proposed a broad-scale geographical zonation (zones A, B, C, D) for the Kermanshah area, identifying distinct raw material sources in each. Based on surface data, they argued for pronounced differences among these geo-zones in the west-central Zagros, with each likely maintaining independent lithic sources and suggesting that inter-zonal raw material transport did not occur during the Paleolithic (Heydari-Guran & Ghasidian, 2020).

This study investigated the diversity of lithic raw materials employed across the Middle Paleolithic, Upper Paleolithic, and Epipaleolithic periods at Bawa Yawan. Situated in the geological macrozone of the west-central Zagros, the area encompasses sedimentary formations including the Cretaceous limestone block of Bistun-Shahu, the Kermanshah radiolarite belt, and the folded zone. As a result, the overall raw material basket at Bawa Yawan, from a geological perspective across all periods, demonstrates over 99% reliance on sedimentary stones.

Broadly speaking, the raw material consumption patterns in the Middle Paleolithic layers at Bawa Yawan, inhabited by Neanderthal groups, can be divided into local and non-local categories. Earlier studies (Heydari, 2000; 2004; Biglari, 2004; 2007) have generally outlined raw material procurement in Paleolithic sites as follows: (1) high-quality layered radiolarites from plains, and (2) low-quality brecciated radiolarite-limestone exposures on the slopes of the Bistun-Shahu block (termed “radiolarite windows” by Jean Broud). Our observations indicate that such outcrops, either in situ or as colluvial fragments, exist within close proximity to Bawa Yawan. At this stage, precisely distinguishing Middle Paleolithic exploitation of these two sources (plain vs. mountainous) is not feasible; it is likely that these groups utilized both with varying emphasis. This combined pattern of using locally accessible low-quality sources

along with distant high-quality ones shows notable parallels with other Paleolithic regions worldwide. In many other geographic contexts, local raw materials typically predominate (Dibble *et al.,* 2009; Gómez de Soler *et al.,* 2020; Matias, 2016; Mayor *et al.,* 2022; Suga *et al.,* 2022), with only minor proportions of high-quality stones transported over distances exceeding 50 km (Karkazi *et al.,* 2024; Brandl *et al.,* 2011; Cieśla, 2018; Doronicheva *et al.,* 2023; Slimak & Giraud, 2007; Turq *et al.*, 2017).

It appears that in some communities, Neanderthals employed low-quality local stones for expedient, non-formalized tools, reserving high-quality and rarer raw materials likely procured from beyond their immediate subsistence territory for standardized or functional tools (Bringmans, 2024). Such patterns are observed, for example, at Qasem Cave in the Levant (Agam, 2020). Certain high-quality materials may also have been carried as part of personal toolkits, as evidenced in Epipaleolithic sites of Neshar Ramla in the Levant (Ekshtain & Zaidner, 2022). The deliberate selection of high-quality stone for manufacturing specialized implements like Quina scrapers procured from distant sources has also been documented in Dordogne, France (Hiscock *et al.,* 2009), and Waldozelt-Hezerwater, Belgium (Bringmans, 2024).

Based on several models (Uerpmann, 1996; Heydari-Guran, 2014; Doronicheva *et al.,* 2023), procurement zones have been categorized as local (<30 km), non-local (30–100 km), regional (100–250 km), and supra-regional (>250 km). Applying this framework, we would classify the plain radiolarite sources as non-local and the mountainous outcrops as local relative to Bawa Yawan. Our observations place the nearest part of the radiolarite belt (Galali) at about 20 km, and Gakia at roughly 40 km from Bawa Yawan.

At this phase of research, a noteworthy point is the high diversity of lithic raw materials utilized by Neanderthal groups, indicating no narrow dependence on a few sources. This aligns with an opportunistic procurement model regardless of raw material quality or acquisition via exchange or cobble transport suggesting Neanderthals at Bawa Yawan exploited all available stone types to meet their needs. The opportunistic model emphasizes availability and quick access to raw materials within the residential landscape (Delpiano *et al.,* 2018).

Our preliminary observations also indicate that for manufacturing certain specialized tools, such as Levallois points and Mousterian convergent scrapers, Neanderthal groups appear to have practiced selective raw material choice a topic that warrants further investigation (Hariri & Heydari-Guran, in preparation).

During the Upper Paleolithic at Bawa Yawan, three main categories of stone radiolarite chert, radiolarite-opal chert, and radiolarite-silt chert exhibit relatively similar patterns of use. However, there is a notable absence of diverse stones such as marl, tuff, basalt, and phyllite (see: Table 2). As a result, the variety of raw materials in the Upper Paleolithic becomes more limited compared to the Middle Paleolithic, while simultaneously demonstrating a certain organizational pattern. The most striking difference in this period relative to the Middle Paleolithic lies in the management of high-quality raw material resources and a reduced use of low-quality local stones. It appears that anatomically modern humans increasingly targeted more distant sources than their

Middle Paleolithic predecessors. However, the precise extent of the procurement range for raw materials in the study area remains to be fully established.

Analysis of Bawa Yawan's Upper Paleolithic assemblages compared to global examples reveals similar dynamics. Extensive studies by Parow-Souchon & Purschwitz (2020) on Upper Paleolithic raw material procurement in the southern Levant show a narrower spectrum of stone types and highly targeted, direct acquisition from source outcrops. A comparable situation is noted in northern and northeastern China, where modern humans traversed distances of approximately 300 to 450 km to obtain high-quality raw materials (Kato, 2017).

The Epipaleolithic lithic assemblage at Bawa Yawan is much smaller than the preceding periods, primarily due to the limited excavation area and thinner stratigraphic deposits. Nevertheless, in terms of raw material quality, despite following a similar trend to the Upper Paleolithic, this period reveals an increased ability to identify and discriminate high-quality sources. The discovery of several lithic artefacts from this layer made of the same stone type, suitable for refitting (highly silicified limestone), suggests that initial core reduction and cortex removal took place at the raw material source itself, with the partially prepared blocks then transported to the site. This economic behavior is not evident in earlier periods.

Given the absence of nearby high-quality sources comparable to the Kermanshah radiolarite belt, and the very low proportion of cortex-bearing tools relative to fully decorticated ones, it implies that the early stages of decortication occurred away from the site and that finished or semi-finished tools were brought to Bawa Yawan. Consequently, Bawa Yawan appears to have functioned both as a residential rockshelter and as a major butchering station, extensively used by both Neanderthal and modern human groups, who sourced their raw materials both locally and from extra-local regions such as the Kermanshah radiolarite belt.

What stands out is the aspect of conscious selection differing between these two hominin groups. It seems that anatomically modern humans achieved a higher level of deliberate selection. Although Neanderthals also had access to these sources, their procurement strategies leaned more toward opportunistic use. Therefore, the scarcity of primary cortex among the lithic assemblage partially answers the question: was collecting and extracting raw material easy or difficult? In reality, it could be both depending on human choices. As previously discussed, both primary (radiolarite belt) and secondary (hill slopes, margins, and the bed of the Razavar River in the Nawdarwan vally) sources of both high and low quality, available as small to large cobbles, were within reach.

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## Authors' Contribution

Dr. Nemat Hariri (corresponding author) conceptualized the research, designed the methodological framework, conducted the macroscopic analyses of lithic artifacts, and prepared the database. Dr. Mohsen Ranjbaran supervised and guided the identification and characterization of lithic raw materials. Dr. Elham Ghasidian critically reviewed and enriched the Persian manuscript and conducted the initial techno-typological classification of the lithic assemblage.

Dr. Saman Heydari-Guran reviewed and enhanced the manuscript and led the archaeological excavations at Bawa Yawan. All authors contributed to the discussion, reviewed the final manuscript, and approved its submission.

## Conflict of Interest

Authors declared no conflict of interest.

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# مـطالعات باسـتان‌شـنـاسی

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# بازسازی الگوی استفاده درزمانی از سنگ‌خام در بین جوامع پارینه‌سنگی غرب زاگرس‌مرکزی در پناهگاه صخره‌ای باوه‌یوان کرمانشاه


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**چکیده**

مجموعهٔ غار و پناهگاه صخره‌ای باوه‌یوان به‌عنوان یکی از محوطه‌های شاخص پارینه‌سنگی در غرب ایران، دارای سه دورهٔ پارینه‌سنگی میانی، نوین و فراپارینه‌سنگی است؛ این محوطه دارای طیف وسیعی از انواع دست‌افزارسنگی بوده که توسط جوامع شکارورز-گردآورنده در هر سه دورهٔ یادشده و به‌طور مشخص توسط دو زیر گونهٔ انسانی نئاندرتال و هوشمند در بازهٔ زمانی تقریبی بین ۸۰ تا ۱۳٫۴هزار سال پیش‌ازحال استفاده شده است. در این پژوهش ما نتایج اولیهٔ سنجش کلان‌نمایی (ماکروسکوپی) مجموعه‌ای تقریباً هزار قطعه‌ای را ارائه می‌دهیم. نتایج پژوهش حاکی از این است که در طول زمان، استفاده از مواد خام سنگی دست‌خوش تغییر می‌شود به این ترتیب که جوامع پارینه‌سنگی‌میانی از طیف متنوع‌تر موادخام‌سنگی استفاده کرده‌اند، اما در جوامع پارینه‌سنگی‌نوین و فراپارینه‌سنگی به‌تدریج شاهد راهبرد استحصال مواد خام‌سنگی انتخاب‌گرایانه که بازتاب آن منابع محدودتر و با کیفیت‌تری هستیم. این دست‌آورد نشان از رفتارهای متنوع انسانی از دورهٔ پارینه‌سنگی‌میانی تا فراپارینه‌سنگی منطقهٔ مطالعاتی دارد. هم‌چنین بیش از ۹۹٪ از سنگ‌های خام مصرفی توسط جوامع پارینه‌سنگی از انواع سنگ‌های کریپتو-میکروکریستالی رسوبی است که در محیط زمین‌شناسی اطراف باوه‌یوان وجود دارند و کمتر از ۱٪ سنگ‌های استفاده شده از سایر انواع سنگ‌های آذرین و دگرگونی است.



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## Manufacture and Use of Bone Tools in Neolithic Societies: Bone Tools from the Posht-e Forudgah Malayer Mound

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**Abstract**

The Posht-e Forudgah Malayer mound, located on the Malayer Plain in the Central Zagros, represents semi-nomadic communities whose subsistence economy during the Late Neolithic was based primarily on pastoralism. In this period, the integration of agricultural and herding practices encouraged the expansion and diversification of tools crafted from stone and, notably, from animal bone. Bone's flexibility, workability, strength, and accessibility made it a crucial raw material in Neolithic daily life. This study examines a small assemblage of bone tools of varied sizes, morphologies, and functions recovered from Posht-e Forudgah. A descriptive-analytical and comparative approach was undertaken, juxtaposing these artifacts with assemblages from other Late Neolithic sites in the Central Zagros. The research addresses three questions: 1) What morphological and functional characteristics do the Posht-e Forudgah bone tools exhibit? 2) Based on structural features, what roles did they have in the lives of nomadic or semi-nomadic communities? 3) Do they show structural or functional affinities with tools from contemporary, horizon-sharing sites? The objectives include analyzing morphology, investigating the toolmakers' technological skills, and assessing probable functions supported by experimental archaeological studies. The findings indicate predominantly conical-bodied, pointed, and polished tools, with wear traces revealing repeated use. Such patterns suggest specialized production, informed by accurate knowledge of bone properties and by a technological system embedded in the dynamic social structure of Late Neolithic semi-nomadic pastoralists. By studying these tools, the research contributes to reconstructing aspects of subsistence, offering insight into social organization, and deepening understanding of bone implement manufacture and uses—especially awls and needles—within nomadic Neolithic societies.

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## 1. Introduction

In the Neolithic period, with the consolidation of agricultural and pastoral subsistence patterns, remarkable transformations took place in the technologies required for daily life, including the manufacture of tools. Among these, the production of tools from animal bones due to their ready availability, high malleability, and relative durability was widely adopted in the everyday activities of human communities. The study of such materials, when approached in conjunction with archaeological research, yields more effective results when the cultural contexts of different regions can be compared. This comparative method was first employed by Robert Braidwood at the prehistoric site of Jarmo in Mesopotamia (Braidwood & Braidwood, 1950; Braidwood *et al.,* 1983). From a broader perspective, examining the cultural remains of various historical periods allows scholars to identify the differences, similarities, and unique attributes of artifacts. Thus, by studying bone tools in nomadic and semi-sedentary communities whose economies were based on pastoralism in the Central Zagros, and by comparing these with ethnographic data from traditional pastoral nomads today, it is possible to gather relatively substantial information. The Central Zagros, as one of the key regions in the emergence and development of Neolithic cultures, encompasses numerous sites such as Tepe Asiab (Braidwood, 1960), Sarab (Braidwood *et al.,* 1961), Guran (Mortensen, 1964), Abdul-Hossein (Pullar, 1990), Ganj Dareh (Young & Smith, 1966), East Chia Sabz (Darabi, 2014), Chogha-Golan (Zeidi *et al.,* 2012), Sheikh-e Abad (Matthews *et al.,* 2008; Mohammadifar *et al.,* 2011), Qalā Gāp (Abdullahi & Sardari Zarchi, 2013; Abdullahi *et al.,* 2014), Qeshlaq (Motarjem & Sharifi, 2018; Dehghan & Motarjem, 2024), and others. Through the study of faunal remains, these sites have yielded valuable insights into both the species exploited and the bone tools themselves. Also, the book The Neolithisation of Iran: The Formation of New Societies, edited by Hassan Fazeli and Roger Matthews (Fazeli-Nashli & Matthews, 2013), provides the most comprehensive account of the Neolithic period in Iran and the processes through which ideas, technologies, and plant and animal species were transmitted between the Near East, the Indian subcontinent, and Central Asia. The volume pays particular attention to key archaeological sites such as Abdul-Hossein, Ganj Dareh, Tepe Sarab, and Hajji Firuz, offering substantial data and insights that enrich and complement previous research.

Another notable site in this region whose role in the later Neolithic cannot be overlooked is the Posht-e Forudgah Malayer mound (Hamedan Province). Among the archaeological finds from this site is a diverse and noteworthy assemblage of bone tools, which is the focus of this study. The investigation of Neolithic bone tools holds importance from several perspectives, as these artifacts provide access to the social, cultural, and economic behaviors of the period. While stone tools, due to their durability, have long been a prime focus of archaeological attention and, in some cases, have even served as the basis for naming and defining entire Neolithic cultures based on their manufacturing techniques (e.g., Zarzian, Khiamian, Moulafatian lithic industries), bone tools have received comparatively little scholarly focus. The manufacture of these tools in the Neolithic reflects aspects of division of labor, technical skill, domestic usage, crafts, and even hunting practices. The semi-nomadic Posht-e Forudgah community, relying on

pastoral subsistence, offers a unique context for the specialized study of such tools. Although the assemblage is small, it exhibits a notable diversity in size and form. Through careful examination of the bone tools from this site, alongside comparative analysis with other contemporaneous sites and shared cultural horizons, we can address significant research questions concerning the reconstruction of cultural and technological behaviors in human communities of the late 6th and throughout the 5th millennium BCE. This is of considerable relevance not only to archaeology, but also to zooarchaeology, ethnoarchaeology, and bio-archaeology.

**Research Questions and Hypotheses:** The first question posed in this study is: What morphological and functional characteristics do the bone tools recovered from the Posht-e Forudgah Malayer site possess? The second question asks: Given the structure of these tools, what role did they play in the daily life of nomadic communities, and for what purposes were they used? The final question investigates: Do the bone tools from this site share structural and functional similarities with those from other contemporaneous and horizon-sharing sites? Considering the semi-sedentary and nomadic lifestyle of the region's inhabitants, the bone tools recovered from Posht-e Forudgah appear to have been intentionally designed in accordance with the subsistence needs of the community. This is evident through a specialized morphological examination of the tools, including their applications in handicrafts and everyday activities. In light of the numerous "Spindle Whorls" also retrieved from the site, it may be inferred that these tools were used in sewing, weaving, and, likely, in leatherworking, basketry, mat-making, as well as for incising designs on pottery in ceramic production. Furthermore, when compared with similar examples from other contemporaneous sites, these tools exhibit numerous morphological, structural, and functional commonalities. Ultimately, drawing on experimental archaeological studies conducted in the research area, the use of analogous bone implements especially awls and needles suggests their involvement in activities such as pottery decoration, sewing, weaving, basketry, mat-weaving, and leather-related crafts.

**Research Methodology:** This study is based on excavation data obtained from the Posht-e Forudgah site, complemented by library-based research grounded in a comparative and descriptive–analytical approach. In addition, for the interpretation of data, the research draws upon the theoretical foundations of ethnoarchaeology, employing ethnologic analogies to analyze the finds under investigation (Asher, 1961; Kramer, 1982; Watson, 1979; David & Kramer, 2001). The present study is organized into six sections. Following the introduction, the second section reviews the research background. Section three and four presents the theoretical framework, while section five discusses the study population, functional aspects, and research findings. The final section is devoted to experimental analyses and overall conclusions.

## 2. Background

Studies in human and animal osteology are among the core subjects of archaeology worldwide, and numerous books and scholarly resources have been written on the topic. Through osteological studies, a variety of analyses can be conducted, producing data relevant to both archaeological

and interdisciplinary research. Examples include The Archaeology of Human Bones (Mays, 2002), Zooarchaeology (Reitz & Wing, 2015), and Human Osteology in Archaeology (Hashemi & Vahdati-Nasab, 2023). It is evident that in archaeological studies, especially in prehistoric contexts, human and animal bones consistently constitute a significant portion of the recovered assemblages. Among animal bones in particular, many have been utilized for various purposes, such as tool-making or the production of decorative objects, with bone tools, especially awls and needles, being of primary importance. Given their abundance in prehistoric contexts, bone tools serve as valuable indicators for investigating the economic, social, and subsistence dimensions of past communities. Nevertheless, focused and specialized studies on this subject remain somewhat limited. A review of available sources shows that bone tools have often been merely cataloged or introduced, without being subjected to detailed analytical study.

Bone tools from the Ali Tepe (El-Tepe) in the eastern Alborz, dating to the transitional period between the Paleolithic and the beginning of the Holocene, are currently preserved in the National Museum of Iran (Manca *et al.,* 2018: 143). At the East Chia Sabz site, attributed to the Neolithic period, several decorative items and bone tools made from goat bone were identified, with one end sharpened for functional use (Darabi, 2014; Darabi *et al.,* 2011: 262). Similarly, at the Pre-Pottery Neolithic site of Sheikh-e Abad, excavated through collaboration between Iranian and British archaeological teams led by Yaghoub Mohammadifar and Roger Matthews, numerous bone artifacts, including polishers, awls, and needles, were recovered, some of which contained perforations likely intended for use (Mohammadifar *et al.,* 1390: 21; Matthews *et al.,* 2008). In Chogha-Golan, belonging to the transitional Neolithic, six engraved bone tools with shallow perforations, probably for decorative purposes, were found (Darabi *et al.,* 2024: 61). From Tepe Sang-e Chakhmaq in eastern Iran, numerous bone tools were also recovered; while initial studies merely noted their presence (Roustaei *et al.,* 2015: 589), a comparative study between the sites of Abdul-Hosein and Tepe Sang-e Chakhmaq was later conducted (Manca *et al.,* 2021: 27–42). This latter research examined bone tools from these sites held in the National Museum, utilizing morphological analysis to document methods of splitting and breaking bones for tool production, and to highlight their application in subsistence activities such as hunting, sewing, and farming insights that have also significantly contributed to the present study. At the Cham Qoleh site, associated with the village-based period in the Simerreh region, findings consisted mainly of large animal remains, attesting to the role of domesticated species such as goats, sheep, and cattle in the bio-economy of these communities (Moqaddam *et al.,* 1394: 61–62, Fig. 3).

In later periods, such as the Chalcolithic, bone tools from multiple sites have been documented. A complete set of Chalcolithic bone tools, including awls, needles, polishers, and arrowheads, has been reported from Chogha Mish (Delougaz & Kantor, 1996: Pl. 128). Another example, Tepe Qeshlaq, has been the subject of a zooarchaeological study that also briefly addressed the bone tools from Level V (Layers 3 and 4), comparing them to similar examples from Dalma, Hajji Firuz, and Jarmo (Sharifi, 2020: 333; Dehghan & Motarjem, 2024: 105). A case study of Tepe Gerd Ashvan in the Lesser Zab basin mentioned noteworthy bone tools from the Late Chalcolithic, alongside

analysis of faunal remains (Sharifi & Salimi, 2023: 116, Fig. 18). In the Qal'eh Bala site of Bijar, examples of bones used in tool production have also been introduced (Ash'ari, 2021: 30). Bone awls and needles from Section VIII of Doushan Tepe in Ozbaki are further notable, reflecting both hunting and herding practices in the Savojbolagh plain from the 6th millennium BCE to the Iron Age (Mashkour & Mohaseb, 2010: 280). Studies of bone arrowheads from Ziwiyeh have examined their functional and developmental trajectory from hunting implements to decorative tools in the Iron Age through both independent and comparative analyses (Hassanzadeh & Mashkour, 2023).

In summary, despite the recovery of bone tools from various historical periods and their evident importance as highly functional implements in human societies, relatively few have been studied in detail from the perspective of morphometric analysis, functional interpretation, and manufacturing techniques. The present authors aim to place the available published information on bone artifacts alongside the results from the semi-nomadic community of the Posht-e Forudgah site. In doing so, they seek to present a relatively comprehensive picture of bone tools, especially awls and needles supported by taking advantage of analogies from other contemporaneous and horizon-related sites, representing communities that, either unconsciously or deliberately, incorporated bone tools into their daily lives.

## 3. Review of Examples of Animal Remains Tools (Teeth and Bone)

The earliest examples of animal remains used as decorative pendants and possibly with a perforating function come from the Late Neanderthal period (33,000–30,000 years ago) at Arcy-sur-Cure, France (Fig. 1). Among the various examples of bone tools bearing engravings and decorative elements are those from the Magdalenian period (Fig. 2) as well as another example used in combination with stone (Fig. 3). In this regard, a prominent case is a Natufian sickle with flint blades for harvesting, made of gazelle horn with inserted flint blades; in some cases, wood was used instead of bone (Lewis *et al.,* 2012: 337, Fig. 13–21), (Fig. 4).


**Fig. 1. Left: Decorative pendants made from animal bone and teeth for necklace production [possibly with perforating function?], from the Neanderthals (33,000–30,000 years ago), excavated at Arcy-sur-Cure, France. Right: (©Wade, 2016).**

It is worth noting that examples of animal-remain tools made of teeth and bone are also known in Iran, with an age of approximately 40,000 years. Yafteh Cave is among the important Upper Paleolithic caves, belonging to the period 24,000–33,000 years BP based on radiocarbon dating. In the second season of excavation at this cave, conducted in 2005 by Marcel Otte and Fereidoun

**Fig. 2: Bone tools from the Magdalenian period (© 2002 The Weinworth Group, division of Thomson Learning).**

**Fig. 3: Reconstruction of a Natufian sickle with flint blades for harvesting, made of gazelle horn with flint inserts (© 2002 The Weinworth Group, division of Thomson Learning).**

**Fig. 4: Example of a wooden sickle with flint blades (© Lewis *et al.*, 2012: 337, Fig. 13–21).**

Biglari, alongside Aurignacian-type lithic tools, a bone awl and a perforator were recovered (Otte *et al.,* 2007, after: Vahdati-Nasab & Ariamanesh, 2015: 298). This bone tool can be considered among the oldest identified examples of bone awls in Iran to date (Fig. 5).


**Fig. 5: Bone tool (awl) from Yafteh Cave, Upper Paleolithic (Otte *et al.*, 2007, after: Vahdati-Nasab & Ariamanesh, 2015: 300, Fig. 5–18).**

Another example is the bone tools from the Ali Tepe site, located within the cultural sphere of northeastern Iran. This site was excavated by Charles McBurney in 1964 (McBurney, 1968). From the deposits of El-Tepe, 12 bone needle tools were recovered: 11 from Layers I to III (dating to 12,458–11,855 years ago) and one from Layers 22–23 (dating to 10,812–10,972 years ago), (Fig. 6). These needles, in terms of appearance and size, are similar to needle finds from Solutrean and Magdalenian sites in France and Upper Paleolithic sites in Russia, such as Kostenki, Mezine, and Gagarino, but show minor differences. At the time of discovery, they were the first of their type in the Paleolithic or Mesolithic of Iran and Iraq, and very different from Neolithic needles such as those from Belt and Hotu Caves. The Ali Tepe needles are long and slender, closely resembling examples from the European Upper Paleolithic (McBurney, 1968, after: Vahdati-Nasab & Ariamanesh, 2015: 395–397).

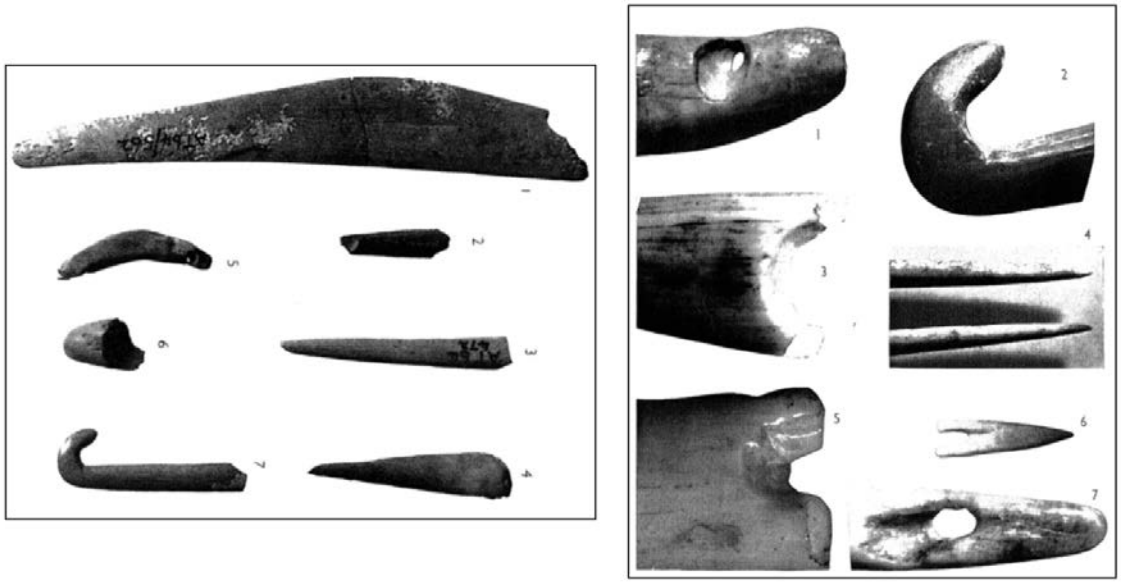

**Fig. 6: Bone and worked needles from Ali Tepe (El-Tepe), (Fig. 6: Bone and worked needles from Ali Tepe (El-Tepe), (McBurney, 1968, after: Vahdati-Nasab & Ariamanesh, 2015: 396, Fig. 32–6).**

Belt Cave and Hotu Cave, the other prominent cave sites situated along the southeastern coast of the Caspian Sea-Iran, date to around 15,000 years ago, on the eve of the Neolithic. These sites, excavated in 1949 and 1951 by Carleton Coon, were reexamined in 2021 by Hassan Fazeli-Nashli (Fazeli-Nashli *et al.,* 2024: 7, 21). From the Neolithic layers of Belt Cave, objects such as bone awls and a bone needle were recovered by Coon (Fig. 7). In the 2021 season, however, only three Canid teeth were recovered, which had been polished and perforated at one end for suspension. According to the excavation director—and given that a complete necklace of such teeth was found on the burial of an infant in Hotu Cave—these are likely to have been used as neck pendants by Mesolithic communities (Fig. 8). Such tooth pendants appear to represent a shared cultural trait among these groups and were previously published by Coon from Belt Cave (Coon, 1951: 115) and by McBurney from Ali-Tepe (McBurney, 1968; Manca *et al.,* 2018). Two similar examples were recovered from Kamishani Cave (Fig. 9) by Hamed Vahdati Nasab, who assigns them to c. 10,628 BP (Vahdati Nasab *et al.,* 2020: 114; cited in: Fazeli-Nashli *et al.,* 2024:

30–31). In the 2023 excavation season led by Hassan Fazeli-Nashli, several additional examples of such pendants were recovered from Kamishani Cave (Fazeli-Nashli, 2023). In addition to Belt Cave, from Hotu Cave in the 2021 reexamination, three bone awls were identified and presented, similar in form and function to the bone tools of Belt Cave (Fazeli-Nashli *et al.,* 2024: 21, Fig. 18), (Fig. 10).

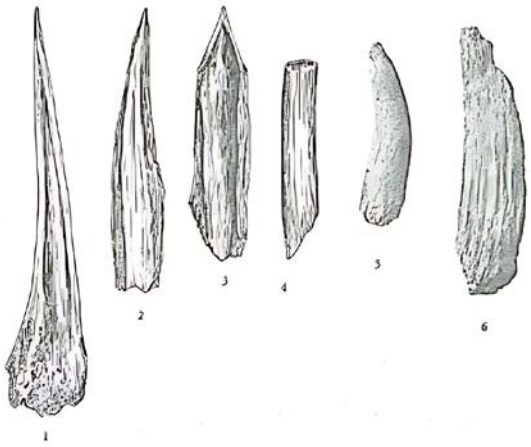

**Fig. 7: Bone tools from Belt Cave (Coon, 1949, after: Vahdati-Nasab & Ariamanesh, 2015: 383, Fig. 24–6).**


**Fig. 8: Example of pendants with wolf teeth from Belt Cave (Fazeli-Nashli *et al.,* 2024: 30, Fig. 16).**

**Fig. 9: Decorative tooth from Kamishani Cave (after: Vahdati-Nasab & Ariamanesh, 2015: 345).**

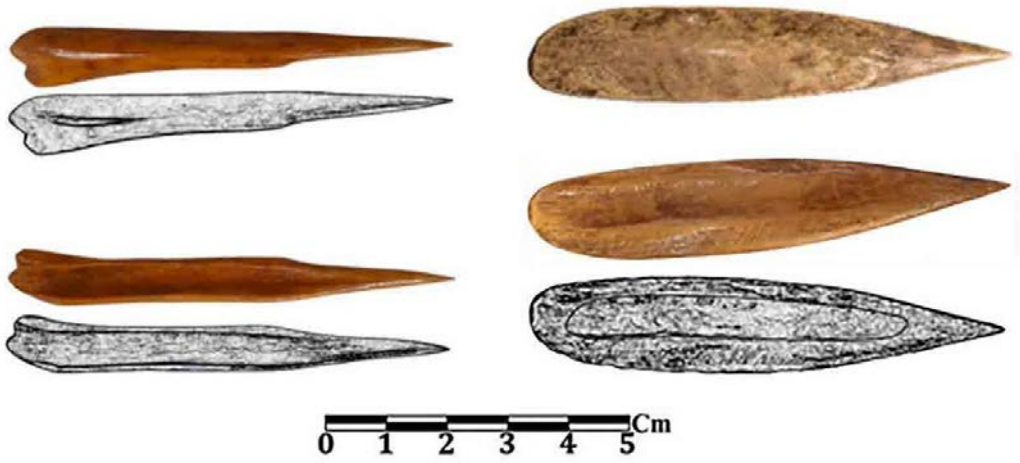


**Fig. 10: Bone tools from Hotu Cave (Fazeli-Nashli *et al.*, 2024: 21, Fig. 18).**

From southwestern Iran, the bone tools from Chogha Mish deserve mention. At this site, a complete set of bone tools—including awls, needles, polishers, and arrowheads among others—was recovered (Delougaz & Kantor, 1996: Pl. 128), (Fig. 11). The bone arrowhead from Chogha Mish counts among the oldest extant examples of this type in Iran. It should also be noted that animal bone remains were widely used for arrowhead production at Ziwiyeh (Fig. 12), where the most representative and significant examples for study have been found (see: Hassanzadeh & Mashkour, 2023: 47–62).

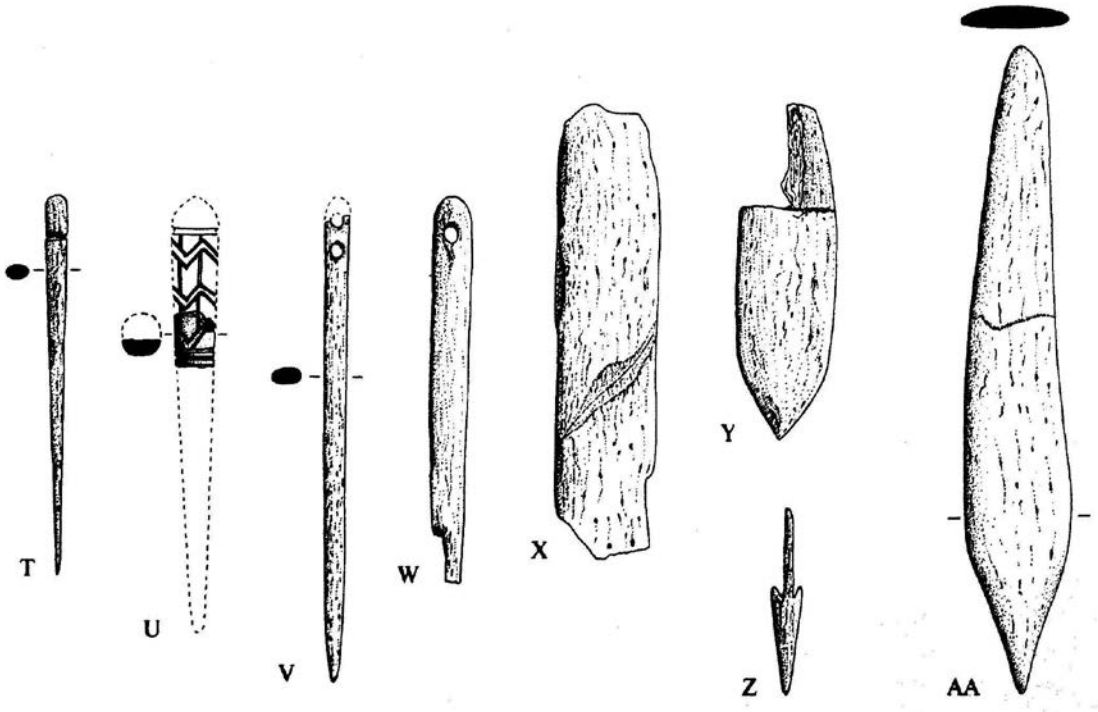


**Fig. 11: Examples of bone tools from Chogha Mish (Delougaz & Kantor, 1996: Pl. 128).**


**Fig. 12: Bone arrowheads from Ziwiyeh (Hassanzadeh & Mashkour, 2023: 51, Fig. 2).**

Examples of bone awls have also been found in the Central Zagros highlands, mostly belonging to Neolithic communities, some of which have been reported in scholarly publications (Hamlin, 1975: 125; Voigt, 1983: 29; Braidwood, 1983: 367). Notable and well-reported sites with significant bone tool assemblages include the Neolithic site of Sheikh-e Abad (Matthews et al., 2008), Tepe Abdul-Hosein (Pollard, 1979; cited in Manca *et al.,* 2021), Qalā Gāp (Abdullahi & Sardari Zarchi, 2013; Abdullahi *et al.,* 2014), and Tepe Qeshlaq (Motarjem & Sharifi, 2018; Dehghan & Motarjem, 2024), among others.

From Sheikh-e Abad, 27 bone objects, mostly from ash layers have been reported, comprising fifteen awls, one drill, two polishers, two decorative items, etc. (Fig. 13). The awls were made from the long bones of goat or sheep, with pointed ends, and in some cases, the tips were heat-treated, perhaps for strengthening. Two well-shaped bones from animal ribs, identified as burnishers by the excavators, were also found. Furthermore, two bone objects with perforations were named pendants; one was broken, but the other was complete, featuring two adjacent perforations along with a series of incised lines on its surface. Wear around the perforations suggests probable use as a necklace pendant (Mohammadifar *et al.,* 2011: 29; Matthews *et al.,* 2008: 137–139).

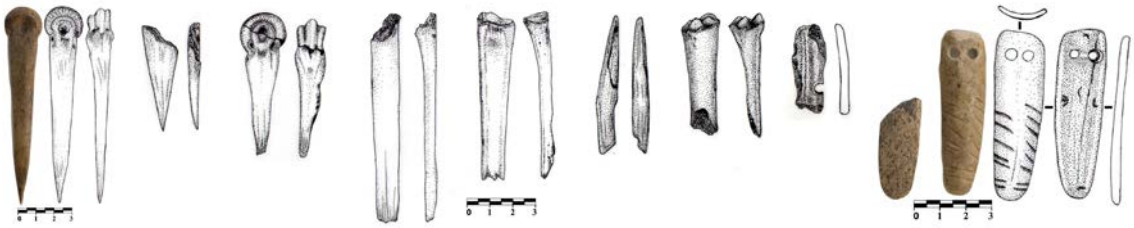

**Fig. 13: Bone tools, awls, and a burnisher from Sheikh-e Abad (Matthews *et al.,* 2008: 137, Fig. 11.1 & 139, Fig. 11.4; personal archive of Yaghoub Mohammadifar).**

Tepe Abdul-Hosein, another major Central Zagros site and the most important Neolithic site in Nurabad, Lorestan Province, was identified in 1969 during a survey by Clare Goff Mead in collaboration with Roman Ghirshman and Judith Pollard, and excavated by Pollard in 1978 (Pollard, 1979). The site contains evidence from both the Pre-Pottery and Pottery Neolithic phases, as well as their later periods; the aceramic layers are contemporary with pottery Neolithic sites such as Jarmo, Sarab, and Guran. Like other Neolithic sites of western Iran, large numbers of animal remain tools (bone and antler) were found here, making it one of the most important locations for studying the bone tool industries and technologies of the Zagros. The assemblage was studied in detail by Leora Manca and colleagues (Manca *et al.,* 2021). The tools, made from the bones of animals such as goat, include awls and needles (Fig. 14). In total, the animal remains from Tepe Abdul-Hosein comprise 159 bone specimens, six antler items, and three teeth (for more details see: Manca *et al.,* 2021: 28–40).

**Fig. 14: Selected bone awls from Tepe Abdul-Hosein (upper row: Manca *et al.,* 2021: 34, Fig. 2; lower row: ©National Museum of Iran archive; photographed by the Authors, 2022).**

From the excavations at Tepe Qeshlaq in Kurdistan Province, 40 bone artifacts have been identified as tools, comprising thirteen needles and six awls (Fig. 15). Most tools from Tepe Qeshlaq were made from the long bones of gazelle and wild goat, with a distinct preference for long bones. The longest cylindrical object measures about 11.7 cm. Analysis of the bone texture indicates that craftsmen mainly used natural bone structures without heat treatment, rather than food remains or discarded fragments (Motarjem & Dehghan, 2024: 104).


**Fig. 15. Bone cylinder and awls from Layers III and IV, Tepe Qeshlaq (Motarjem & Dehghan, 2024: 105, Fig. 1–2).**

From the Neolithic site of Dash Tepe, located in Hamedan Province, fifteen bone tools, including awls, needles, and a polisher, were recovered from sections damaged by illicit digging. These tools were collected and documented during a field visit by the authors. Based on the pottery collected from the site surface, Dash Tepe dates to the Late Neolithic. The bone tool assemblage includes a variety of polishers (one specimen) and awls (eight specimens), as well as needles (five specimens). Of note are the double-pointed needles, which are rare and noteworthy in their type (Fig. 16). It is worth noting that a double-pointed needle also occurs in the bone tool assemblage from Gerd Ashvan (Sharifi & Salimi, 2023: 117, Fig. 20, No. 5).

**Fig. 16: Various bone awls and tools from the looted excavation section of Dash Tepe, Razan (Authors, 2018).**

## 4. Theoretical Foundations (Experimental Archaeology)

As is well known, ethnoarchaeology, as an interdisciplinary approach within archaeology, uses the study of living communities and their comparison with past material data to foster a better understanding of the function, production, and meaning of ancient tools. Its theoretical framework incorporates perspectives of processual "New Archaeology" (Johnson, 2002: 5). This method, by employing various ethnoarchaeological analogies, enables the precise reconstruction of operational sequences in the production and use of tools, thereby preventing the misinterpretation of data. The approach is grounded in analogical reasoning: by comparing structures, processes, and behaviors in contemporary communities with past artifacts and material evidence, it seeks to achieve a deeper grasp of the function, production, and use of ancient tools. John Yellen (1977) identified four types of ethnoarchaeological analogy: the general model, the buckshot, the spoiler, and the laboratory. Each of these methods, in different contexts, contributes to the more accurate analysis of tools and helps avoid the erroneous extension of short-term data to long-term interpretations. Ethnoarchaeology, by differentiating functional from stylistic attributes of artifacts

(Sackett, 1990), facilitates the reconstruction of the operational sequence of tool production, use, and discard, leading to a more profound understanding of cultural and technical interactions. From this perspective, tool analysis is not limited to examining form or raw material; rather, such objects are situated within their cultural–social contexts, so that in addition to understanding the technology they also reveal aspects of past identities and social relations (Hasler, 2005, cited in: David & Kramer, 2001: 75). In analyzing tools, if appropriate questions are posed of artifacts, these can yield insights into how humans adapted to their environments, what social arrangements they had, and the conceptual systems they maintained, in other words, how they influenced the world, one another, and themselves. These categories correspond to the three well-known subdomains of "culture" proposed in Lewis Binford's theory (1962; 1965): Technomic – interaction with the material environment; Sociotechnic – interaction with others in social contexts; and Ideotechnic – interaction with ideas, beliefs, and symbolic systems. Yet, in dealing with tools, the challenge remains that archaeologists encounter only the end products of human behavior and must therefore rely on morphological features of artifacts for classification and seriation (temporal/typological ordering). Through these methods and other forms of analysis, they define tool kits and draw inferences about socio-cultural systems (David & Kramer, 2001: 162).

In the broader perspective of Nicholas David and Carol Kramer five steps are proposed for the analysis of ancient tools using an ethnoarchaeological approach. Selection of a sample of tools: Choosing a set of archaeological tools (for example, stone tools, bone implements, or decorative ceramics) from a specific archaeological site. Collection of ethnographic data: Gathering ethnographic information on the production, use, and discard of similar tools in contemporary communities with comparable cultural and environmental settings. Descriptive and comparative analysis: Examining the morphological features, manufacturing techniques, and use-wear of archaeological tools and comparing them with ethnographic data. Reconstruction of the operational sequence: Identifying the stages of production, use, and discard of tools with the aid of ethnoarchaeological models. Cultural interpretation: Analyzing the results within the framework of cultural, social, and technical models to gain a better understanding of past lifeways (see: David & Kramer, 2001: 163). These methods have not been without criticism. They outline a set of arguments and responses through which the duality of views on analogy raised by critics has taken specific shape. This debate focuses on the growing concern that analogy appears both essential for interpretation and yet always potentially misleading. At a more fundamental level, these discussions can be seen as reflecting a core dilemma faced by archaeologists in using their data seriously as evidence of the cultural past: namely, that any broadening of research scope comes only at the cost of reduced (actual or potential) methodological precision. Each critical reaction to analogy, and each corrective response to such criticism, represents an effort to confront this dilemma. Some accept one of the available methodological options, assuming research is inevitably limited or tentative. Others reject these options altogether and seek to demonstrate how one of the assumptions underlying the dilemma might be modified to escape it (for further discussion, see: Wylie, 1985: 63–111).

Within this context, "Analogy" that is, comparison, resemblance, or metaphor has been developed in ethnoarchaeological studies to provide better anthropological parallels and thereby assist in interpreting archaeological data. Put simply, analogy is used when attempting to understand something new or complex by comparing it to something familiar or simple. It involves placing two different things side by side because of their similarity in one or more features. In broader terms, analogy means "comparison for better understanding" (David & Kramer, 2001: 75). Adopting this perspective and employing the method of analogy, Vitezović (2020), in his article "Technological changes and innovations in the osseous industries in the early and late Neolithic in the Balkans", provides an in-depth examination of Neolithic tools and offers valuable insights into the identification and interpretation of technological innovations in prehistory.

In the present research, using ethnographic data related to contemporary communities and employing morphological and technical analysis of archaeological specimens through an analogical approach (comparison for better understanding), an attempt has been made to explain not only past technologies but also the cultural and social dimensions of tools. The results indicate that ethnoarchaeology offers an effective approach to achieving deeper insights into the history of human lifeways and their cultural–technical interactions.

## 5. From Manufacture to Use: Reconstruction of Bone Tools with Reference to Experimental Archaeology

Experimental archaeology (ethnoarchaeology) possesses the potential for application across all historical periods and encompasses subfields ranging from environmental archaeology to archaeological methods of study and investigation aimed at understanding human activities. Such identifications and analyses reveal to all the manner of tool manufacture and use, as well as the ways of interaction and adaptation to the environment. In the archaeological record, examples of bone tools produced through certain manufacturing methods bear striking resemblance to stone tools, yet with the distinction that bone and stone possess different physical properties. Nevertheless, the structural suitability of both has been considerable for toolmaking, depending on the specific need (Udaya Kumar, 2023: 280). Among these, the bones identified as tools have been examined to provide a better picture of technological adaptation and the cultural traditions of prehistoric humans. In the twentieth century, bone tools came to be regarded as an innovation in early tool production (Backwell *et al.,* 2014: 950). Consequently, zooarchaeology, social archaeology, and the emergence of archaeozoology have offered the potential to examine marrow as food, as well as to analyze and develop the technology of bone industries for toolmaking. The study of animal bones from archaeological sites has aimed to provide insights into human behavior in the past (Gates St-Pierre, 2007: 107).

As mentioned earlier, in archaeological sites of Iran, numerous tools have been identified including drills, knives, scrapers, grinders, projectile points, needles, awls, and so forth and these industries form one of the important components in defining sites. However, their function and use have often been forgotten or mentioned only briefly and in a limited manner. The study of

bone tools still remains dominated by morphological (typological) description, and little effort has been made to understand their technological aspects (Udaya Kumar, 2023: 280).

- Manufacturing techniques: The methods and techniques of bone tool production have shared notable overlap and consistency of application across nearly all human cultures and periods, from the Paleolithic to recent centuries. These include softening, percussion, scraping, splitting, cutting, grooving, heat treatment for hardening, and so forth. Ultimately, these tools fall into two main categories: Hunting tools – such as projectile points and spearheads. Domestic and industrial tools – such as needles, polishers, blades, knives, perforators, and so on (Gupta, 2021: 221–222). In a broader view, the application of methods for working and cutting bones may be classified into four techniques; Grooving, Splitting, Percussion (Taha, 2014: 44–45), Polishing and sharpening. These together comprised the principal approaches to bone tool manufacture (see: Fig. 17).

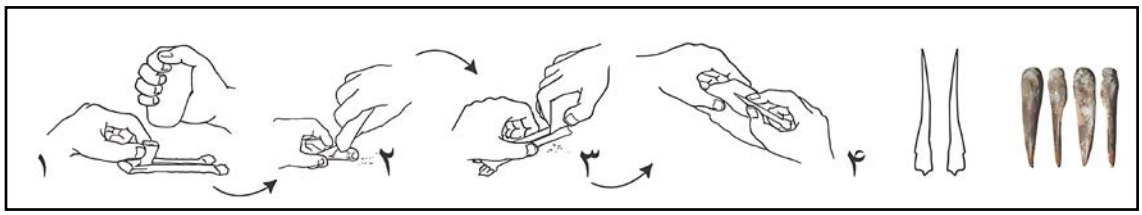


**Fig. 17: Reconstruction of the bone tool manufacturing process, from percussion to shaping (Authors, 2024).**

Manca and colleagues (Manca *et al.,* 2021), in their analysis of the bone tools from Tepe Abdul-Hossein and Sang-e Chakhmaq, have provided a detailed description of the manner and stages of bone tool production. The principal stage consisted of the general shaping of the tool, carried out through two fundamental methods: 1) bipartitioning, and 2) fracturation. These processes were performed using fresh bone raw materials (prior to fossilization). Following these two stages, the subsequent steps, namely shaping the pieces according to the intended function of the tools were undertaken. These included: 1) scraping, 2) retouching, and 3) abrasion. However, among the assemblages, there are occasionally tools that were used directly as intermediary implements without any specialized shaping or particular finishing. It is noteworthy that the selected bones were predominantly from small mammals and sheep/goat caprines (Manca *et al.,* 2021: 38) a point also mentioned in studies and descriptions of tools from other sites, such as-e Abad (Mohammadifar *et al.,* 2011: 29) and Qeshlaq (Motarjem & Dehghan, 2024: 104), where the raw materials were mainly long, elongated bones, and at times the ribs of hunted domestic and wild animals such as gazelle, goat, and sheep. Based on the study of tools from the Neolithic community of Tepe Abdul-Hossein, compared with those from Tepe Sang-e Chakhmaq, it has been established that Neolithic societies employed organized production systems for bone tools. Tool manufacture was carried out through the conscious selection of bone raw materials, based on the physical properties of the bones and the intended function of the tools (Manca *et al.,* 2021: 39–40).

- Application methods: Regarding the known uses of bone tools particularly awls, it can be stated that during the Mesolithic, the transitional phase to the Neolithic, and the Neolithic to the

Chalcolithic periods, these tools were employed alongside the making of blades and micro-blades in the production of sickles, within the so-called "Mousterian-related and post-Mousterian" tradition from antler and bone tools, for the detachment of blades and micro-blades from cores. This tradition, which began in the Zarzian and Zawi Chemi cultural contexts, focused on the tangential pressure technique for the production of micro-blades and blades from cores, which, in the Neolithic, took on a more specialized character and often appeared in the "bullet-shaped" form. Such specialization, noted at Sheikh-e Abad with the increase in sickle blade counts in later layers, subsequently became widespread in sites such as Chia Sabz-e Sharqi and in most sites dating from the tenth and ninth millennia BCE to the Chalcolithic period, known as the post-Mousterian tradition. This tangential pressure method was simultaneously employed in the Levant in the production of large projectile point industries and bifacial tools (Kozlowski, 1996; 1999). The use of the pressure debitage technique for producing long blades and sickle-related elements is one of the most important characteristics of this tradition, which ultimately, in the sixth and fifth millennia BCE of the Zagros, is defined as the "post-Mousterian" toolmaking tradition (for further information, see: Darabi, 2013: 7–24). Thus, one of the most significant applications of bone tools particularly the awl from the Mesolithic and Neolithic through to the Chalcolithic was in the production of blades and micro-blades via the tangential pressure technique (in Fig. 18, the operational process of this method is illustrated).

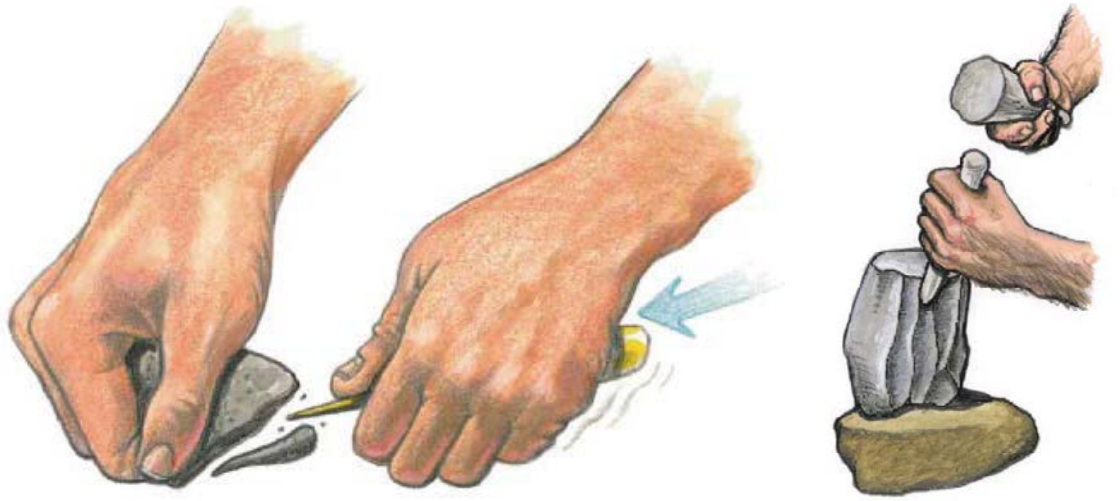

**Fig. 18: Use of bone tools (such as the awl) from the Mesolithic, Neolithic, to the Chalcolithic "Mousterian-related and post-Mousterian" periods in the manufacture of stone tools (blades, microblades, etc.), (© Lewis *et al.*, 2012: 299, Fig. 12 19 & 300, Fig. 12 21).**

Building upon experimental archaeology, and employing the method of analogy, reference is here made to certain handicraft productions of contemporary traditional communities in which awls and needles constitute essential tools. These tools can be matched with similar examples from earlier periods, prior to the awareness of metal. Through the analysis of the recovered tools within the framework of ethnoarchaeological and comparative ethnographic approaches, cultural patterns and techniques for manufacturing bone tools have been identified. It must first

be recalled that ethnology examines the patterns of thought and behavior of past communities by considering how these might be employed within present-day systems; ethnologists study contemporary cultures and compare them with those of the past. There is no doubt that many ethnologists and ethnographers are capable of examining the relationships between material remains and their structural relationships, in connection with ways of life, such that their principal aim is understanding the past through observation of today's traditional societies (Alizadeh, 2004: 75–77).

Among these, the art of basketry is considered one of the ancient Iranian crafts, having produced many innovations and products, and practiced in regions where the climate has been relatively favorable and accompanied by high-quality vegetation (trees). The Malayer region in Hamadan Province, for instance, has, up to the present day, used this craft (basket weaving or wicker weaving) to represent itself at the national level. In basketry, the core coiled method, generally designed on the basis of mental concepts and patterns is employed. One of the important tools for joining plant elements (reeds) together has been the awl and the needle, which have remained in use to the present day, facilitating the work of artisans (Shah Hosseini & Hajian Foroushani, 2023: 32–33), (Fig. 19: No. 1).

Another use of bone tools (various types of awls and needles) has been in the pottery industry. In this technique, when the clay vessel has not yet dried and its surface is still wet, sharp tools are used to remove clay in order to create incised decoration. Notable examples of this decorative method are seen in the pottery tradition of the Dalma culture, known as pinch decorated pottery, in which a pointed tool (awl) was employed in the process (for examples, cf.: Balmeki, 2017: 69, Fig. 6; Sharifi, 2024: 21, Fig. 8). The same method, in the past, was also employed by potters in the traditional pottery workshops of Lalejin, Hamadan (Fig. 20). Among the reasons cited for the use of bone in traditional pottery making in the past few centuries is its greater resistance to the moisture of pottery clay in comparison to wooden and metal tools. Furthermore, after the pottery had dried, potters would also use sharp tools or blunt edges for decorating the surface with various colors (Fig. 19: No. 2).

Another category of tools worth explaining are the weaving bone tools, tangible and exemplary specimens of which have been identified from the Neolithic period at the sites of Tepe Qalā Gāp (Abdullahi & Sardari Zarchi, 2013: 130), Gerd Ashvan (Sharifi & Salimi, 2023: 115, Fig. 15), and Tepe Posht-e Forudgah. These tools, given their structure and the sharpness present both at the tip and along the sides, bear a strong resemblance to modern traditional crochet hooks (Fig. 19: No. 3). The technique of using these tools, in earlier examples, was also employed in producing early sickles (cf. Figs. 3 & 4). Present day tangible and exemplary parallels include the art of kilim weaving (for more information, see: Faghirizadeh, 2009).

As noted, although tools such as various awls were technologically and intelligently designed and produced for their intended functions, one of the principal and important uses of awls and needles has invariably been as perforators (/borers) in the processes of sewing, weaving, and related tasks. Based on field observations, due to the durability, flexibility, and suitability of metal

tools, in the traditional leather working workshops of Hamadan Province, metal versions of these tools are employed. Among these tools, the following may be mentioned: Gazen (Gāzen): a tool for cutting, scraping, and trimming leather; Awl: for perforating and sewing leather; Hook: for threading and stitching. Given the durability, resistance, and flexibility of leather as well as its importance in early communities this animal derived product (especially among nomadic and transhumant societies) held a crucial place in the production of clothing and various types of leather footwear, among other items. Evidence shows that leather and fiber working have been practiced from remote antiquity up to the present day. Before metals came to be known by humans, bone tools were among the essential implements for leather processing and sewing, and had extensive applications in this field (personal interview with: Mohammad Salim, 2019). Therefore, another major use of bone tools particularly the awl by early communities was in sewing (processing of leather and fibers), (Fig. 22: Nos. 4 & 6).

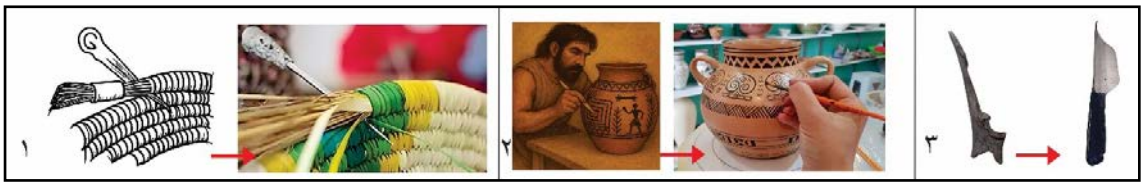

**Fig. 19: A brief overview of tools and their applications across different historical periods (basketry image adapted from: Shah Hosseini & Hajian Foroushani, 2023: 32, Fig. 3; with ad ditions by: Authors, 2024).**

**Fig. 20: A brief overview of "incising" tools and their applications in the pottery art of Lalejin (creating incised decoration using various pointed tools, and separating the shaped vessel from the clay and potter's wheel with a needle and awl), in a comparative analysis with the method of creating pinch incised decoration on Dalma pottery (Dalma pottery images adapted from: Balmeki, 2017: 69, Fig. 6; other images by: Authors, 2025).**

## 6. Bone Tools Discovered at Tepe Posht-e Forudgah

Tepe Posht-e Forudgah, located to the south of Malayer County in Hamadan Province, lies at an elevation of approximately 1,680 m above sea level. The site, with an area exceeding 5,000 m², contains phases of the Late Neolithic, with an absolute date of 5216 B.C.E. (Beik-Mohammadi, 2024: 82), the transitional period from the Neolithic to the Chalcolithic, the Early Chalcolithic, and a short term Islamic occupation during the 3rd–4th centuries AH. The majority of the recovered remains were concentrated in the southern part of the mound. Upon removal

of the surface layers, a volume of ash resulting from the subsistence activities of semi-sedentary and nomadic communities was revealed, together with cultural materials associated with the subsistence economy of such communities (e.g., spindle whorls, clay loom weights, tools made from animal remains, etc.). In the spring of 2017 C.E. (1396 A.H. Solar), the site was examined and subjected to archaeological studies for the purpose of delimiting its boundaries and protected area (for further information, see: Beik-Mohammadi, 2017; Beik-Mohammadi *et al.,* 2018; 2020; 2021). From this site, a total of eight examples of various types of bone tools were recovered, including awls, needles, burnishers, and others, in different dimensions and sizes (Fig. 21).

**Fig. 21: Examples of bone tools recovered from Tepe Posht-e Forudgah, Malayer (Beik-Mohammadi, 2017).**

A technological study and analysis of the bone tool assemblage from the site of Posht-e Forudgah allows for the reconstruction of certain aspects of the production processes and the informed, technical knowledge of its Late Neolithic communities. These tools not only reflect the subsistence needs of the semi-nomadic society of the period but also provide a lucid account of the structure and physical characteristics of the primary raw materials, as well as their functional applications. The morphology and structure of the tools from this site are as follows: elongated, conical, and symmetrical bodies, apparently produced from the long portions of bones; a broad base tapering into a narrow, sharp tip with an oval cross section features that indicate deliberate design for tasks such as perforation (fibers, leather, etc.). The presence of wear and polish marks on the mid section and tip attest to repeated use in production processes (Fig. 21: No. 1). In terms of appearance and structure, this specimen closely resembles tools recovered from other sites, including Yafteh Cave, Abdul-Hossein, Sheikh-e Abad, Qalā Gāp, Qeshlaq, and others (Figs. 5, 6, 7, 13, 14, 15, 16, 17; Table 1: 1).

Another specimen has a triangular body with an oval, nearly solid and compact cross section, preserved in relatively good condition. From a functional perspective, the fineness and sharp tip suggest that it may have been used as a sewing implement or for the production of finer crafts. The high manufacturing quality, sharp tipped and well shaped form of this specimen point to advanced technical skill in producing versatile tools for everyday life (Fig. 21: No. 2); this piece is comparable to specimens from Abdul-Hossein and Sheikh-e Abad (Figs. 13, 14; Table 1: 2).

Another tool is extremely slender and rod shaped, with a solid, circular cross section. Owing to the inherent strength of bone, it exhibits considerable fineness. Such rod like tools, which were recovered in nearly solid form, were likely employed in Neolithic contexts for the production

of handicrafts (basketry, brush making, sewing), (Fig. 21: No. 3); comparable to examples from Sheikh-e Abad, Abdul-Hossein, Chogha Mish, Chogha-Golan, Qeshlaq, and Dash Tappeh (Figs. 13, 14, 15, 16; Table 1: 3).

Other specimens feature an oblique and curved edge, placing their overall form in the category of cutting or abrading implements, functioning as scrapers, blades, and cleaning tools, and are comparable to examples from Sheikh-e Abad, Qeshlaq, and Dash Tappeh (Figs. 13, 15, 16; Table 1: 3). Tools Nos. 4, 5, and 6 exhibit straight bodies of uniform thickness, in some cases with a blunted tip, designed for daily use. Within these finds, the presence of sharper, curved edges, similar to (rudimentary) knives, reveals the existence of relatively sophisticated technologies (Fig. 21: Nos. 4, 5, 6; Table 1: 4, 5, 6); analogous to those observed at Abdul-Hossein (Figs. 13, 15, 16; Table 1: 3). Another tool fragment, with its elongated shape and relatively sharp tip, also belongs to the category of multipurpose implements (blade, scraper, craftwork). The tool's appearance a straight, rod like body with a sharp edge suggests everyday uses such as cleaning tasks or handicraft production (particularly weaving). This resembles examples from Qalā Gāp (Abdullahi & Sardari Zarchi, 2013: 130, Fig. 14) and Gerd Ashvan (Sharifi & Salimi, 2023: 115, Fig. 15), (Fig. 21: No. 7; Table 1: 7).

Another tool, of particular structural and functional significance for understanding and examining the daily life of these communities, is one that has been vertically carved and possesses a flat, elongated surface. What distinguishes this tool from the rest is the presence of a neatly made perforation at the upper part of the bone, likely intended for passing a connector, thread, or perhaps a suspending element, combined with an end that exhibits breakage resembling that of a hammerstone. It is unclear whether the longitudinal cut and fissure along its surface were produced during manufacture or occurred naturally.

A technical examination reveals that the perforation was made with precision; however, due to breakage in the bone, the boring process was not completed, and only the outer surface of the bone was cut. This piece was likely used as a grinding or abrading implement, comparable to examples from Sheikh-e Abad (Fig. 13), Sang-e Chakhmaq (Manca *et al.,* 2021: 34, 11), and Dash Tappeh (Fig. 16), (Fig. 21: No. 8; Table 1: 8).

Although stone tools are present among the bone tools from Tepe Posht-e Forudgah, there is no evidence to suggest that awls were used in stone tool production that is, as tangential pressure tools for producing blades and micro-blades. This is because all of the awls from this site display polished surfaces, contrary to what is observed in studies of tools from Tepe Abdul-Hossein and Sang-e Chakhmaq, where the awls exhibit numerous chipping fractures at the tip and along the body. These fractures have been interpreted as resulting from their use in blade production (Manca et al., 2021: 39 40).

## 7. Discussion and Analysis

Given the trajectory of animal domestication during the Neolithic and Chalcolithic periods, it can be stated that most animals kept by nomadic-communities were sheep and goats. These animals

**Table 1: Examples of bone tools recovered from Tepe Posht-e Forudgah, Malayer, in comparison with other Neolithic sites (Authors, 2024).**

| No | Image of the tools behind Tepe Posht-e Forudgāh | Attributes of the Tools | Manufacturing Method | Comparable Image | Possible Function | Description | | References |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Similarity | Difference | |
| 1 |  | Sharp tip, conical body, polish and wear on the tip | Limited-angle flaking, shaping at the distal end |  Sheykhi-ābād | Drilling | Fully similar in shape and body (spindle-shaped) | There is no difference | Mattews et al., 2008 |
| | | | |  Sheykhi-ābād | Drilling | Similarity in the tip and its sharpness | There is no difference | Authors, 2022; © National Museum Archive |
| | | | |  Sheykhi-ābād | Drilling | Similarity in the tip and its sharpness | Difference at the distal end, which is also sharper | Abedi, 2015: 7 |
| 2 |  | Triangular, sharp-tipped | Retouched at the distal end |  Abdul-Hosein | Drilling, lightweigh t hunting arrowhead | Similarity in tip and sharp distal end | Difference in edge shaping (manufactur ing method | Manca et al., 2021: 43 |
| 3 |  | Rod-shaped, thin, and long | Completely polished and dense |  Chogha-Golan | Drilling, similar to a long needle | Similarity in length | Fractured body | Darabi et al., 2024 |
| | | | |  Abdul-Hosein | Drilling, similar to a long needle | Similarity in length | Possessing two perforations along the edge | Authors, 2022; © National Museum Archive |
| 4 |  | Scraper, blade | Lightly flaked, forming an angle on one side |  Abdul-Hosein | Because of the slanted edge: functions include abrasion, cleaning, meat cutting, and scraping | Similar | More prominent edge at Tepe Posht-e Forudgāh | Manca et al., 2021: 43 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5 |  | Long, slanted edge | Incomplete flaking at the edge and weakly sharp distal end |  Abdul-Hosein | Because of the oblique edge: functions include cleaning and meat cutting | Similarity in edge and length | The distal end is more chamfered in the specimen | Manca et al., 2021: 43 |
| | | | |  Abdul-Hosein | Because of the oblique edge: functions include cleaning and meat cutting | Similar edge and length in the body | The distal end is more chamfered in the specimen | Manca et al., 2021: 43 |
| 6 |  | Long, weak and slanted edge | Flaking or breakage at both the edge and the distal end |  Abdul-Hosein | Because of the oblique edge: functions include cleaning and cutting meat | Central part of the bone, slanted edge | Less sharp compared to the tools from Tepe Posht-e Forudgāh | Manca et al., 2021: 43 |
| 7 |  | Narrow and elongated, sharp | Flaking or breakage at both the edge and the distal end |  Qalā Gāp | Sharp and cutting, blade, scraper, handicraft | Sharp and narrow edge | Tools from Tepe Posht-e Forudgāh are sharper and thinner, providing ease of use | Abdollahi & Sardari Zarchi, 2013: 130, Figure 14 |
| | | | |  Gerd Ashvan | Sharp and cutting, blade, scraper, handicraft | Sharp and narrow edge, Tip fracture of the tool | Tools from Tepe Posht-e Forudgāh are sharper and thinner, providing ease of use | Sharifi & Salimi, 2023: 115, Fig. 15 |
| 8 |  | Flat with rounded edge | Flaking or breakage on both the edge and the distal end |  Sheykhi-ābād | Used for cleaning, scraping, and abrasion | Similar | They do not differ | Mattews et al., 2008 |
| | | | |  Sang-e Chakhmaq | Used for cleaning, scraping, and abrasion | Similar | They do not differ | Manca et al., 2021: 34, 11 |
| | | | |  Dash Tepe | Used for cleaning, scraping, and abrasion | Similar | They do not differ | Authors, 2018; |

were among the most beneficial and best adapted to the environment (especially in the Zagros), (Zagarell, 2008: 104). Zooarchaeological studies indicate that the bones of these two species (including sheep and goat) were extensively utilized in tool manufacture. A general overview of the tools recovered from Tepe Posht-e Forudgah, Malayer, shows considerable diversity in form, manufacturing techniques, and probable functions. Zooarchaeological research across various periods, particularly in prehistory, has been of central importance, and alongside it, the study, analysis, and functional interpretation of bone tools offers essential insight. Through the identification and examination of different species, whether domesticated or wild, it also becomes possible to better understand the animal and plant ecosystems; within this process, the products of earlier human communities play an important role in understanding their culture and society. Before the introduction of metals, one of the most important cultural materials was hard substances such as stone and bone. Stone tools and processing techniques have greatly contributed to our understanding of past economies and consumption patterns, and bone data are no exception they, too, shed light on and facilitated aspects of human life. In general, the applications of tools (including those from Posht-e Forudgah) can be divided into two groups: Tools with more specialized and precise functions. Tools with more general, processing level applications.

These, in turn, fall into two main categories: first, pointed tools with conical or spindle shaped bodies, generally designed for perforation and sewing; and second, tools with worked or oblique (weaker) edges, used for incising or engraving. From a technological perspective, the available evidence indicates that these tools exhibit polished and worn surfaces, created by repeated use over their working lives. The perforating and scraping tools from Tepe Posht-e Forudgah display notable fineness. Their dimensions and proportions are such that they enhance the user's control due to their well considered sizing, thereby facilitating work. From an ethnographic perspective, it can be deduced that these tools were used in the production of handicrafts such as basketry, pottery, and domestic crafts. As noted earlier, experimental archaeology seeks to explore past art, culture, and technologies in order to present them within today's traditional societies. Accordingly, it can be said that raw materials in the past, as natural and readily available resources for manufacturing a range of tools, have persisted though with changes in material in similar forms and functions in contemporary traditional communities. It should be noted that bone, thanks to its physical properties and high durability, was capable of fulfilling human needs. For example, an awl, used by many artisans in basketry to divide and arrange the work, was made with a relatively long body and a sharp point to facilitate the craft. In modern basketry, this implement is used almost in the same form (Shah Hosseini & Hajian Foroushani, 2023: 32–33), the only difference being the material composition (Fig. 22: No. 1). Another tool, found in Neolithic contexts including Chogha-Golan and Tepe Posht-e Forudgah, is a long rod. Unfortunately, in both sites, the specimens appear to have been broken, preventing precise measurement of their dimensions. However, given their thinness and delicacy, it is plausible that these may have served as knitting needles comparable to those used today in traditional kilim weaving in various parts of Iran (Fig. 22: No. 2). Another example of a domestic craft tool is one comparable to a weaving knife. Similar implements have

been recorded at Qalā Gāp, classified as weaving tools (Abdullahi & Sardari Zarchi, 2013: 130, Fig. 14), and at Gerd Ashvan (Sharifi & Salimi, 2023: 115, Fig. 15). The specimen in question, made from the central portion of a bone, was thin and sharp and likely used for cutting thread; it is also possible that the tip had an additional function, serving as a hook (Fig. 22: No. 3). Among other branches of animal product processing is the craft of tanning. This traditional technique maintaining its essential nature, and even its raw materials persists to this day. Animal skins, treated with chemical agents (in the past, salt) and physical manipulation, were transformed from their raw state into relatively stiff and decay resistant sheets (Saadian, 1970: 157). Another tool, retaining its functional concept, is the "Knife/Cleaner tool" used for cleaning meat, plant skins, and similar materials. Present in modern domestic contexts as well, this implement is represented at Tepe Posht-e Forudgah by a specimen with a sharp and cutting tip and body, likely used for scraping and cleaning (Fig. 22: No. 5). Sewing, like knitting, has a variety of tools, which in the past were made of bone and today are typically of metal. The primary form was the awl or punch, used for perforation and for passing connectors (Fig. 22: No. 6), as well as needles that could be employed for both sewing and weaving (Fig. 23).

**Fig. 22: Comparison of past and present tools used in basketry (basketry image adapted from: Shah Hosseini & Hajian Foroushani, 2023: 32, Fig. 3; Authors, 2024).**

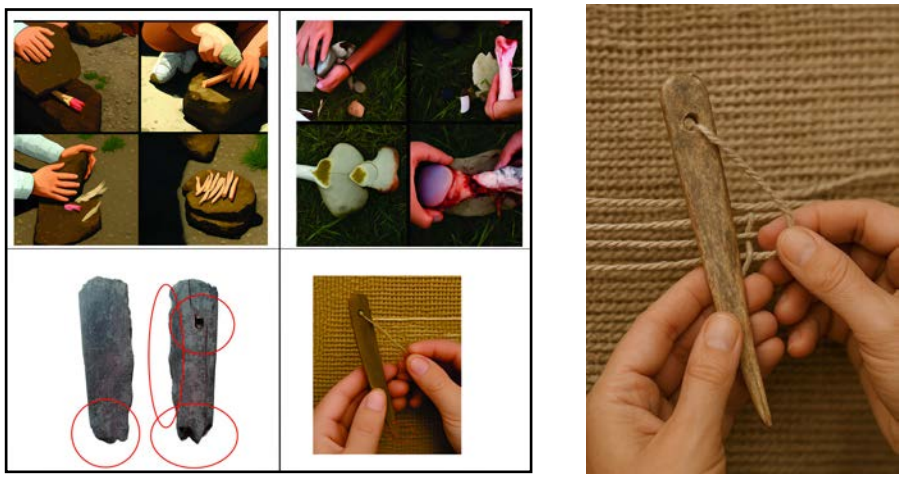

**Fig. 23: Process of bone tool production through to stages of use (Authors, 2024).**

## 8. Conclusion

The study of bone artifacts has not received serious attention in Iranian archaeology, except in a few cases to which reference has been made in the body of this research. This neglect stems from an insufficient understanding of their practical functions and applications. However, with a thorough knowledge of such objects, they can serve as connectors between cultural sequences. By examining the subsistence strategies and cultural exchanges of past communities, the dynamic and intelligent adaptations of human societies can be discerned. Accordingly, the study of bone artifacts in this research shows that although their quantity at the site of Tepe Posht-e Forudgah is limited, they nonetheless contribute to confirming the subsistence economy of this region's nomadic and semi sedentary community, based on pastoralism. Although few in number, the bone tools and associated data indicate the intelligent use of resources and a high level of technical skill, embedded within a self sustaining internal economy. These implements were used for domestic tasks, and preliminary examination suggests that they bear traces of wear as a result of prolonged use during their time. It should be noted that most of the materials examined here show a high degree of overlap with finds from other Neolithic sites, which indicates the diffusion of shared traditions in the manufacture, finishing, and use of bone artifacts within a common cultural horizon. However, it must be borne in mind that Tepe Posht-e Forudgah was a seasonal and nomadic settlement center. Compared with larger sites which accommodated greater human populations, it held fewer inhabitants and thus yielded fewer artifacts overall. Nevertheless, it produced tools in accordance with the needs of its community. Ultimately, it may be concluded that, given the semi sedentary and nomadic lifeways of the region, the recovered bone tools were purposefully made to meet the subsistence needs of the society. This is observable in the specialized morphology of the tools, reflecting their role in crafts and daily life. When bone artifacts are considered alongside other abundant site finds especially "Spindle Whorls" it becomes clear that they were employed in sewing, weaving, and possibly spinning, as well as basketry, mat weaving, and even leather working. Based on parallels from contemporaneous sites, these implements show extensive similarity in morphology, structure, and function. Moreover, when compared with present day experimental archaeological studies in the region, modern examples of bone tool use especially awls and needles clearly point to their role in activities such as decorating pottery, sewing, weaving, leather working, and related tasks.

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## Authors' Contribution

All authors contributed equally to the writing of this paper.

Conflict of Interest

The authors hereby declare, in adherence to publication ethics and proper citation practices, that there is no conflict of interest.

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# مـطالعات باسـتان‌شـنـاسی

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# ساخت و کاربری ابزارهای استخوانی در جوامع نوسنگی: مطالعه‌ای بر ابزارهای استخوانی محوطهٔ تپهٔ پشت‌فرودگاه ملایر


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**چکیده**

محوطهٔ تپهٔ پشت‌فرودگاه در دشت ملایر، در زمرهٔ محوطه‌های شاخص جوامع نیمه‌کوچ‌رو با اقتصاد معیشتی دامداری، از اواخر نوسنگی جدید در زاگرس‌مرکزی به‌شمار می‌رود. در این دوران با تثبیت شیوه‌های کشاورزی و دامداری، منجر به گسترش و تنوع در ساخت ابزارهایی از مواد خام سنگ و به‌ویژه بقایای جانوران (استخوان) شده است. بقای استخوان‌های جانوری به‌دلیل دارا بودن ویژگی‌هایی همچون: انعطاف‌پذیری، قابلیت پرداخت، مقاومت نسبی و دسترسی آسان، نقش مهمی در زندگی و معیشت جوامع نوسنگی داشته است. در این پژوهش، تعداد محدودی از ابزارهای استخوانی که با ابعاد و ویژگی‌های ظاهری و عملکردی مختلف به‌دست آمده از محوطهٔ تپهٔ پشت‌فرودگاه به روش توصیفی-تحلیلی و مقایسه‌ای با سایر محوطه‌های شاخص زاگرس‌مرکزی مورد بررسی قرار خواهند گرفت. پرسش نخست در این باب آن است که، ابزارهای استخوانی به‌دست آمده از محوطهٔ پشت‌فرودگاه ملایر دارای چه ویژگی‌ها و خصوصیات ریخت‌شناسی و عملکردی هستند؟ دوم، با توجه به ساختار ابزارها، چه نقشی در زندگی روزمرهٔ جوامع کوچ‌رو و به چه‌منظور مورداستفاده بوده‌اند؟ و پرسش‌آخر، بین ابزارهای این محوطه و سایر محوطه‌های هم‌عصر و هم‌افق خود، قرابت ساختاری و کارکردی وجود دارد؟ این پژوهش به‌دنبال اهدافی چون: تحلیل ویژگی‌های ریخت‌شناسی، فناوری هوشمندانهٔ مردمان و کارکرد احتمالی آن‌ها و با کمک گرفتن از مطالعات باستان‌شناسی تجربی بوده است. یافته‌ها نشان می‌دهد که ابزارها عمدتاً دارای بدنهٔ مخروطی، نوک‌تیز و سطح صیقل یافته‌اند و آثار سایش که نشانگر استفادهٔ مکرر بوده، قابل مشاهده است. نتایج این پژوهش بر اثبات نوعی تخصص‌گرایی در ساخت ابزارهاست؛ آگاهی درست از خواص موادخام استخوانی و شکل‌گیری نظام فناورانه همراه با ساختار اجتماعی پویا در دوران نوسنگی، به‌ویژه در جامعهٔ نیمه‌کوچ‌رو دامدار تپهٔ پشت‌فرودگاه دلالت دارد؛ چراکه با تحلیل ابزارها و بازسازی جنبه‌های معیشتی می‌توان تاحدی ساختار اجتماعی جوامع پیش‌ازتاریخ را بررسی و درک بهتری در نحوهٔ ساخت، استفاده و کاربرد از نوع ابزارهای استخوانی، به‌ویژه درفش و سوزن‌ها در جوامع نوسنگی کوچ‌رو ارائه کرد.



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## Typological and Structural study of Pottery from Tell Aswad, Damascus, Syria: A Proposed Chronology Based on Thermoluminescence/Optically Stimulated Luminescence (TL-OSL) Dating

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**Abstract**

One of the most significant Neolithic sites in southwestern Syria is Tell Aswad. This site was excavated by DeContenson and Stordeur, and a limited number of pottery sherds were recovered. The excavators initially attributed the pottery sherds from Tell Aswad to the Pre-Pottery Neolithic (PPN) period. However, typological studies conducted by the authors revealed that these sherds can be assigned to the Neolithic, Chalcolithic, Bronze Age, and historical periods. The primary objective of this research is to establish a typology of Tell Aswad pottery based on form and manufacturing techniques. Additionally, the study aims to determine the precise dating of the Tell Aswad pottery using both pottery analysis and the thermoluminescence dating method. To achieve this, the research seeks to address the following questions: How can the Tell Aswad pottery be explained in terms of typology and structure? How can an absolute dating be provided for Tell Aswad, determined using the thermoluminescence technique? In this study, a typological analysis based on form and construction techniques, combined with thermoluminescence testing, was conducted. The pottery findings from Tell Aswad were analyzed based on their form and construction techniques. The results revealed that the pottery from this site exhibits a limited variety in terms of form and decorative techniques. However, in terms of construction techniques, it appears that the potters of Tell Aswad possessed a high level of expertise in pottery-making. Based on the thermoluminescence dating results, it can be concluded that while settlement in Tell Aswad began during the Pre-Pottery Neolithic (PPN) period, the pottery findings represent occupation periods ranging from the Neolithic up to the historical period.

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## 1. Introduction

Tell Aswad is located 3 km southeast of Damascus (DeContensen, 1972: 187). The site was first discovered in 1967 by Henri DeContensen and subsequently excavated from 1971 to 1972. From 2001 to 2010, Bassam Jamous and Daniel Stordeur conducted further excavations at Tell Aswad (Stordeur, 2003a: 3). A total of 73 pottery sherds were identified during these excavations. Based on the excavation results and the pottery findings, DeContensen proposed that the site dates back to the Neolithic period. However, despite the excavations carried out by Stordeur and Bassam Jamous, the lack of typological analysis of the pottery and necessary laboratory studies has led to the site being classified as Neolithic based solely on the conclusions of DeContenson and Stordeur (DeContenson, 1972; 1985; 1992; Stordeur, 2003b: 3). This conclusion was made without a detailed examination of the pottery or any testing.

In the typology and workshop evaluations conducted by the authors, it was determined that some of the pottery sherds were wheel-made, indicating that they belong to both prehistoric and historical periods. To establish a precise dating for Tell Aswad, 73 pottery samples, representing all identified sherds, were selected for typological study, and 12 pottery samples were chosen for thermoluminescence (TL) dating. The TL/OSL dating tests were carried out using the RISO TL/OSL DA-203 device at the Atomic Energy Commission Laboratory in Syria.

This research focuses on the pottery findings from Tell Aswad and addresses the following questions: How can the pottery from Tell Aswad be explained in terms of typology and structural analysis? How can absolute dating be determined using thermoluminescence dating tests on the pottery from Tell Aswad? The study aims to conduct a typological analysis of the pottery alongside laboratory tests. The objectives are twofold: first, to identify the manufacturing techniques used in producing the pottery, and second, to determine the time period during which the pottery was made.

## 2. Research background

In 1967, Henry DeContenson began archaeological investigations at Tell Aswad. His excavations revealed that the settlement underwent three distinct phases: PPNA (Pre-Pottery Neolithic A), Old PPNB (Pre-Pottery Neolithic B), and Middle PPNB. The results of his excavations were published in 1972 and 1973 (DeContenson, 1972; 1973).

In 1979, Van Zeist conducted research on ancient plant and legume remains at Tell Aswad, concluding that the subsistence economy of the Neolithic inhabitants was based on the cultivation of cereals, including barley, wheat, chickpeas, and lentils. His findings were published in 1979 (Van Zeist & Bakker-Heeres, 1979). In 1995, DeContenson published the results of his studies on the archaeological artifacts found at Tell Aswad, including stone tools, architecture, and plant remains, and compared them with those from Tell Al-Ghoraifa (DeContenson, 1995). From 2001 to 2010, Danielle Stordeur and Bassam Jamous conducted excavations at Tell Aswad. Based on their findings and the examination of artifacts such as arrowheads and ornaments, they concluded that Tell Aswad dates to the Old, Middle, and Late PPNB Neolithic periods (Stordeur, 2001: 3).

Stordeur published the results of these excavations in the *AAAS journal* in 2002, 2003, 2005, 2006, 2007, and 2010 (Stordeur, 2002; 2003; 2005; 2006; 2007; 2010). Other archaeological studies have also been conducted at the site. For example, in 2006, Stordeur and Jamous examined flint stone tools discovered at Tell Aswad, including blades, Jebili point arrowheads, Jericho point arrowheads, hilt blades, serrated blades, small blades, and sickles (Stordeur & Khawam, 2006a: 21–22; Stordeur & Khawam, 2007). In 2007, Helmer and Gourichon analyzed the animal bones discovered at Tell Aswad. They determined that the Neolithic-period fauna at Tell Aswad comprised 26 species of birds and aquatic animals, such as ducks, as well as 20 species of mammals, including goats and sheep (Helmer & Gourichon, 2007; 2008). In 2017, Helmer and Gourichon further concluded that goat, sheep, and cattle farming were integral to the economy of the site's inhabitants (Helmer & Gourichon, 2017). Also in 2007, Delerue examined obsidian tools unearthed at Tell Aswad and determined that the obsidian originated from Nimrud Dagh, Bingol, and Golg Dagh (Delerue, 2007). In 2008, Stordeur and Jamous studied the architectural remains of Tell Aswad and concluded that the structures at the site featured a circular, semi-subterranean design and were constructed using thatch and reeds (Stordeur & Jamous, 2008-2009: 9-10). Hala Al-Rashi analyzed the ornaments, figurines, and clay objects found at Tell Aswad, publishing her findings in 2010 (Al-Rashi, 2010). In 2013, Orange et al. conducted EDXRF and SEM-EDS laboratory analyses on obsidian tools from Tell Aswad to determine their origin. They concluded that SEM-EDS testing could differentiate between obsidian from Nimrud-Dagh and that from Bingol (Orange et al., 2013). Rima Khawam studied the plastered skulls from Tell Aswad, publishing her conclusions in 2014 and 2015 (Khawam, 2014; 2015). In 2016, Baker, Khawam, and colleagues investigated the relationship between cause of death and burial practices in the Neolithic period at Tell Aswad, based on paleopathological lesions identified on human skeletons. They concluded that individuals who died from disease were buried around the site, and the burial process occurred in multiple stages. Special attention was given to the interior of the burial sites and the limited but valuable grave goods that symbolized the deceased (Baker *et al.,* 2016).

In 2018, Douche and Willcox compared Neolithic plant and grain remains from Tell Aswad in southern Syria with those from Jaadat al-Maghara in northern Syria (Douche & Willcox, 2018). In 2021, Baker, Chamel, and Dutour examined skeletons from Tell Aswad for lesions associated with tuberculosis (TB). They identified TB lesions in a child skeleton from the PPNB period, specifically Serpens Endocrania Symmetric (SES) lesions, attributed to chronic tuberculous meningitis. Baker et al. concluded that tuberculosis was present in the Levant during the Neolithic period, coinciding with the advent of agriculture and animal domestication (Baker *et al.,* 2021).

## 3. Tell Aswad

The Tell Aswad site is located in the Damascus Basin plain, between Lake Al-Otaiba and Lake Al-Hayjaneh (DeContenson, 1972: 187). It sits at an elevation of 606 meters above sea level and covers an area of 5 hectares (250 x 250 m²), (DeContenson, 1989: 32). The site comprises 18 layers, listed from oldest to most recent (Table 1).

**Table 1: Cultural layers of Tell Aswad (Stordeur&Jamous. 2008-2009: 8-9)**

| Period | Layers |
|---|---|
| Old PPNB period | layers B12 to B9 |
| Transition period from Old PPNB to Mid PPNB | layers B8 |
| Middle PPNB period. | Layers B7 to B1 |
| Late PPNB period | Layers B0 to B-5 |

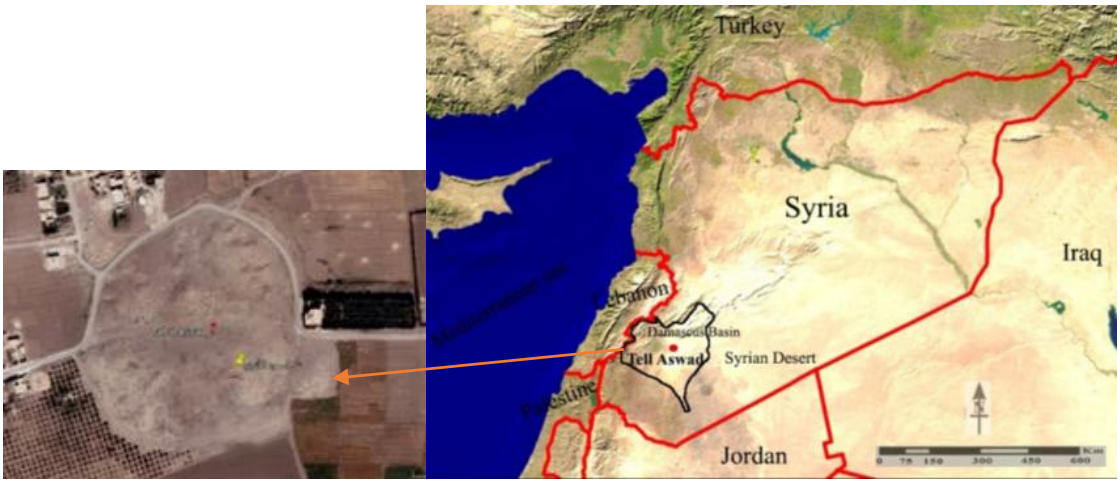



**Fig. 1: Geographical Location of Tell Aswad (Authors, 2024).**

## 3-1. Characteristics of Tell Aswad

With the onset of settlement during the Old PPNB period, the architecture at Tell Aswad featured circular, semi-subterranean structures made of clay and reeds (Stordeur & Jamous, 2008-2009: 9-10). During the transition from the Old PPNB to the Middle PPNB, adobe began to be used for building houses. The Middle PPNB houses were oval and varied in size, while the New PPNB structures were rectangular and constructed with regularly shaped adobe bricks (Stordeur, 2008: 9-10). A total of 2,708 flint tools were recovered from Tell Aswad, including Jebili point arrowheads, Jericho point arrowheads, blades, and sickles (Stordeur & Khawam, 2006b: 21-22). Additionally, obsidian tools, believed to have been sourced from Nimrud-Dagh, Bingol, and Golg-Dagh, were also found (Delerue, 2007: 151). A total of 305 figurines were recovered from Tell Aswad, including both human and animal figurines. The animal figurines represented cows, sheep, pigs, and gazelles (Ayobi, 2014: 27). Additionally, 239 ornaments made of stone, bone, raw clay, and shells, including beads, necklaces, and bracelets, were identified at Tell Aswad (Al-Rashi, 2010). The subsistence economy of the Tell Aswad settlement in its early stages involved the cultivation of cereals such as wheat, lentils, chickpeas, and barley. Walnut, pistachio, and almond trees were also grown using rainfed agriculture (Van Zeist & Bakker-Heeres, 1982). In addition to cereal cultivation and fruit collection, the inhabitants relied on hunting deer and wild boar, as well as fishing. During the second phase of the settlement, cereals and legumes like lentils, chickpeas, peas, flax, and vegetables were cultivated (Van Zeist & Bakker-Heeres, 1982:

168–191). Excavations of Tell Aswad's garbage pits revealed significant quantities of animal bones, including those of 26 bird species, aquatic animals such as ducks, and 20 mammal species, including goats and sheep (Helmer & Gourichon, 2007: 121).

### 3-2. Instrumental Analysis

A total of 73 pottery sherds have been unearthed in Tell Aswad. No comprehensive studies or laboratory analyses have been conducted on these sherds before. The excavators of Tell Aswad, DeContensen, and Stodeur have attributed this site to the Neolithic period.

Fourier-transform infrared spectroscopy (FTIR) to examine the slip of pottery sherds. FTIR spectroscopy was carried out using a Nicolet 6700 FTIR spectrometer with KBr pellets. All Spectra were collected in the range of 4000-400 cm-1 at 4 cm-1 resolution with 64 numbers scans.

pottery sherds were examined by Scanning Electron Microscope (SEM) To study morphological structure. Segments of 5 mm length were carefully selected from samples and before the examination, the samples were coated with a thin layer of gold. SEM examination was conducted using a TESCAN VEGA II apparatus.

Thermal Gravimetric Analysis (TGA) was carried out for the samples in Mettler instrument (TG50) thermalanalyzer. The tests were carried out in a nitrogen atmosphere, purged (30 ml/min) using sample weights of 10-15 mg at a heating rate of 10° C/min. The resolution of the balance is given, as 1 microgram for weights less than 100 milligrams, and the temperature precision of the instrument is ± 2°.

X-ray fluorescence (XRF) used to investigate the composition of pottery. The samples were irradiated by a 109Cd radioisotope source (~9 108 Bq) for 1000 s (tripled samples), and the measurements of the X-ray fluorescence outgoing from the samples were carried out with an X-ray spectrometer mounting a Si(Li) detector with an energy resolution (Full-Width-half-maximum) of about 180 eV at 5.9 keV for the Mn-Kα X-Ray.

The TL measurements were performed using an automated RISØ TL/OSL reader model DA-20, equipped with calibrated beta (90Sr/90Y) and alpha (241Am) sources with a dose rate of 0.135 Gy/s and 0.045 Gy/s respectively, a photomultiplier tube (PMT), model 9235/0158/1498AMP, made in USA. The samples were placed on a controlled heated tray, and were heated to 500°C in N2 with temperature rising at rate of 5°C/s.

## 4. Typology of Tell Aswad Pottery

### 4-1. Typology of Tell Aswad Pottery Based on the Type of Pottery Sherds

A total of 73 pottery sherds were recovered from Tell Aswad (Table 2), including 44 body sherds, 11 handle sherds, and 18 rim sherds. Since no complete vessels or sherds related to the base of the vessels were found, the pottery sherds were divided into three categories: rims, bodies, and handles (Chart 1). Body sherds do not provide sufficient information about the shape of the vessels, so the typology focuses on analyzing the forms of rims and handles.

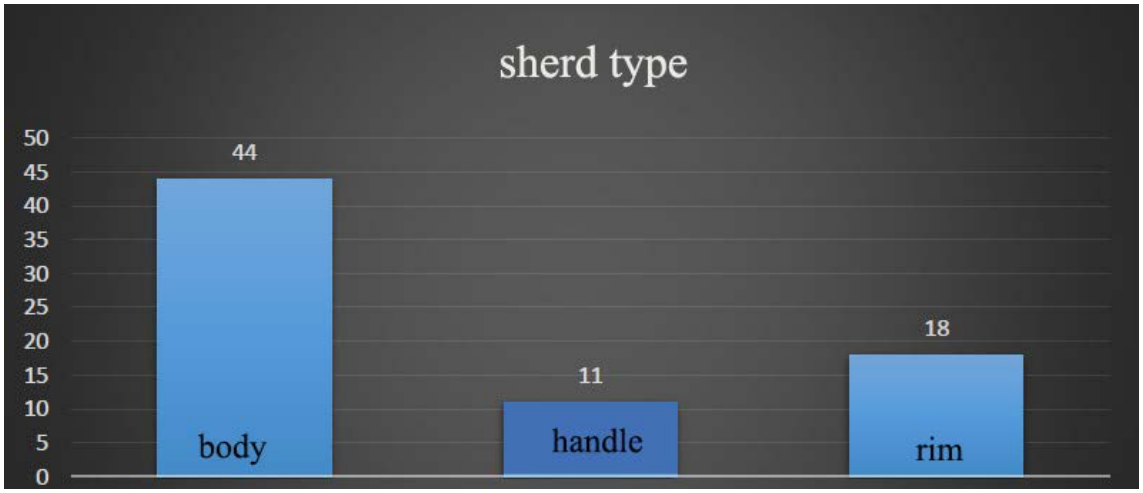



**Chart 1: Classification of pottery sherds discovered from Tell Aswad (Authors, 2024).**

**Table 2: Catalog of pottery sherds discovered from Tell Aswad (Authors, 2024).**

| No | Context | Sherd type | Pottery type | Forming | Firing Level | Temper | Length | Width | Thickness | External Slip Color | Internal Slip Color | Core Color |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 435 | Handle | Coarse Ware | Handmade | High Fired | Organic and Mineral | 7.5cm | 3.2cm | 2.cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 7.5YR 5.3/2.5 |
| 2 | 435 | Handle | Coarse Ware | Handmade | Medium fired | Organic and Mineral | 4.2cm | 3.1cm | 1.5cm | 0.3YR 7.3/6.3 | 0.3YR 7.3/6.3 | 3.3YR 5.9/9.2 |
| 3 | 293 | Rim | Medium Ware | Wheelmade | High Fired | Organic and Mineral | 6cm | 5cm | 1cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 7.1YR 7.0/3.3 |
| 4 | 454 | Rim | Medium Ware | Wheelmade | High Fired | Organic and Mineral | 3.5cm | 3cm | 1.3cm | 0.7YR 6.9/4.6 | 0.7YR 6.9/4.6 | 6.6YR 8.0/5.1 |
| 5 | 292 | Body | Medium Ware | Nested pottery | Medium Fired | Organic and Mineral | 4.5cm | 3.8cm | 1cm | 5.8YR 7.3/4.0 | 6.9YR 7.6/2.2 | 6.9YR 7.6/2.2 |
| 6 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 10.5cm | 6.5cm | 2cm | 5.8YR 7.3/4.0 | 5.8YR 7.3/4.0 | 6.6YR 8.0/5.1 |
| 7 | 472 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 10.3cm | 7.2cm | 3cm | 4.2YR 7.1/4.8 | 0.3YR 7.3/6.3 | 0.7YR 6.9/4.6 |
| 8 | 453 | Body | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 5cm | 3.2cm | 1.3cm | 7.3YR 7.1/5.9 | 7.3YR 7.1/5.9 | 7.3YR 7.1/5.9 |
| 9 | 292 | Handle | Medium Ware | Handmade | High Fired | Organic and Mineral | 12cm | 4cm | 1cm | 5.6YR 8.5/4.0 | 5.6YR 8.5/4.0 | 5.6YR 8.5/4.0 |
| 10 | 446 | Rim | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 5.5cm | 5cm | 2cm | 0.3YR 7.3/6.3 | 2.1YR 6.1/8.2 | 0.3YR 7.3/6.3 |
| 11 | 292 | Rim | Medium Ware | Wheelmade | High Fired | Mineral | 5.5cm | 3.7cm | 0.7cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 5.5YR 7.5/6.7 |
| 12 | Surface | Rim | Medium Ware | Handmade | High Fired | Mineral | 4.5cm | 3.2cm | 1cm | 9.0YR 7.9/5.9 | 9.0YR 7.9/5.9 | 9.0YR 7.9/5.9 |
| 13 | 292 | Rim | Medium Ware | Wheelmade | High Fired | Mineral | 3.5cm | 3cm | 0.8cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 |
| 14 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 11cm | 9cm | 3cm | 5.8YR 7.3/4.0 | 4.2YR 7.1/4.8 | 5.8YR 7.3/4.0 |
| 15 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 11cm | 8cm | 2cm | 6.6YR 8.0/5.1 | 0.7YR 6.9/4.6 | 7.1YR 7.0/3.3 |
| 16 | 292 | Rim | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 9cm | 6.3cm | 4cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 7.5YR 5.3/2.5 |
| 17 | 292 | Body | Coarse Ware | Handmade | Medium Fired | Organic and Mineral | 7cm | 6.3cm | 1.5cm | 3.3YR 5.9/9.2 | 3.3YR 5.9/9.2 | 3.3YR 5.9/9.2 |
| 18 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 6.5cm | 5.4cm | 1cm | 3.3YR 5.9/9.2 | 6.2YR 7.4/5.8 | 6.2YR 7.4/5.8 |
| 19 | 292 | Rim | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 8.2cm | 5.5cm | 1cm | 0.3YR 7.3/6.3 | 0.3YR 7.3/6.3 | 7.5YR 5.3/2.5 |
| 20 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 10cm | 9cm | 1cm | 5.8YR 7.3/4.0 | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 |
| 21 | 315 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 5cm | 4.5cm | 0.5cm | 4.2YR 7.1/4.8 | 5.1YR 8.1/3.4 | 5.6YR 8.5/4.0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 315 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 3.3cm | 2.9cm | 0.5cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 |
| 23 | 303 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 4.1cm | 3.5cm | 0.5cm | 6.0YR 6.3/3.0 | 2.2YR 6.0/1.8 | 2.2YR 6.0/1.8 |
| 24 | 303 | Body | Medium Ware | Handmade | Very High Fired | Organic and Mineral | 2.2cm | 1.3cm | 0.5cm | 6.0YR 6.3/3.0 | 2.2YR 6.0/1.8 | 2.2YR 6.0/1.8 |
| 25 | 303 | Body | Medium Ware | Handmade | High Fired | Mineral | 3cm | 2.8cm | 0.5cm | 3.2Y 9.3/1.2 | 3.2Y 9.3/1.2 | 0.1Y 8.8/3.0 |
| 26 | 315 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 9.3cm | 3.1ccc m | 1cm | 5.1YR 8.1/3.4 | 5.1YR 8.1/3.4 | 5.6YR 8.5/4.0 |
| 27 | 315 | Rim | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 3.2cm | 2.6cm | 0.5cm | 5.6YR 8.5/4.0 | 5.6YR 8.5/4.0 | 2.2YR 6.0/1.8 |
| 28 | 292 | Body | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 11.2cm | 8.5cm | 2.8cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 7.5YR 5.3/2.5 |
| 29 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 6.6cm | 5.8cm | 1.6cm | 2.2YR 6.0/1.8 | 7.5YR 5.3/2.5 | 1.7YR 5.9/5.3 |
| 30 | 292 | Rim | Medium Ware | Handmade | High Fired | Organic and Mineral | 6.2cm | 2.8cm | 2cm | 7.5YR 5.3/2.5 | – | 1.7YR 5.9/5.3 |
| 31 | Surface | Handle | Medium Ware | Handmade | High Fired | Organic and Mineral | 9cm | 2.5cm | 3cm | 5.6YR 8.5/4.0 | 5.6YR 8.5/4.0 | 9.5YR 7.5/2.1 |
| 32 | Surface | Handle | Coarse Ware | Handmade | Medium Fired | Organic and Mineral | 5.5cm | 2.5cm | 2cm | 5.6YR 8.5/4.0 | 5.6YR 8.5/4.0 | 9.5YR 7.5/2.1 |
| 33 | Surface | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 7.2cm | 4cm | 0.7cm | 5.8YR 7.3/4.0 | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 |
| 34 | Surface | Handle | Medium Ware | Handmade | High Fired | Organic and Mineral | 6cm | 3cm | 1.6cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 9.5YR 7.5/2.1 |
| 35 | 269 | Body | Medium Ware | Wheelmade | High Fired | Organic and Mineral | 2.8cm | 2.3cm | 0.5cm | 5.1YR 8.1/3.4 | 4.2YR 7.1/4.8 | 6.9YR 7.6/2.2 |
| 36 | 309 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 5.5cm | 3cm | 1cm | 5.1YR 8.1/3.4 | 5.1YR 8.1/3.4 | 5.1YR 8.1/3.4 |
| 37 | 161 | Rim | fine ware | Handmade | High Fired | Organic and Mineral | 4cm | 2.8cm | 0.5cm | 5.8YR 7.3/4.0 | 5.8YR 7.3/4.0 | 5.8YR 7.3/4.0 |
| 38 | 306 | Body | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 3.5cm | 3cm | 1.2cm | 5.1YR 8.1/3.4 | 7.5YR 5.3/2.5 | 7.5YR 5.3/2.5 |
| 39 | Surface | Body | Medium Ware | Wheelmade | High Fired | Organic and Mineral | 8.3cm | 7.1cm | 1cm | 5.6YR 8.5/4.0 | 5.6YR 8.5/4.0 | 5.6YR 8.5/4.0 |
| 40 | Surface | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 4.9cm | 4.5cm | 0.5cm | 4.2YR 7.1/4.8 | 3.9YR 7.2/3.3 | 7.5YR 5.3/2.5 |
| 41 | Surface | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 5cm | 5.8cm | 0.5cm | 2.1YR 6.1/8.2 | 2.1YR 6.1/8.2 | 7.1YR 7.0/3.3 |
| 42 | Surface | Body | Coarse Ware | Handmade | High Fired | Organic and Mineral | 9.7cm | 6cm | 3cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 7.5YR 5.3/2.5 |
| 43 | 292 | Handle | Coarse Ware | Handmade | High Fired | Organic and Mineral | 10cm | 4cm | 2cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 7.5YR 5.3/2.5 |
| 44 | 292 | Handle | Medium Ware | Wheelmade | High Fired | Mineral | 8.2cm | 4.5cm | 1.5cm | 5.1YR 8.1/3.4 | 5.1YR 8.1/3.4 | 5.1YR 8.1/3.4 |
| 45 | 292 | Rim | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 22cm | 8cm | 5cm | 5.1YR 8.1/3.4 | 0.7YR 6.9/4.6 | 7.5YR 5.3/2.5 |
| 46 | 292 | Body | Medium Ware | Wheelmade | High Fired | Mineral | 11.5cm | 9.5cm | 1cm | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 |
| 47 | 292 | Body | fine ware | Handmade | High Fired | Mineral | 2cm | 1.5cm | 0.3cm | 5.8YR 7.3/4.0 | 1.7YR 5.9/5.3 | 5.6YR 8.5/4.0 |
| 48 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 8cm | 3cm | 1.7cm | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 | 7.5YR 5.3/2.5 |
| 49 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 11.5cm | 6cm | 1.5cm | 5.1YR 8.1/3.4 | 5.1YR 8.1/3.4 | 7.5YR 5.3/2.5 |
| 50 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 8.5cm | 6cm | 1cm | 0.7YR 6.9/4.6 | 0.7YR 6.9/4.6 | 7.5YR 5.3/2.5 |
| 51 | 446 | Body | Medium Ware | Nested pottery | Medium Fired | Mineral | 4.5cm | 3cm | 0.8cm | 4.2YR 6.6/6.5 | 1.7YR 5.9/5.3 | 1.7YR 5.9/5.3 |
| 52 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 22cm | 12cm | 1.5cm | 6.0YR 8.3/2.9 | 6.0YR 8.3/2.9 | 5.1YR 8.1/3.4 |
| 53 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 9.5cm | 8cm | 3cm | 3.3YR 5.9/9.2 | 3.3YR 5.9/9.2 | 7.5YR 5.3/2.5 |
| 54 | 292 | Body | Medium Ware | Handmade | High Fired | Mineral | 12cm | 8cm | 2cm | 5.6YR 8.5/4.0 | 4.2YR 7.1/4.8 | 7.1YR 7.0/3.3 |
| 55 | 435 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 10.5cm | 6.3cm | 1cm | 3.9YR 7.2/3.3 | 6.6YR 8.0/5.1 | 7.5YR 5.3/2.5 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 435 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 10cm | 8.5cm | 0.7cm | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 |
| 57 | 435 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 9cm | 7cm | 0.7cm | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 |
| 58 | 435 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 4cm | 3.2cm | 0.8cm | 6.0YR 8.3/2.9 | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 |
| 59 | 435 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 7cm | 4.1cm | 0.8cm | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 | 6.6YR 8.0/5.1 |
| 60 | 435 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 7cm | 6cm | 2cm | 5.6YR 8.5/4.0 | 0.7YR 6.9/4.6 | 7.5YR 5.3/2.5 |
| 61 | 147 | Rim | fine ware | Handmade | High Fired | Organic and Mineral | 3.6cm | 3.2cm | 0.4cm | 6.6YR 8.0/5.1 | 5.6YR 8.5/4.0 | 6.6YR 8.0/5.1 |
| 62 | 147 | Handle | Coarse Ware | Handmade | High Fired | Organic and Mineral | 4cm | 2cm | 3cm | 4.2YR 6.6/6.5 | 4.2YR 6.6/6.5 | 4.2YR 6.6/6.5 |
| 63 | 188 | Rim | Medium Ware | Wheelmade | High Fired | Organic and Mineral | 13cm | 5cm | 1cm | 4.2YR 6.6/6.5 | 4.2YR 6.6/6.5 | 7.5YR 5.3/2.5 |
| 64 | 188 | Handle | Medium Ware | Handmade | High Fired | Organic and Mineral | 6cm | 5cm | 2cm | 2.2YR 6.0/1.8 | 2.2YR 6.0/1.8 | 7.5YR 5.3/2.5 |
| 65 | 188 | Body | Medium Ware | Wheelmade | High Fired | Organic and Mineral | 8.5cm | 7.2cm | 0.7cm | 0.7YR 6.9/4.6 | 5.8YR 7.3/4.0 | 6.6YR 8.0/5.1 |
| 66 | 188 | Handle | Medium Ware | Handmade | High Fired | Mineral | 8.5cm | 1.5cm | 1.3cm | 6.2YR 7.4/5.8 | 6.2YR 7.4/5.8 | 6.2YR 7.4/5.8 |
| 67 | 63 | Rim | White ware | Handmade | High Fired | Mineral | 4.5cm | 3cm | 0.4cm | 8.3YR 8.9/2.8 | 8.3YR 8.9/2.8 | 8.3YR 8.9/2.8 |
| 68 | 451 | Rim | Medium Ware | Handmade | High Fired | Organic and Mineral | 8.5cm | 5.8cm | 0.8cm | 5.8YR 7.3/4.0 | 0.7YR 6.9/4.6 | 7.5YR 5.3/2.5 |
| 69 | 292 | Body | Medium Ware | Handmade | High Fired | Organic and Mineral | 3.5cm | 2.3cm | 0.5cm | 5.1YR 8.1/3.4 | 6.9YR 7.6/2.2 | 5.1YR 8.1/3.4 |
| 70 | 453 | Rim | Medium Ware | Wheelmade | High Fired | Organic and Mineral | 4.7cm | 3.4cm | 0.7cm | 5.8YR 7.3/4.0 | 4.2YR 6.6/6.5 | 7.1YR 7.0/3.3 |
| 71 | 453 | Body | Medium Ware | Handmade | low-fired | Mineral | 3.2cm | 2.4cm | 0.4cm | 0.7YR 6.9/4.6 | 0.7YR 6.9/4.6 | 0.7YR 6.9/4.6 |
| 72 | 453 | Rim | Medium Ware | Handmade | Medium Fired | Organic and Mineral | 3.3cm | 1.2cm | 0.9cm | 4.2YR 7.1/4.8 | 4.2YR 7.1/4.8 | 7.5YR 5.3/2.5 |
| 73 | 453 | Body | Medium Ware | Handmade | High Fired | Mineral | 2.5cm | 2cm | 0.4cm | 5.8YR 7.3/4.0 | 5.8YR 7.3/4.0 | 6.6YR 8.0/5.1 |

### 4-1-1. Group One: Rims

Rims are among the most distinctive parts of pottery vessels used in daily life. 18 rims were retrieved from Tell Aswad, categorized into three forms:

1. Flared rim: Four rims of this form were identified, with thicknesses ranging from 1 to 2 cm (Fig. 2a-b, Sketches 1a-b, Table 3).

2. Rounded rim: Eight rims of this form were found, with thicknesses between 1–2 cm (Fig. 3a-b, Sketches 2a-b, Table 3).

3. Simple rim: Six rims of this form were obtained, with thicknesses also between 1–2 cm (Fig. 4, Sketch 3, Table 3).

### 4-1-2. Group Two: Handles

11 handles were obtained from Tell Aswad, divided into two types based on form:

1. Simple handle: Three handles of this type were found (Fig. 5, Sketch 4, Table 4). These were made using the handmade wicking method and were attached to the neck of the vessel from the rim.

2. Thick and medium semi-circular handle: Eight handles of this type were found (Fig. 6, Sketch 5, Table 4). These were also made using the handmade wicking method and were attached to the body of the vessel from the neck.

**Table 3: Rim Forms of Tell Aswad (fig: 2a-2b-3a-3b-4), (Authors, 2024).**

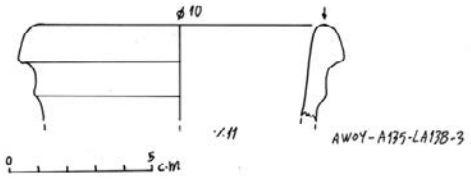
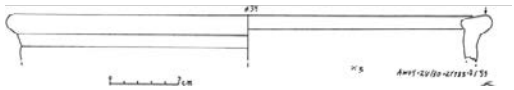
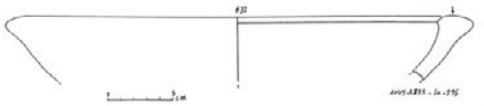
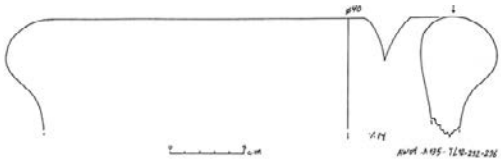
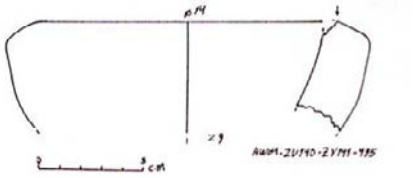
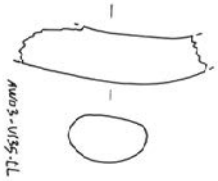
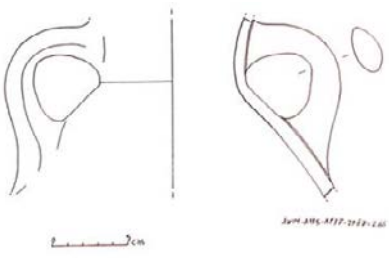
| Form | Fig/ Sketch Number | Figure | Sketch |
|---|---|---|---|
| Flared | Fig. 2a Sketch. 1a |  |  |
| | Fig. 2b Sketch. 1b |  |  |
| Rounded | Fig. 3a Sketch. 2a |  |  |
| | Fig. 3b Sketch. 2b |  |  |
| Simple | Fig. 4 Sketch. 3 |  |  |

**Table 4: Handle Forms of Tell Aswad (fig: 5-6), (Authors, 2024).**

| Form | Fig/Sketch Number | Figure | Sketch |
|---|---|---|---|
| Simple | Fig. 5 Sketch. 4 |  |  |
| Thick and Medium Semi-circular | Fig. 6 Sketch. 5 |  |  |

### 4-2. pottery vessels

Due to the absence of complete pottery vessels at Tell Aswad, the pottery forms were reconstructed based on the designs of pottery sherds related to the rim and handle. As a result, the pottery forms have been categorized into four groups:

1. Bowls
2. Jars
3. Pots
4. Large earthen jars

### 4-2-1. Bowls

Ten bowl rims were found at Tell Aswad. The characteristic shapes of Tell Aswad bowls include:

• Bowls with a flared rim and a hemispherical body

• Bowls with a rounded rim and a flat body

The bowl group is further divided into two subgroups: deep bowls and shallow bowls.

• Shallow bowls: Four rims were identified. These are defined as bowls with a rounded rim and a hemispherical body. They can also be described as bowls with a flared rim and a hemispherical body (see: Sketch 6a-b and Table 5).

• Deep bowls: Six rims were identified. These include a variety of shapes, such as bowls with rounded rims and hemispherical bodies, bowls with flared rims and hemispherical bodies, and bowls with flared rims and flat bodies (see: Sketch 7 and Table 5).

### 4-2-2. Jars

Two groups of pottery jars were found at Tell Aswad, divided based on their form:

1. Necked jars: Characterized by a rounded flared rim (see: Sketch 8a and Table 5).

2. Neckless jars: Defined by the absence of a neck, with the rim attached directly to the body. A characteristic shape is the jar with a flared rim (see: Sketch 8b and Table 5).

### 4-2-3. Pots

Five handles and rims related to pots were found at Tell Aswad, divided into two subgroups:

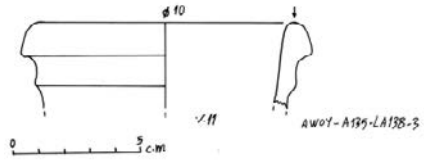
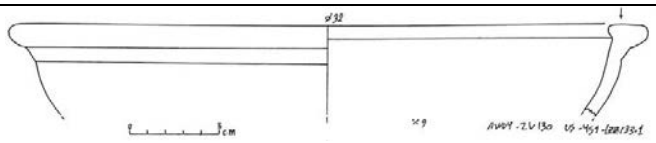
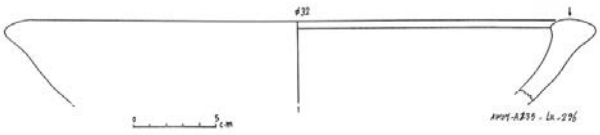
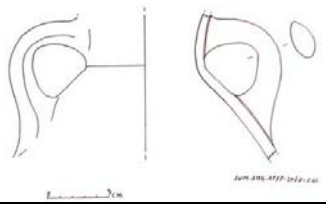
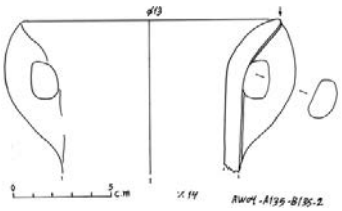
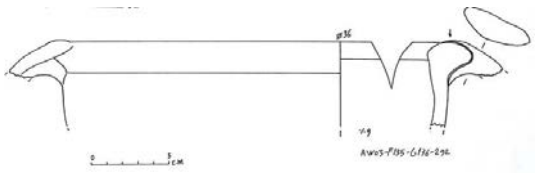
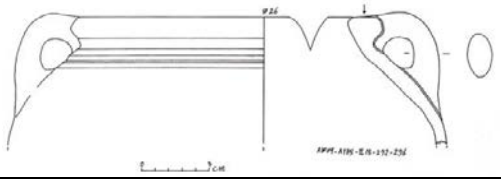
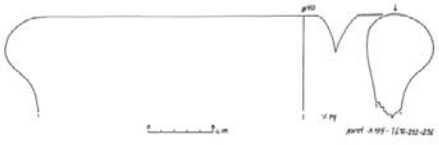
1. Open-mouth pots: Characterized by a flared rim and a spherical or hemispherical body (see: Sketch 9a and Table 5).

2. Closed-mouth pots: Characterized by rounded rims and spherical bodies (see: Sketch 9b and Table 5).

### 4-2-4. Large Earthen Jars

Two large earthen jars with rounded thick rims were unearthed at Tell Aswad. Their characteristic forms include a rounded flared rim, a neck, and a spherical body (see: Sketch 10 and Table 5).

**Table 5: Pottery vessel forms from Tell Aswad (Authors, 2024).**

| Form | Sketch Number | Type | Sketch |
|---|---|---|---|
| **Bowls** | Sketch. 7 | Deep Bowls |  |
| | Sketch. 6a | Shallow Bowls |  |
| | Sketch. 6b | |  |
| **Jars** | Sketch. 8a | Necked Jar |  |
| | Sketch. 8b | Neckless Jar |  |
| **Pots** | Sketch. 9a | Open-mouth Pot |  |
| | Sketch. 9b | Closed-mouth Pot |  |
| **Large Earthen Jar** | Sketch. 10 | |  |

## 5. Typology based on manufacturing technique

### 5-1. Pottery Type

The pottery sherds from Tell Aswad are classified into three groups:

1. Coarse ware: 7 sherds (10% of the total).
2. Medium ware: 62 sherds (85% of the total).
3. Fine ware: 3 sherds (4% of the total).

Additionally, one sherd of white ware was recovered, accounting for 1% of the total pottery (see: Chart 2).

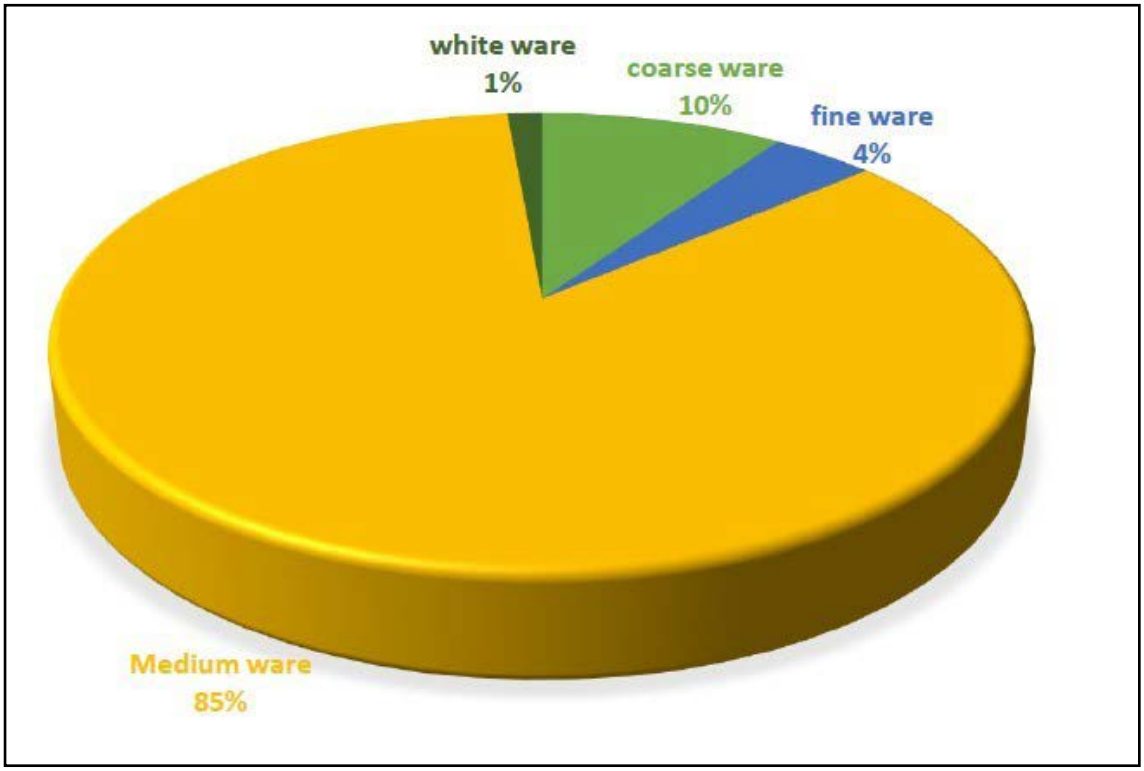



**Chart 2: Types of pottery discovered at Tell Aswad (Authors, 2024).**

## 5-2. Pottery fabrication technique

The pottery sherds from Tell Aswad were made using both handmade and wheel-made techniques:

**• Handmade techniques:**

- The "shaping in the thumb method" was used for deep and shallow bowls.
- The "shaping in the wick or tube method" was used for large earthen jars, jars, and vessel handles.
- Two sherds were made using the nested method, consisting of two layers of paste with distinct textures in terms of temper and paste.
- Two sherds were made using the finger method.
- In total, 62 pieces of handmade pottery were identified.

**• Wheel-made techniques:**

- Both fast and slow pottery wheels were used to manufacture shallow bowls (see: Fig. 7).


**Fig. 7: Shallow bowls discovered at Tell Aswad were made using a potter's wheel (Authors, 2024).**

## 5-3. Color of Pottery Core

The pottery cores from Tell Aswad are categorized based on Munsell's table (see: Table 6):

- Red core: 2 sherds
- Black core: 19 sherds
- Pea core: 17 sherds
- Brown core: 11 sherds
- Orange core: 24 sherds

**Table 6: The color of the potsherds of Tell Aswad (Authors, 2024).**

| Pottery Core Color | Quantity | Color code |
|---|---|---|
| Red | 2 | 1.7YR 5.9/5.3 |
| Black | 19 | 7.5YR 5.3/2.5 |
| Pea | 17 | 9.0YR 7.9/5.9 ، 5.8YR 7.3/4.0 ،6.2YR 7.4/5.8 , 5.6YR 8.5/4.0 , 0.1Y 8.8/3.0, 9.5YR 7.5/2.1 ،5.1YR 8.1/3.4 |
| Brown | 11 | 7.1YR 7.0/3.3 , 2.2YR 6.0/1.8 |
| Orange | 24 | 5.5YR 7.5/6.7 ،6.6YR 8.0/5.1 ،3.3YR 5.9/9.2 ،0.7YR 6.9/4.6 , 0.3YR 7.3/6.3 , 4.2YR 7.1/4.8 |

## 5-4. Pottery Temper

Pottery temper can be divided into two major categories: organic (such as straw and chaff) and mineral (such as sand, etc.). Identifying the type of temper is undeniably linked to the strength of the pottery after firing and is particularly significant in pottery studies. The pottery excavated at Tell Aswad contains two types of temper: organic (including straw and chaff) and mineral (including stone powder, sand, and lime powder). Notably, 82% of the pottery sherds from Tell Aswad contain both types of temper, while 18% contain only the mineral temper (see: Chart 3). Workshop studies indicate that no pottery sherds with only organic temper have been found

at this site. To analyze the Tell Aswad pottery in greater detail, four samples (1, 4, 7, 11) were selected from different layers and examined using a Tescan Vega II XMU microscope at the Syrian Atomic Energy Commission laboratory (see: Fig. 8 and Table 7). The SEM (Scanning Electron Microscope) results of the Tell Aswad pottery samples at a 50 µm scale reveal that these samples contain mineral temper. Mineral crystals, such as sand and silica, are observed, and salt crystals are present in pottery sample 11. Additionally, it is worth noting that pottery samples 1, 4, and 11 contain organic temper (straw), which burned during firing, leaving cavities in its place.

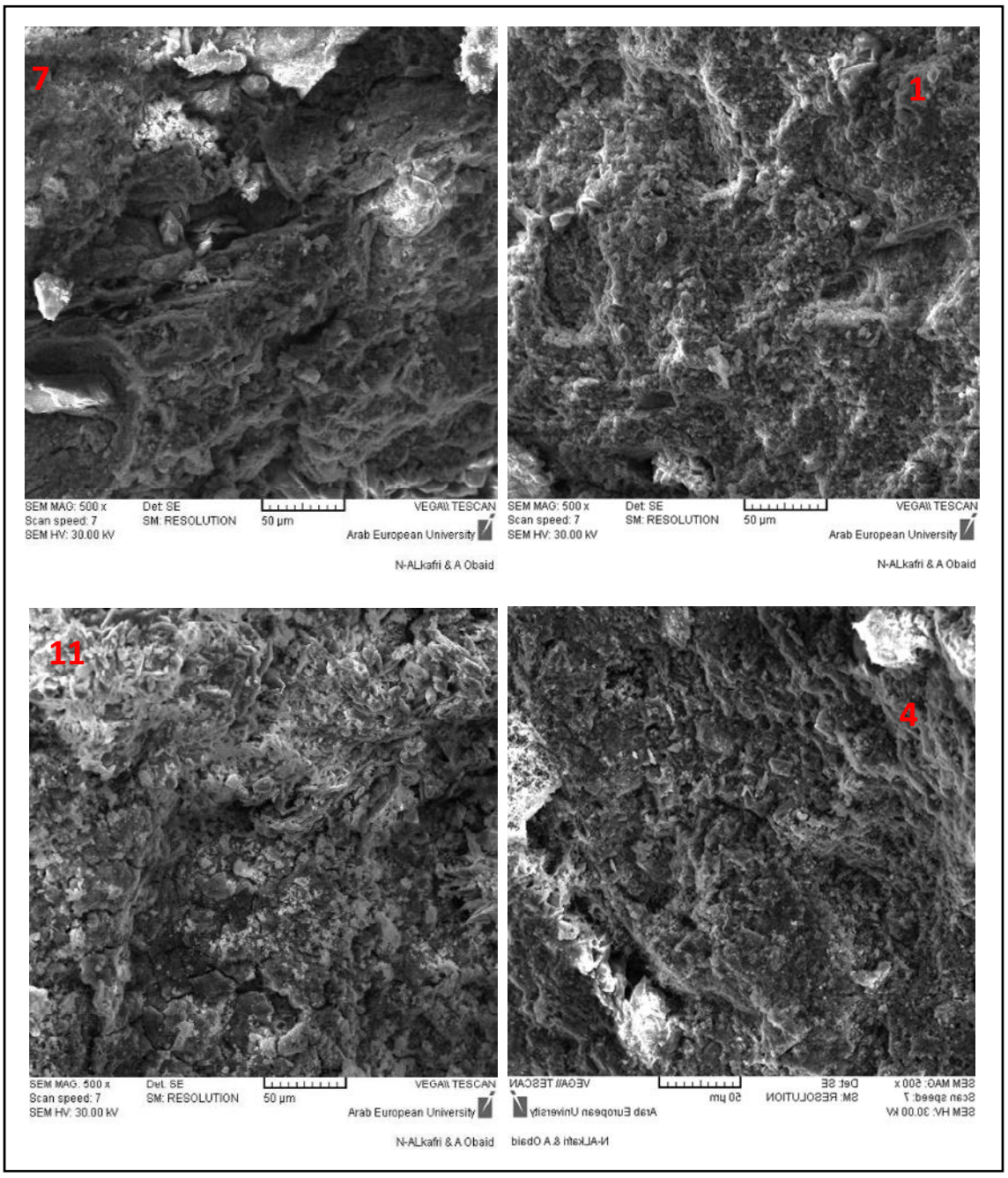



**Fig. 8: SEM results of samples 4, 15, 19, and 23 from Tal Aswad at 50 µm (Authors, 2024).**

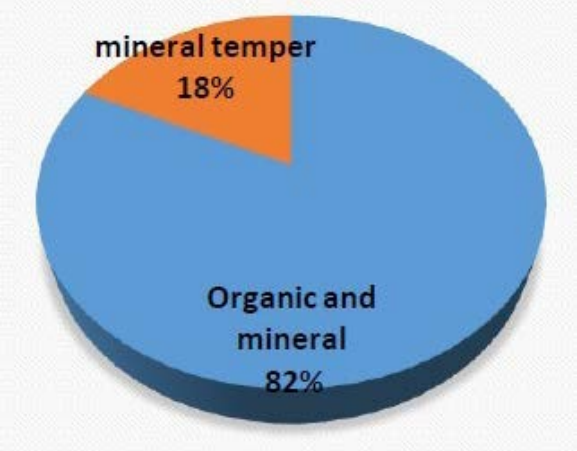



**Chart 3: Temper of pottery sherds discovered from Tell Aswad (Authors, 2024).**

## 5-5. Pottery Firing Rate

Pottery is fired at one of five rates: very low fired (up to 400°C), low fired (400–700°C), medium fired (700°C and above), high fired (900°C and above), and very high fired (1,100–1,200°C). The workshop study of Tell Aswad pottery, conducted by the authors, yielded the following conclusions: 78% of the pottery sherds from this site are high fired, 19% are medium fired, 1% are low fired, and 2% are very high fired (see: Chart 4). Furthermore, the SEM results indicate the presence of fused silica in the pottery samples. The presence of fused silica suggests that the pottery sherds were subjected to high temperatures, resulting in complete firing and high strength.

To accurately determine the firing temperature of Tell Aswad pottery, TGA (Thermogravimetric Analysis) tests were performed on samples 1, 4, 7, and 11 at the Syrian Atomic Energy Laboratory (see: Table 7). The results show that the firing temperature of Tell Aswad pottery ranged from 1,000 to 1,100°C (see: Charts 5, 6, 7, and 8). This indicates that the pottery underwent sufficient and complete firing. It should be noted that during the TGA tests, the temperature was increased to 4,000°C until the clay in the pottery sherds was completely decomposed, as seen in Charts 5, 6, 7, and 8. However, the maximum firing temperature of the pottery itself was 1,000–1,100°C.


**Chart 4: Firing rate of pottery sherds discovered from Tell Aswad (Authors, 2024).**

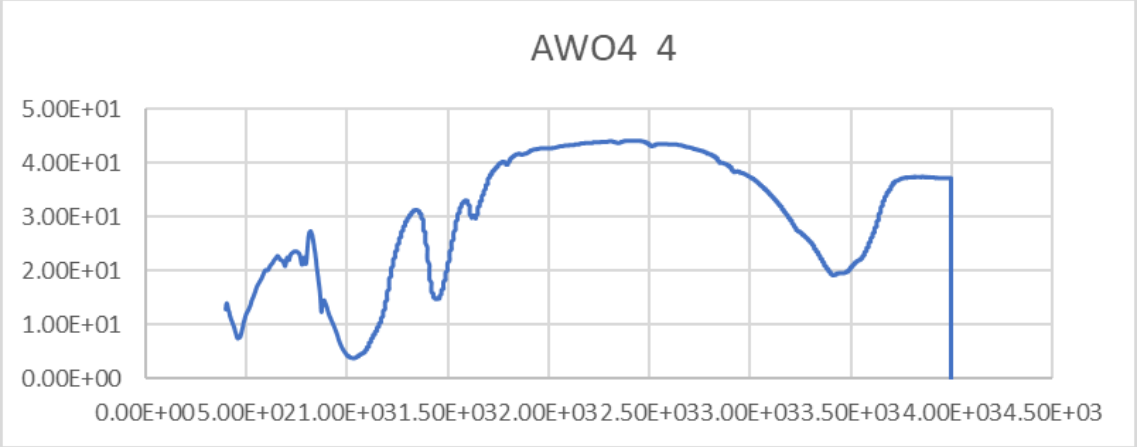



**Chart 5: TGA test result for pottery sample 1 from Tell Aswad (Authors, 2024).**

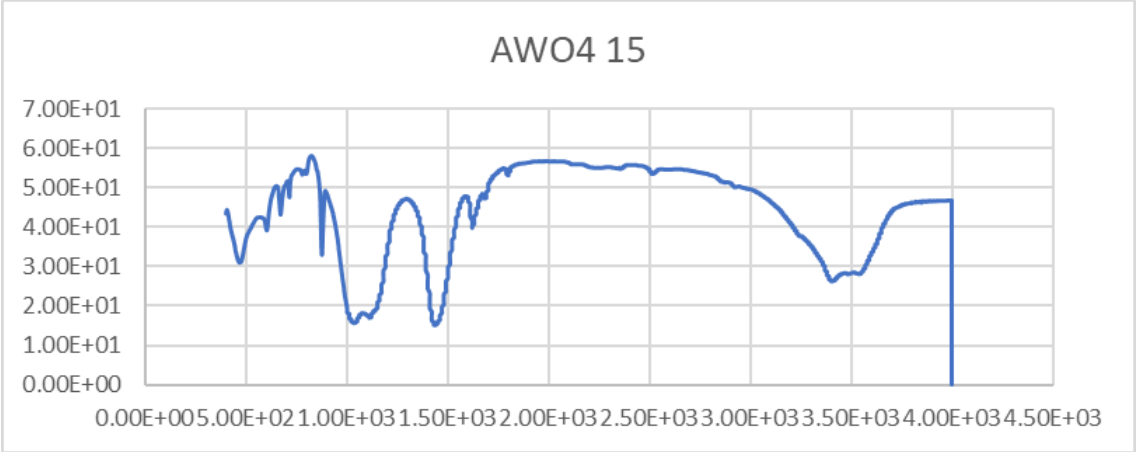



**Chart 6: TGA test result for pottery sample 7 from Tell Aswad (Authors, 2024).**


**Chart 7: TGA test result for pottery sample 4 from Tell Aswad (Authors, 2024).**

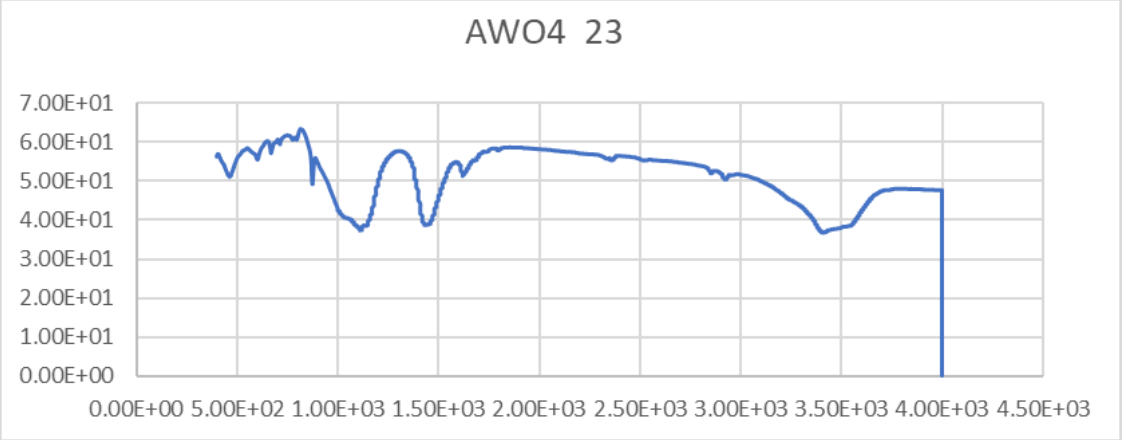



**Chart 8: TGA test result for pottery sample 11 from Tell Aswad (Authors, 2024).**

## 5-6. Pottery polishing

Pottery can be polished using various methods to create a uniform surface. In Tell Aswad pottery, wet hand polishing and coating methods are applied to different types of pottery (see: Fig. 9).


**Fig. 9: Pottery sherds unearthed at Tell Aswad reveal wet-hand polishing methods (Authors, 2024).**

## 6. Typology based on Pottery Decoration

90% of the pottery sherds unearthed at Tell Aswad feature slip decoration, while 18% display carved, embossed, or colored decoration.

## 6-1. Slip decoration

In this method, after the vessel dries, it is dipped into a mixture of clay and water. Colored slurry is used to alter the color of the vessel body. This type of decoration is observed in 90% of the pottery sherds from Tell Aswad (see: Figs. 10a and 10b).


**Fig. 10a-b: Slip decoration on pottery sherds from Tell Aswad (Authors, 2024).**

The study aimed to investigate the composition of the slip (colored coating) on pottery sherds discovered at Tell Aswad. Four samples (1, 4, 7, and 11; see Table 7) were selected from different layers of the site for analysis. Fourier Transform Infrared (FTIR) spectroscopy experiments were conducted at the Syrian Atomic Energy Commission laboratory using a Thermo Scientific Nicolet 6700 FT-IR Spectrometer.

**The FTIR analysis revealed several key findings:**

**1. Absence of Kaolinite:** The characteristic absorption bands of kaolinite (typically observed at 3698 $cm^{-1}$, 3660 $cm^{-1}$, 3620 $cm^{-1}$, and 3670 $cm^{-1}$) were not detected in any of the Tell Aswad pottery samples. This indicates that kaolinite was not present in the slip of these pottery pieces.

**2. Presence of Illite/Muscovite:** Absorption bands at 463 $cm^{-1}$, which are indicative of illite/muscovite, were observed in the Tell Aswad samples. This suggests the presence of illite and muscovite structures in the pottery.

**3. Albite:** An absorption band at 1600 $cm^{-1}$, associated with albite, was detected in the Tell Aswad samples but was notably absent in Sample 1.

**4. Calcite:** Absorption bands at 1874 $cm^{-1}$, 1713 $cm^{-1}$, and 1436 $cm^{-1}$, consistent with calcite, were identified in the Tell Aswad pottery samples.

**5. Quartz:** An absorption band at 1778 $cm^{-1}$, accompanied by a doublet band at 1801 $cm^{-1}$, indicative of quartz, was observed in these samples.

**6. Feldspar/Orthoclase:** Absorption bands in the range of 900–1200 $cm^{-1}$ correspond to feldspar/orthoclase mineral structures. Specifically, bands at 1113 $cm^{-1}$ and 1143 $cm^{-1}$ in the clay samples are diagnostic of plagioclase feldspar. The band at 1070 $cm^{-1}$, associated with Si-O stretching vibrations, further supports the presence of silicate minerals. The bands at 1113 $cm^{-1}$ and 1143 $cm^{-1}$ also exhibit a comb-like spectral pattern characteristic of silicon bonding environments.

**7. Organic Material:** An absorption band at 1621 $cm^{-1}$, characteristic of carbonyl (C=O) stretching vibrations, suggests the presence of organic material in the Tell Aswad pottery samples. However, this feature is absent in Sample 1. Additionally, two distinct bands at 1292 $cm^{-1}$ and 1285 $cm^{-1}$, attributable to C-H bending vibrations, further indicate organic components. These organic signatures are also absent in Sample 1.

In summary, the FTIR analysis of the Tell Aswad pottery samples revealed the presence of illite/muscovite, albite, calcite, quartz, feldspar/orthoclase, and organic materials, while confirming the absence of kaolinite. These findings provide insights into the mineralogical and organic composition of the pottery slip at Tell Aswad.

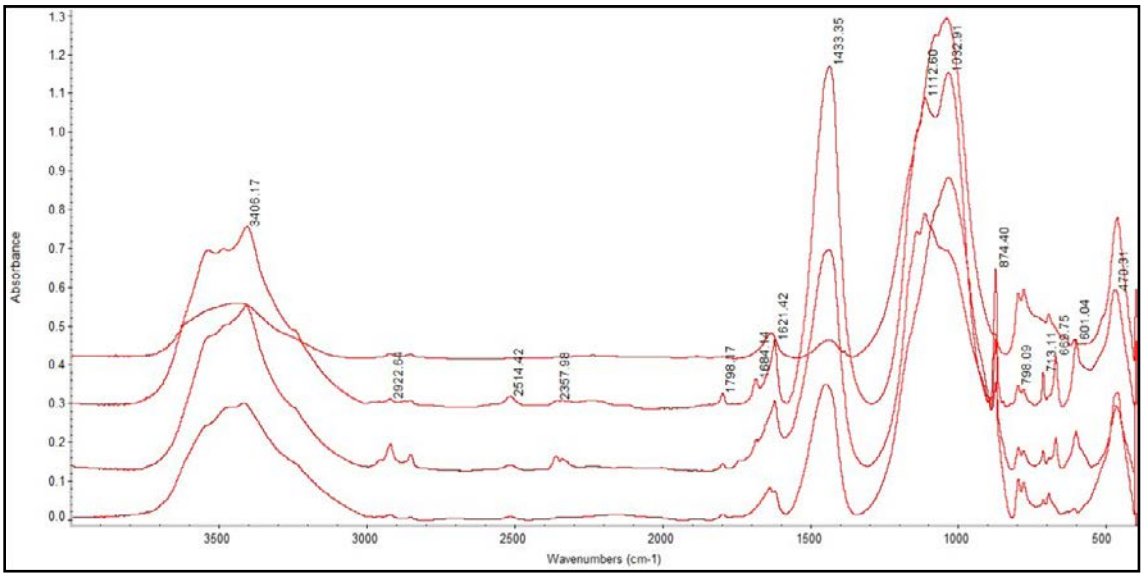



**Chart 9: FTIR test results for pottery samples 4, 7, 11, 1 discovered from Tell Aswad (Authors, 2024).**

Using the Munsell Soil Color Chart, the Tell Aswad pottery sherds were classified into four distinct slip color categories: orange ware, pea ware, brown ware, and two-colored ware.

**Orange Ware:** The orange ware pottery from Tell Aswad (with Munsell color codes 5.5YR 7.5/6.7, 4.2YR 7.1/4.8, 6.6YR 8.0/5.1, 3.3YR 5.9/9.2, 0.7YR 6.9/4.6, and 0.3YR 7.3/6.3) represents the most abundant pottery type at the site. It can be categorized into three distinct groups:

**1. Medium Orange Ware:** This group consists of handmade pottery with thin orange slips applied to both surfaces. It contains organic temper and medium to coarse mineral particles, exhibits well to high firing ranges, and has wall thicknesses of 1-2 cm.

**2. Coarse Orange Ware:** Also handmade, this type features interior and exterior slips, organic temper with coarser mineral particles, and medium firing (though some high-fired examples exist). The walls are thicker, measuring 1.5-3 cm.

**3. Medium Wheel-Made Orange Ware:** This group is characterized by thinner walls (0.7-1.5 cm), similar slip applications, and organic temper with medium-coarse mineral particles.

**Pea Ware:** The pea ware from Tell Aswad, with Munsell color codes 9.0YR 7.9/5.9 and 5.1YR 8.1/3.4, has been categorized into three groups:

**1. Medium Pea Ware:** This handmade pottery features pea-colored slips on both surfaces, contains organic temper with medium-to-coarse mineral particles, was fired at medium to high temperatures, and has wall thicknesses of 1-2 cm.

**2. Fine Pea Ware:** Also handmade, this type has thin slips that match the clay paste color. It is distinguished by fine mineral temper, high firing temperatures, and thin walls (0.4-0.5 cm).

**3. Medium Wheel-Made Pea Ware:** This group features pea-colored slips on both surfaces, contains organic temper with medium mineral particles, was high-fired, and has intermediate wall thicknesses of 1-1.5 cm.

**Brown Ware:** The brown ware from Tell Aswad displays Munsell color codes of 7.1YR 7.0/3.3 (light brown) and 2.2YR 6.0/1.8 (dark brown/blackish brown). This handmade pottery has a monochromatic surface, with both interior and exterior coated in thin brown to blackish-brown slips. The fabric contains organic temper with either medium-sized or fine mineral particles. Most examples were high-fired, though a minority show medium-fired characteristics. The ware has wall thicknesses ranging from 0.5-2 cm, with thinner examples typically containing finer mineral particles.

**Two-Colored Ware:** Eight sherds of two-colored pottery were obtained from Tell Aswad. This type is medium ware and handmade, though some sherds are wheel-made. It features an outer slip of thin clay in cream, pea green, and red or brown colors, and an inner slip of thin clay in red, orange, and cream colors. This pottery contains both organic and mineral temper and is highly fired.

## 6-2. Decoration with Color

Traces of colored pigments in red, cream, and brown have been observed on 8% of the pottery sherds (six sherds) discovered at Tell Aswad (see: Figs. 11a and 11b).


**Fig. 11a-b: Tell Aswad's pottery sherds are decorated with color (Authors, 2024).**

## 6-3. Carved Decorations

These decorations are created by carving into semi-dry pottery using sharp, pointed tools. This type of decoration was found on 6% of the pottery sherds from Tell Aswad. Examples include geometric circular designs (one sherd, see Fig. 13 and sketch 13) and horizontal band decorations on the upper half of the pottery vessel (two sherds, see Figs. 12a and 12b). Additionally, comb-shaped decorations are also present in the pottery from this site.


**Fig. 12a-b: Horizontal band-type carved decorations from Tell Aswad pottery (Authors, 2024).**

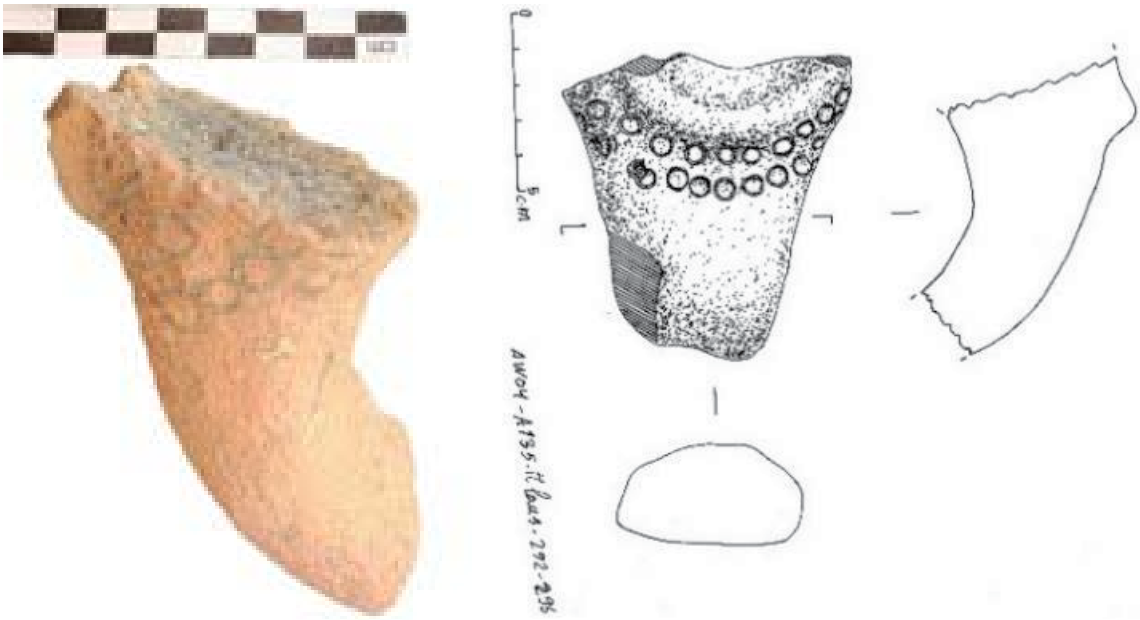


**Fig. 13 & Sketch 11: Handle with geometric decorations carved in a circular shape (Authors, 2024).**

### 6-4. Embossed Decorations

Small pieces of clay added to the body of a vessel in various forms are referred to as "added patterns." In some cases, these additions or raised elements serve purely decorative purposes. In other instances, they are intended to enhance the strength or usability of the object. Embossed decorations are found in 4% (3 sherds) of the pottery sherds from Tell Aswad. These decorative elements appear as broad horizontal bands, meticulously crafted using the added pattern technique and applied horizontally along the upper section of the pottery sherd (Fig. 14 a-b).


**Fig. 14 a-b: embossed decorations including horizontal bands created with the added-pattern technique on Tell Aswad pottery (Authors, 2024).**

### 7. Dating the Tell Aswad Pottery Using the Thermoluminescence Method (TLOSL)

The thermoluminescence (TL-OSL) dating method is a significant tool in archaeological research, as it allows for direct and accurate dating of ceramics, pottery, and burnt bricks. Its advantages include rapid analysis, minimal sample requirements (only milligrams), and an error margin of 5–10%. This study utilized TL-OSL to determine the age of pottery sherds from Tell Aswad, thereby establishing a precise chronology for the site. Twelve pottery samples were selected from various trenches and layers at Tell Aswad and analyzed using a RISO TL/OSL DA-20 device at the laboratory of the Syrian Atomic Energy Commission. Each sample consisted of 300 mg. It is important to note that the thermoluminescence dating results have a margin of error of ±120–250 years. The analysis revealed that the pottery from Tell Aswad spans multiple chronological periods: the Neolithic period (c. 6000 BC), the Chalcolithic period (c. 3400 BC), the Bronze Age (1800–1200 BC), the Iron Age (c. 800 BC), and the Roman period (571 CE), (Table 7).

### 8. Analysis and Decision

In this study, a total of 73 pottery sherds from the Neolithic site of Tell Aswad were analyzed and examined. The classification of the sherds was based on their form, manufacturing techniques, and decorative features.

**Table 7: Results of the thermoluminescence dating test "TLOSL" (Authors, 2024).**

| No | Catalog number | Trench | Layer | Context | Locus | Sample Age (years BP) |
|---|---|---|---|---|---|---|
| 1 | 60 | A130 | - | 435 | D132 | 3266 (1266 BCE) |
| 2 | 21 | F135 | - | 315 | G315 | 2200 (200 BCE) |
| 3 | 5 | Zv135 | 296 | 292 | TL | 3600 (1600 BCE) |
| 4 | 53 | A135 | 296 | 292 | TL | 5400 (3400 BCE) |
| 5 | 11 | A135 | 296 | 292 | C137 | 1571 (571 CE) |
| 6 | 63 | A125 | Fosse82 | 188 | B127 | 2542 (542 BCE) |
| 7 | 7 | Zv142 | 526 | 472 | Cuvette | 8000 (6000 BCE) |
| 8 | 49 | A135 | 296 | 292 | A137 | 3200 (1200 BCE) |
| 9 | 50 | A135 | 296 | 292 | TL | 2874 (874 BCE) |
| 10 | 16 | A135 | 296 | 292 | TL | 3700 (1700 BCE) |
| 11 | 15 | A135 | 296 | 292 | TL | 3800 (1800 BCE) |
| 12 | 70 | Zv130 | - | 453 | Zy133 | 3400 (1400 BCE) |

**Form:** The pottery from Tell Aswad includes bowls (both deep and shallow), jars, large earthen jars, and pots (open-mouth and closed-mouth varieties).

Manufacturing Technique: The pottery was categorized into three groups based on thickness:

• Coarse ware: 10% of the samples, with a thickness greater than 1.4 cm.

• Medium ware: 85% of the samples, with a thickness ranging from 0.7 to 1.4 cm.

• Fine ware: 4% of the samples, with a thickness less than 0.7 cm (Chart 2).

This indicates that medium-sized sherds are the most prevalent at Tell Aswad.

Manufacturing Method: The pottery was either handmade (62 sherds) or wheel-made (11 sherds), (Chart 3).

**Pottery Temper:**

• 82% of the pottery had both organic and mineral temper.

• 18% had only mineral temper (Chart 4).

**Firing Temperature:**

• 78% of the pottery was fired at a high temperature.

• 19% at a medium temperature.

• 2% at a very high temperature.

• 1% at a low temperature (Chart 5).

**Decoration:**

• 90% of the pottery had slip-type decorations in colors such as orange, brown, and pea-green, covering both the interior and exterior surfaces.

• 18% featured carved, embossed, and colored decorations.

Scientific Analysis:

• Thermogravimetric Analysis (TGA) indicates that the pottery was fired at approximately 1000°C.

• Scanning Electron Microscopy (SEM) reveals that the temper in the pottery includes mineral

crystals, silica, and organic materials. The presence of fused silica suggests that the sherds were fired at very high temperatures, contributing to their high strength.

• Fourier Transform Infrared Spectroscopy (FTIR) analysis of the slip on the sherds shows that it contains minerals such as albite, muscovite, calcite, and orthoclase, as well as organic components.

**Dating:** Some of the pottery sherds at Tell Aswad are wheel-made, indicating that they belong to both prehistoric and historical periods. This is further confirmed by thermoluminescence dating conducted on 12 pottery samples. The results are as follows:

• One sherd (sample number 7) dates to the Neolithic period, around 6000 BCE.

• One sherd (sample number 4) dates to the Chalcolithic period, around 3400 BCE.

• Six sherds (sample numbers 1, 3, 7, 10, 11, and 12) date to the Bronze Age.

• Three sherds (sample numbers 2, 6, and 9) date to the Iron Age.

• One sherd (sample number 5) dates to 500 CE.

These findings provide a comprehensive understanding of the pottery from Tell Aswad, its production techniques, and its chronological context.

## 9. Conclusion

Tell Aswad, a Neolithic site located in the Damascus Basin, has yielded 73 pottery sherds to date. Through the examination of these sherds analyzing their typology and employing thermoluminescence dating the following findings have been established:

**Typology of Pottery Findings:** The pottery from Tell Aswad was classified based on its form and manufacturing techniques, including vessel type, production methods, and decorative styles.

**1. Typology Based on Vessel Form:** The pottery at Tell Aswad includes bowls, jars, pots, and large earthen jars. This indicates a limited variety in vessel forms.

**2. Typology Based on Manufacturing Technique:**

• Medium Pottery Type: This category constitutes 85% of the pottery found at Tell Aswad.

• Manufacturing Method: Most of the pottery sherds were handmade.

• Tempering: Two types of tempering were observed—mineral and organic-mineral. Organic-mineral tempering is predominant, accounting for 82% of the pottery.

• Firing: 78% of the pottery was fired at high temperatures.

• Decoration: 90% of the pottery features a slip coating, while only 18% exhibits carved, embossed, or colored decorations.

From these findings, it can be concluded that the potters of Tell Aswad were skilled in pottery production, particularly in selecting temper materials, controlling firing temperatures, and employing various handmade techniques, such as nesting. However, the pottery decoration was relatively simple and limited, with only 18% of the sherds showing decorative elements.

**Dating of Tell Aswad Pottery:** The typology of Tell Aswad pottery (including its forms and manufacturing techniques) and the presence of wheel-made pottery suggest that the site dates to multiple periods, spanning both prehistoric and historical eras.Thermoluminescence dating

of twelve pottery samples further supports this, indicating that the pottery dates to the sixth, fourth, second, and first millennia BCE. Tell Aswad is not merely a Neolithic site. Instead, it was continuously inhabited from the Pre-Pottery Neolithic (PPN) period through the Pottery Neolithic (PN), Chalcolithic, Bronze Age, and into historical periods.

## Endnotes

1. A layer of soil in this site has been removed due to military operations conducted therein.
2. It is imperative to acknowledge that the primary objective of the excavation at Tell Aswad was to investigate the beginnings of agriculture and animal domestication, and to study the plastered skulls. Consequently, the pottery sherds identified in this site have not been the focus of attention.
3. Riso TL/OSL DA-20: Technical Specifications: Irradiation sources: Beta radiation (90Sr/90Y). Optical stimulation: either blue LEDs (470 nm, 80 mW/cm2) or IR LEDs (870 nm, >135 mW/cm2). Thermal stimulation: up to 700 oC at heating rates from0.1 to 10 K/s. OSL and TL signals detection: with a blue/UV sensitive photo electron multiplier tube (PMT), with maximum detection efficiency between 200 and 400 nm. detection filters: Hoya U-340 (7.5 mm thick, ø = 45 mm), Schott BG 39 (2 mm thick, ø = 45 mm), Corning 7-59 (4 mm thick, ø = 45 mm). Sample positions: 48 individual sample positions. Operating environment: darkroom (red light).
4. The presence of Jebeil point arrowheads and ornaments, which date back to the same period, in these same layers has been discovered.
5. The whiteware is made from lime powder. It has a polished outer and inner surface and is fired at a medium to high temperature.
6. Scanning Electron Microscope (SEM) XL Chamber With CCD Motorized. stage SED BSED.
7. Features: ETC EverGlo source for long life. Dynamic Alignment ensuring exceptional high-resolution line shapes. USB 2.0 interface, Full integration with the OMNIC software. allowing the user to focus on their studies. Configurable for multiple spectral ranges (far-IR to UV-Vis). Five external beam options. Wide selection of detectors.

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## Authors' Contribution

A.B. and C. conceived of the presented idea. A.B. developed the theory and performed the computations. D carried out the experiment A.B. and C.D. verified the analytical methods. All authors discussed the results and contributed to the final manuscript.

## Conflict of Interest

Authors declared no conflict of interest.

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# مـطالعات باسـتان‌شـنـاسی

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# گونه‌شناسی و مطالعهٔ ساختاری سفال‌های تل اسودِ دمشق، سوریه و پیشنهاد گاهنگاری محوطه با استفاده از آزمایش سالیابی ترمولومینسانس


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**چکیده**

یکی از مهم‌ترین محوطه‌های دورهٔ نوسنگی در جنوب‌غرب سوریه محوطهٔ تل اسود می‌باشد. این محوطه توسط «دوکنتنسن و استوردر» کاوش شده و تعداد محدودی قطعات سفال به‌دست آمده است. کاوشگران قطعات سفال شناسایی شده در تل اسود را به دورهٔ نوسنگی باسفال نسبت داده‌اند، در صورتی که در بررسی‌های کارگاهی انجام‌یافته توسط نگارندگان، مشخص گردید که این قطعات سفالی به دوره‌های نوسنگی، مس‌وسنگ، مفرغ و دوران تاریخی قابل انتصاب هستند. مسأله اصلی این پژوهش، گونه‌شناسی سفال تل اسود براساس فرم و تکنیک ساخت، و مشخص کردن تاریخ‌گذاری دقیق محوطه تل اسود براساس یافته‌های سفالی با استفاده از روش آزمایش سالیابی ترمولومینسانس می‌باشد؛ از این‌رو، تلاش خواهد شد به پرسش‌های طرح شده پاسخ داده شود؛ ۱. یافته‌های سفالی تل اسود ازلحاظ گونه‌شناسی و مطالعهٔ ساختاری به چه شکل قابل معرفی است؟ ۲. تاریخ‌گذاری مطلق با استفاده از آزمایش سالیابی ترمولومینسانس تل اسود به چه شکل قابل تعیین می‌باشد؟ در این پژوهش، گونه‌شناسی براساس فرم و تکنیک ساخت به‌همراه آزمایش ترمولومینسانس انجام خواهد شد. سفال‌های این محوطه ازلحاظ فرم و تکنیک تزئین تنوع زیادی ندارند، ولی ازلحاظ تکنیک ساخت به‌نظر می‌رسد که سفالگران تل اسود در زمینهٔ ساخت سفال تجربهٔ کافی داشته‌اند. براساس نتایج تاریخ‌گذاری یافته‌های سفالی با استفاده از روش ترمولومینسانس می‌توان گفت که با توجه به این‌که استقرار در تل اسود از دورهٔ نوسنگی بدون سفال آغاز شده است، ولی سفال‌های به‌دست آمده نشان‌دهندهٔ دورهٔ نوسنگی تا دوران تاریخی هستند.



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## Bridging the Gap: Godin Tepe and the Origins of Proto-Elamite Communities

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**Abstract**

Based on archaeological evidence, during the mid and late fourth millennium BCE, Godin Tepe lacked hallmark Uruk material culture (such as distinctive pottery, specific architecture, or administrative technologies), and thus cannot be identified as a purely Uruk trading outpost. The discovery of tablets with layouts and structures closely resembling Proto-Elamite texts indicates the existence of a local administrative system linked to the management of highland community resources, integrating Godin Tepe into the wider Proto-Elamite economic network. The complementary functions of pastoral nomadism (livestock products and transport services) and sedentary agriculture (agricultural produce and handicrafts) suggest that Godin Tepe acted as a conduit for regional exchange and a seasonal gathering place for nomadic groups. Findings such as the coexistence of Susa II economic tablets and formative Proto-Elamite types, the presence of pottery from the highlands and the central plateau, and the application of standard Proto-Elamite architecture reinforce the site's role as a multi-cultural commercial hub and a meeting point for administrative technologies (including economic tablets and sealings). Additionally, storage facilities and large jars underline Godin's function in warehousing and distribution. Chronologically, the material culture of Godin VI:1 bridges the gap between Susa II and Susa III and documents the initial stage of Proto-Elamite formation (ca. 3500–3200 BCE), marking the transformation from purely numerical tablets to fully developed Proto-Elamite texts. This "Formative Proto-Elamite" phase is defined by administrative innovations, cultural diversity, and expanded regional interaction, occurring in parallel with the ongoing Uruk/Susa II culture. Collectively, the evidence positions Godin Tepe not as a peripheral Uruk outpost, but as an active commercial center for Proto-Elamite pastoral nomads, with a central role in the development of administrative systems.

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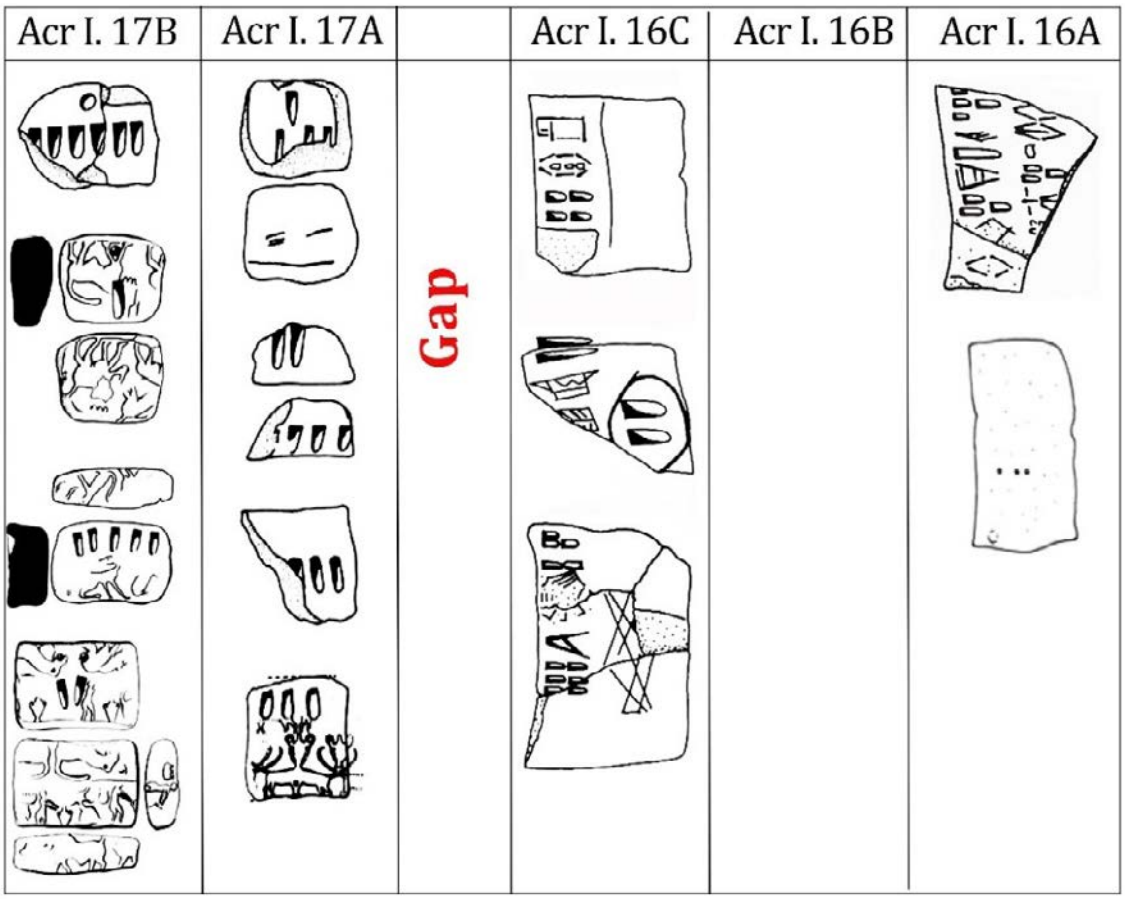
## 1. Introduction

The late fourth millennium BCE in the Susiana plain witnessed a transformative period marked by the Susa II (Late Uruk related) and Susa III (Proto-Elamite) phases, representing important junctures in the development of complex administrative systems that laid the groundwork for subsequent Elamite civilizations (Amiet, 1972; Potts, 1999). Susa II, characterized by increasing proto-urbanism and societal complexity, demonstrates a significant influence from the Uruk culture (Algaze, 2008; Pollock, 1999), evidenced by the emergence and local adaptation of administrative technologies such as cylinder seals and early numerical tablets (Schmandt-Besserat, 1992; Englund, 1998). This period reflects an initial phase of centralized control, with clear indications of resource management and distribution, establishing a foundation for more sophisticated administrative practices. Conversely, the Susa III (Proto-Elamite) period exhibits a notable advancement in administrative sophistication (Damerow & Englund, 1989; Dahl *et al.,* 2018). The emergence of the Proto-Elamite complex tablets, while still largely undeciphered, signifies a distinct and indigenous system of book-keeping, diverging significantly from Susa II practices (Table 1). This period saw an expansion of administrative functions beyond basic accounting, potentially encompassing intricate forms of economic and social governance. The widespread distribution of standardized Proto-Elamite administrative artifacts underscores a degree of inter-regional connectivity and semi-centralized organization, demonstrating the development of a unique Iranian administrative tradition that transcended mere emulation of Mesopotamian models. However, the transition between Susa II and Susa III remains a subject of scholarly contention (Dyson, 1987: 648; Le Brun, 1978). The observed occupation gap in Susa Acropole I, specifically between layers 17 and 16, presents a significant discontinuity in our understanding of this evolution, particularly concerning administrative practices (Canal, 1978: 173). Layer 17, indicative of Susa II, reveals a well-established administrative system with numerical tablets and seal impressions, reflecting continuity with preceding levels (22-18) and Mesopotamian influences (Schmandt-Besserat, 1992; Englund, 1998). In contrast, Layer 16, marking the Proto-Elamite period, presents a fully developed and distinct administrative system, complete with the complex Proto-Elamite tablets and a divergent repertoire of seal impressions (Damerow & Englund, 1989; Amiet, 1972). The critical absence of transitional materials between these layers constitutes a substantial lacuna in our comprehension of the Proto-Elamite emergence (Stolper, 1985: 5).

Although the most visible evidence of discontinuity between Susa II and Susa III phases derives from the stratigraphy of trench Acropolis I, where levels 17 and 16 show a marked break, this observation should be contextualized within the broader material and administrative changes at Susa, while acknowledging that this gap may not reflect uniform conditions across the entire site (Table 1). This gap highlights the abrupt nature of the cultural shift, prompting questions about the mechanisms and origins of the Proto-Elamite administrative system (Alden *et al.,* 1982: 624). The sudden appearance of a fully formed administration system, without clear precursors within the immediate Susa II context, suggests either a rapid internal development or, more likely, a significant external influence (Amiet, 1992).

**Table 1: Semantic and Lexical Gap Between Tablets in Susa Acropol 1, layers 17 and 16 (Authors, 2024).**




Drawing upon Dittmann's concept of discontinuity, this gap is not merely a stratigraphic anomaly but a profound break in the cultural and potentially political continuity of Susa. Dittmann's framework posits that such discontinuities often signify significant shifts in population, administrative structures, or socio-economic organization (Dittmann, 1986). Applying this to the Susa gap, we must consider that the Proto-Elamite administration may not have evolved organically within Susa, but rather appeared fully formed, suggesting an external origin or rapid transformation (Amiet, 1992; Dyson, 1987: 648). The abrupt appearance of Proto-Elamite culture, devoid of local developmental antecedents, implies potential population replacement or substantial influence from an external cultural sphere (Algaze, 2008).

In light of this perplexing occupational gap, Godin Tepe, situated in the Zagros Highlands, emerges as an extremely important site for investigation. Its strategic location, facilitating interaction between Susiana and the Iranian plateau, positions it as a potential nexus of cultural and administrative exchange (Weiss & Young, 1975). The site's stratigraphy, particularly Godin VI1 (mid-fourth millennium BCE), has yielded administrative materials offering a novel perspective on the Proto-Elamite phenomenon (Weiss & Young, 1975; Schmandt-Besserat, 1992). Godin Tepe's role as a marketing hub further suggests potential multi-cultural influences on administrative development (Lamberg-Karlovsky, 1978). Specifically, some of administrative artifacts, including tablets and seal impressions beside architecture and pottery assemblages,

from Godin Tepe exhibit hybrid characteristics, blending elements of initiative administration system and early Proto-Elamite traditions (Elendari, 2024). The discovery of numerical tablets with Proto-Elamite decimal numerical system and semantic and lexical layout indicates a gradual evolutionary process outside Susa, challenging the conventional lowland-centric view (Damerow & Englund, 1989). This hypothesis is further supported by the potential association of Proto-Elamite culture with pastoral nomadism, a subsistence strategy typically associated with highland regions (Alden, 1982a).

This paper addresses the critical occupation gap in Susa Acropole I by examining the discontinuity between Susa II and Proto-Elamite levels, which obscures the evolution of early administration. We begin by establishing the significance of these periods and the problem of the gap, then introduce Godin Tepe as a crucial highland site. We will detail the administrative systems of Susa II and Proto-Elamite, highlighting the discontinuity at Susa. Subsequently, we present a thorough analysis of administrative artifacts from Godin Tepe, focusing on tablets that blend early numerical tablets and Proto-Elamite standard characteristics. We then interpret these findings, arguing for a highland genesis of Proto-Elamite administration, potentially linked to pastoral nomadism, and offer an explanation for the Susa gap. Finally, we conclude by summarizing our findings and suggesting future research directions.

## 2. Proto-historic Chronology of Susa

Archaeological data regarding the Susa can be obtained from various sources, spanning different periods (Le Brun, 1985). This is because, in addition to the excavations by Dieulafoy, de Morgan, and de Mecquenem, which were primarily focused on the discovery of artifacts and antiquities across all periods without any attention to contextual distribution, subsequent excavations have been principally based on scientific and controlled investigations, aligned with established cultural horizons. These periods encompass the prehistoric era, including the Susa A culture; the protohistoric periods, the Uruk period corresponds to the Susa II and the Proto-Elamite culture or Susa III respectively, followed by the historical periods related to the Awan and Old, Middle, and Neo-Elamite dynasties, the Achaemenid, Parthian, and Sasanian empires, starting from Susa IV and continuing to Susa XI.

The foundation of Susa is uncertain, but the oldest radiocarbon dates from the Susa A layer on the Acropolis fall between 4395 and 3955 BCE (Carter & Stolper, 1984). Although excavations in Acropole I project, Layers 19 to 24 are not yet fully understood, and the available documentation for some layers is insufficient, the analysis and examination of the recovered artifacts allow for the identification of three Susa periods in the following sequence (Le Brun, 1990) as Period I: Layers 27 to 23, Period II: Layers 22 to 17 and Period III: Layers 16 to 14B. Period I, represents the initial occupation and settlement of Susa and is known as the Susa A phase, as its ceramic materials correspond to those recovered by Le Brun from Jafarabad and Susa (Le Brun, 1971; Le Brun, 1978). These ceramic materials, particularly in Layers 27 to 25, are characterized by a distinctive black on buff wares, which continue with variations through Layers 24 and 23. These

variations, marked by the emergence of smaller bricks in buildings and the prevalence of Uruk-type pottery, continue up to Layer 17. Johnson considers Layer 24 to be the late Susa A phase, followed by Layers 23 and 22 as the Early Uruk period, Layers 21 to 19 as the Middle Uruk period, and Layers 18 and 17 as contemporaneous with the Late Uruk period (Johnson, 1973, 60). Within Layer 16 at Susa, there is a clear shift in the material culture; specifically, the tablets, cylinder seals, seal impressions, and the architectural orientation show a sharp contrast between what came before and what came after (Amiet, 1972; Dittmann, 1986; Le Brun, 1978).

## 3. Susa II Cultural Horizon

The Susa II period (c. 3800-3100 BCE) in Susiana, as defined by significant shifts in architecture, brick size, and ceramic styles in Susa Acropole I levels 22–18 (Steve & Gasche, 1990: 27), mirrors the contemporaneous Uruk period in Mesopotamia. While scholarly debate persists regarding the precise subdivisions of Uruk (Johnson, 1973: 54–8; Wright & Johnson, 1985: 26–9; Nissen, 1993), the ceramic evidence undeniably demonstrates a strong Mesopotamian influence, with Uruk-style ceramics replacing local traditions of painted pottery of Susa A. This period witnessed notable social and economic transformations, including population growth, centralized ceramic production, and a hierarchical settlement pattern, suggesting increased societal complexity (Wright & Johnson, 1985). Interpretations of this Mesopotamian influence vary, with some arguing for a "Mesopotamian" population dominance or even full-scale colonization (Algaze, 1993: 15–17), while others emphasize complex interregional interactions and challenge the feasibility of large-scale colonization (Steinkeller, 1993: 109). Regardless, the striking ceramic similarities underscore a clear cultural connection, raising questions about the nature of political and economic relations between Susiana and Mesopotamia (Amiet, 1979a; 1979b; 1992). The Susa II period represents a distinct break from both the preceding Susa I and the succeeding Susa III periods, highlighting a period of intense cultural exchange and transformation in the region. Steinkeller supports an Uruk colonization of Susiana, citing the Sumerian origin of Inshushinak, Susa's patron god, as evidence (Steinkeller, 1993). The Uruk expansion, traditionally Late Uruk, now shows Middle Uruk presence in Syria (Oates & Oates, 1994: 168) and earlier Uruk types in Susiana. The close parallelism of Susa II ceramics with Mesopotamian Uruk is difficult to explain by a simple ascendancy of a pre-existing Mesopotamian population element. The introduction of potters and people from outside Susiana seems more likely. However, while Uruk ceramics suggest potential colonists, the distinct writing systems in Susiana and Mesopotamia argue against a complete subjugation. Nissen emphasizes the size disparity between Uruk and Susian sites. Uruk's vast expansion and extensive exposed architecture dwarf Susian settlements (Nissen, 1985; 1993). Uruk's proto-cuneiform writing system, with its complex numerical systems and hierarchical organization, reflects a bureaucratic need unique to Uruk (Nissen *et al.*, 1990). The spread of Uruk numerical systems to Susa indicates diffusion, not independent invention, further suggesting Uruk's influence rather than Susian parity. Numerical tablets, bearing cylinder seal impressions, appear in Susa Acropole I Level 18 (LeBrun, 1985; 1990: 61; LeBrun & Vallat, 1978:

31) and continue in Level 17 (Vallat, 1986a), mirroring similar finds in Uruk and other sites across Mesopotamia and surrounding regions (Friberg, 1979; Schmandt-Besserat, 1981: 323). While Uruk employed thirteen numerical systems (Damerow & Englund, 1985), Susa adopted only three (Friberg, 1994: 485), suggesting selective borrowing. These systems were nearly identical between Uruk and Susa, indicating a shared book-keeping practice. Although numerical tablets precede proto-cuneiform texts, both occur together in Uruk (Nissen, 1986: 326; Englund, 1994: 16), challenging a simple developmental sequence. The absence of complex proto-cuneiform texts in Susa, despite the presence of numerical tablets, suggests a limited Uruk influence, likely due to a few scribes rather than a full administrative takeover. The physical arrangement and shapes of Susa tablets differ from those of Uruk, further indicating a degree of independence. The presence of bullae and tokens in Susa (Amiet, 1987; Friberg, 1994: 492–5), predating tablets, supports a shared administration system tradition. The text argues for an infiltration of Mesopotamians into Susiana, rather than a political conquest. The limited adoption of Uruk accounting practices and distinct tablet features suggest local agency. The "priest-king" imagery found in Uruk, Susa, and Choga Mish (Amiet, 1986: 64; 1985; Harper *et al.*, 1992: 52) raises questions about political and religious connections. While interpretations vary, the author suggests a more complex relationship than a simple diffusion of a shared institution (Fig. 1).

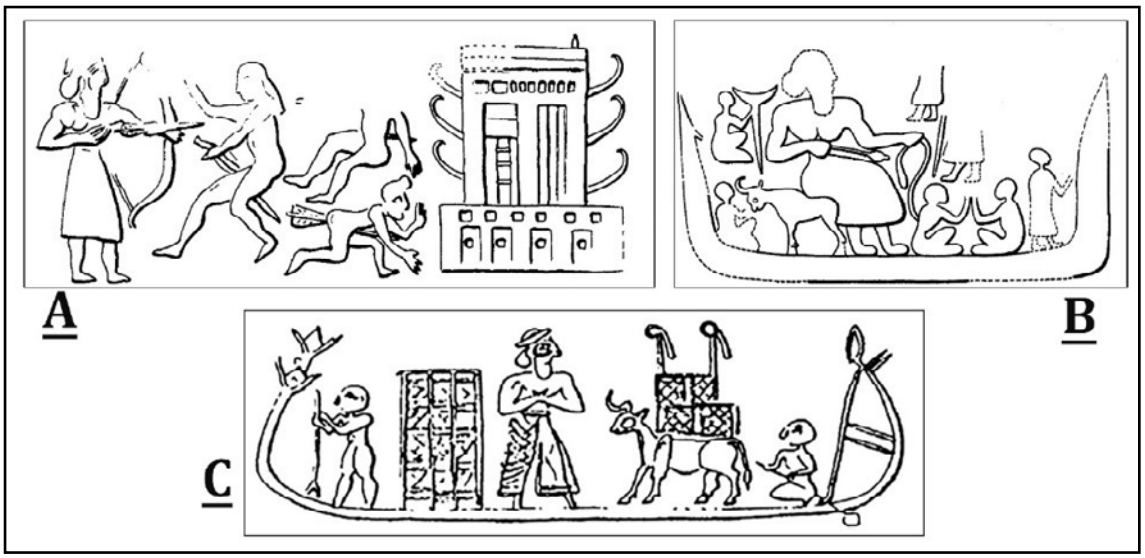



**Fig. 1: The "Priest-King" Imagery Found in Susa (A), (Amiet, 1957), Choga Mish (B), (Alizadeh, 2008) and Uruk (C), (Mathews 1993) Respectively.**

## 4. Susa III Cultural Horizon

The Susa III period, characterized by the emergence of distinctive complex tablets and sealings, has been a subject of scholarly debate. De Morgan's excavations at Susa yielded two tablets, briefly published by V. Scheil in 1900 (Scheil, 1900). Later, Scheil presented a larger group of similar texts, terming them 'Proto-Elamite' (Scheil, 1905), many bearing cylinder seal impressions that differed from Susa II/Late Uruk precedents (Amiet, 1972; 1986). Despite the poor stratigraphic context of early finds, Le Brun's work in Acropole I Levels 16-14b confirmed their Susa III dating.

The term 'Proto-Elamite' is problematic, implying a link to later Elamite texts without sufficient linguistic or graphic evidence. Therefore, these tablets are referred to as Susa III texts based on Daniel Potts label. Approximately 1550 Susa III texts have been found at Susa (Damerow & Englund, 1989). Understanding these texts necessitates examining their relationship to earlier Late Uruk/Susa II economic tablets and later Elamite texts.

The Susa III tablets differ significantly from Jamdat Nasr/Uruk III counterparts, primarily due to their more abstracted signs (Damerow & Englund, 1989). Early editors recognized limited signs borrowing between Mesopotamian and Iranian systems. Graphic parallels are considered insignificant, as similar features appear in disparate cultures (Damerow & Englund, 1989). Despite graphic divergences, structural similarities between Susa III and Uruk III texts are evident, thanks to the work of Friberg, R, Englund, and Damerow. Friberg suggested the Proto-Elamite SˇE-system was a copy of the Proto-Sumerian SˇE-system (Friberg, 1978). Damerow and Englund's research revealed that most Susa III numerical systems, except for the decimal and bisexagesimal B# systems, were identical or derived from Uruk proto-cuneiform systems.

Damerow and Englund's research revealed that most Susa III numerical systems, except for the decimal and bisexagesimal B# systems, were either identical to or derived from Uruk proto-cuneiform systems; however, this diffusionist view has been challenged by Desset, who proposes the independent development of the Proto-Elamite script within the highlands, reflecting a more localized trajectory of writing innovation (Desset, 2016).

The SˇE-system's presence in Susa II suggests some Susa III numerical techniques stemmed from earlier local systems. The Susa III writing system's creators were proficient in Mesopotamian numerical systems, but their sign list's divergence indicates a separate system. The Susa III texts remain largely undeciphered, unlike Mesopotamian proto-cuneiform, which benefited from comparisons with later cuneiform (Damerow & Englund, 1989).

## 5. Susa Acropole 1 stratigraphy and the question of Susa III origin

The shift from Susa II to Susa III reveals a profound cultural discontinuity, demanding a re-evaluation of the region's trajectory and prompting a search for external origins. Amiet's characterization of Susa as "diminished" during this phase (Amiet, 1992: 81) is not merely a quantitative observation; it signifies a qualitative shift in settlement patterns, with occupation contracting to the Acropole, implying a significant societal restructuring or decline. This spatial contraction serves as the initial indicator of a larger cultural upheaval. More critically, the material culture, particularly tablets, cylinder seals and seal impressions, presents a stark contrast between the preceding and succeeding periods. Le Brun's analysis of the Acropole I stratigraphy reveals a "complete disjunction" between Levels 17 and 16 (Le Brun, 1978). This is not a gradual evolution of styles but a sudden introduction of distinct fabrics and shapes, signaling a fundamental break with the established ceramic traditions of Susa II. Such a radical change in material culture suggests the influx of new populations or the adoption of entirely new cultural practices, pointing towards an external influence rather than internal development.

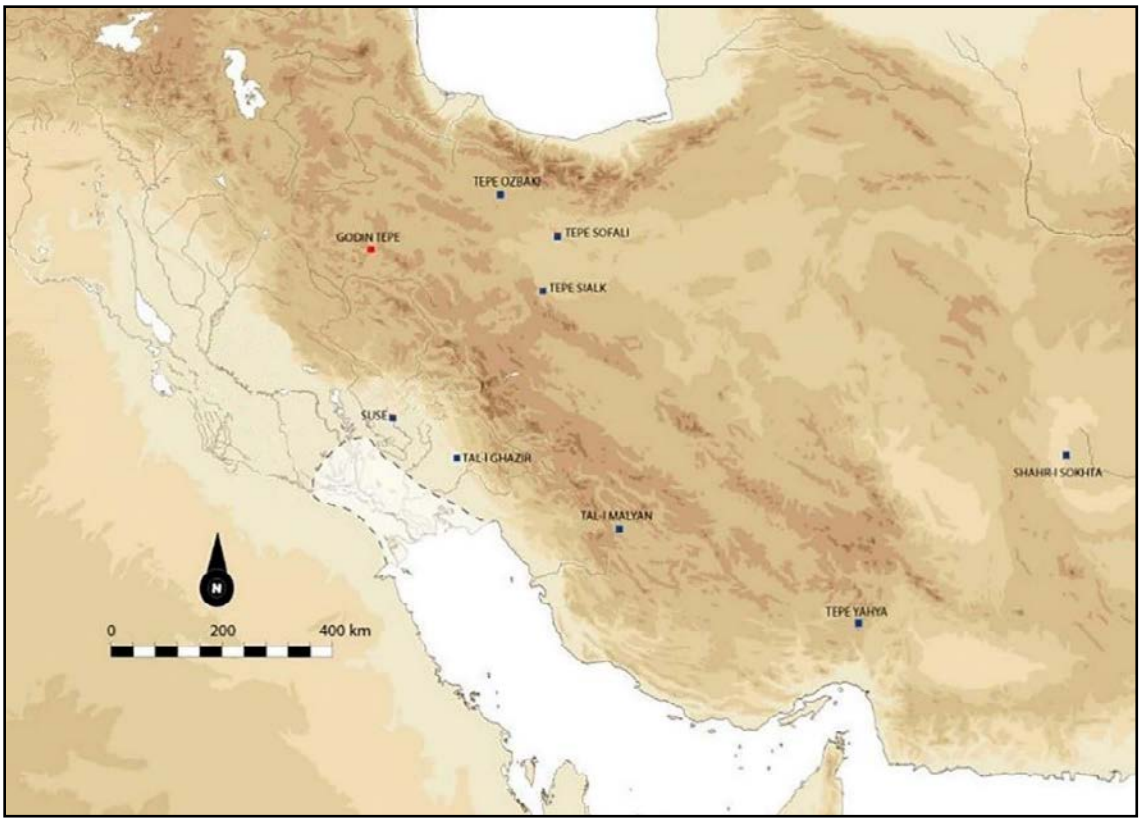
The stratigraphic evidence further substantiates this cultural rupture. Dyson highlights the "discontinuity" evident in the Acropole I section (Dyson, 1987: 648). The walls of Level 17B, once integral to the Susa II settlement, are found covered by "sloping strata of secondary trash termed 17A," indicating a period of abandonment or neglect. Subsequently, the "levelling activity" preceding the construction of Level 16 structures, which exhibit a "different orientation" from those of 17B, signifies a deliberate break with the past. This stratigraphic sequence reveals not only a temporal gap but also a fundamental change in architectural practices and spatial organization, further solidifying the notion of a cultural discontinuity.

The abandonment of the haute terrasse at the end of Level 17 (Canal, 1978: 173) reinforces the idea of a widespread disruption. This abandonment, coupled with the dramatic changes observed on the Acropole, suggests a systematic shift in settlement patterns and a potential abandonment of previously vital areas of the site. The combined weight of these indicators, a diminished settlement, a radical shift in material culture specifically tablets and seal impressions, a clear stratigraphic break, and the abandonment of a significant area, renders the existence of a substantial cultural gap between Levels 17 and 16 undeniable.

As Dyson concludes, "there is a discontinuity in the stratigraphy of unknown duration which must be taken into consideration" (Dyson, 1987: 648). This "discontinuity" is not merely a temporal gap but a cultural chasm that necessitates the exploration of external origins for the Susa III culture. The abrupt changes in administration materials, architecture, and settlement patterns strongly suggest that the Susa III culture did not evolve seamlessly from the preceding Susa II context but was likely introduced or influenced by external forces. Therefore, to understand the origins of Susa III, we must look beyond the immediate stratigraphic sequence at Susa and investigate potential sources of cultural influence from neighboring regions.

The distribution and interpretation of Susa III (Proto-Elamite) texts across Iran, have sparked debates about the origins and nature of this cultural horizon. While tablets of the Susa III type are found at multiple sites particularly at sites like Malyan, Tepe Ozbaki, Tepe Sialk, Tepe Yahya and Tepe Sofalin (Lamberg-Karlovsky, 1978; Damerow & Englund, 1989; Dahl *et al.,* 2018), their close uniformity with those from Susa is evident. The structural and graphic consistencies, including numerical systems and text layouts, suggest a shared administrative system throughout the Iranian Plateau (Damerow & Englund, 1989) contemporary where they cannot be the origin for Proto Elamite culture (Map 1).

Alden's hypothesis of a "highland script" originating at Malyan (Alden *et al.,* 1982: 624) has been challenged by stratigraphic and epigraphic evidence. The observed discontinuity at Susa between periods II and III prompted discussions about the origin of the Susa III assemblage (Dyson, 1987: 649). some scholars, like Amiet (1992), suggested a highland annexation of Susa, and others, like Alden (Alden et al., 1982), proposed Susa as a "port-of-trade." Damerow and Englund's analysis demonstrates that the numerical systems used in Susa III texts derive from the Uruk IV and III tradition (Damerow & Englund, 1989), and numerical systems were already present in Susa II (Stolper, 1985: 5). The large-scale economic activity recorded in Susa III texts,




**Map 1: The Distribution of Proto Elamite Tablets Across Iran (After: Desset 2016).**

with substantial animal and grain accounts (Damerow & Englund, 1989), further challenges the notion of Susa as a minor outpost. Therefore, the available evidence suggests that all known Proto-Elamite sites across Iran, with their Proto-Elamite tablets, represent the final stage of this writing system's development. It is difficult to attribute any of these sites as the sole origin of Proto-Elamite culture. Rather, the uniformity of the texts indicates a widespread and well-established administrative system.

## 6. Godin Tepe: Bridging the Gap

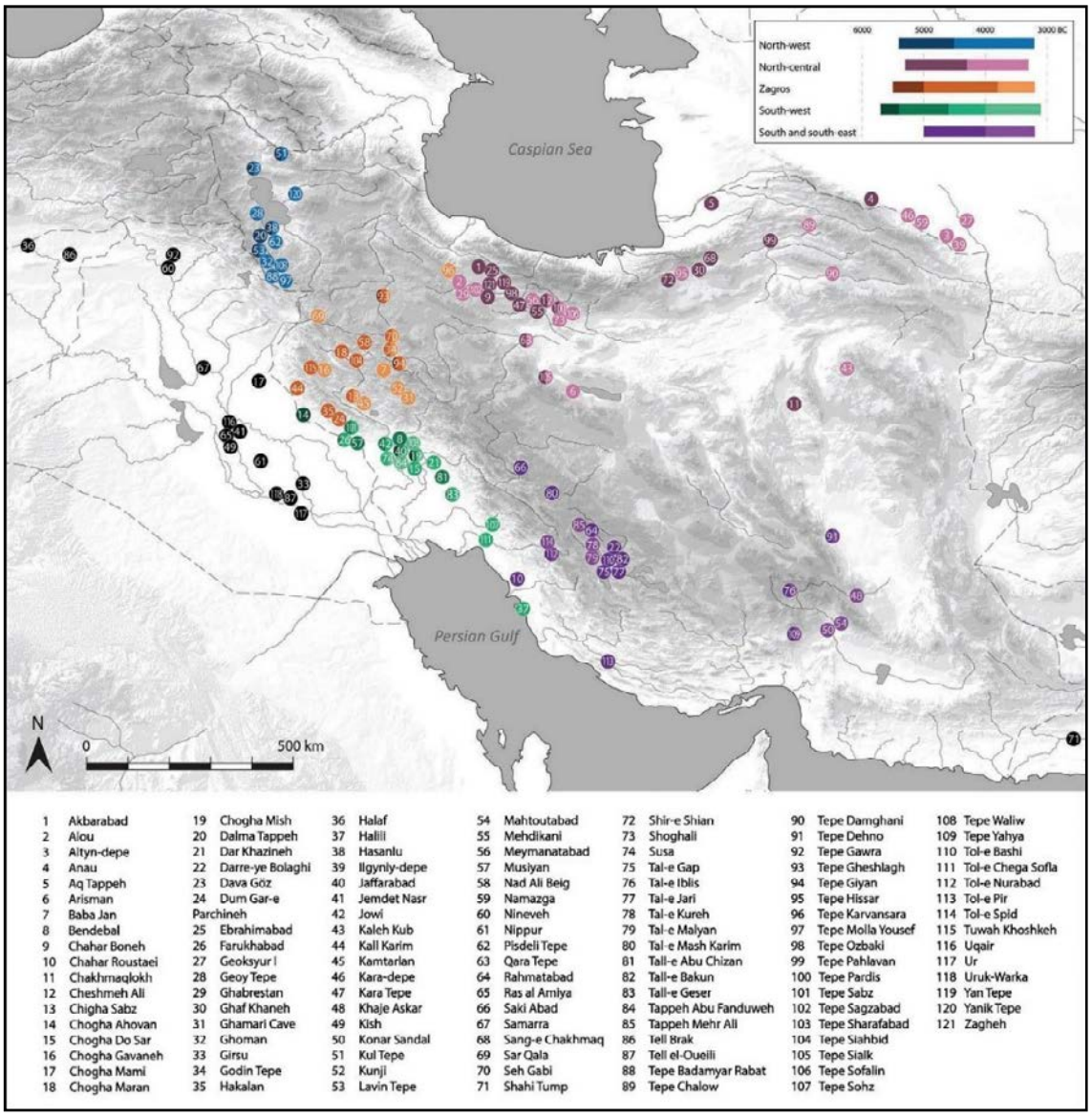
Godin Tepe, with its evidence of early bookkeeping practices and its location in a highland valley in central Zagros, stands as a strong candidate for the region of origin. It is important to note that the presence of Susa II and Susa III administration materials that are "like (but not identical to) those from Susa in Level 17 and 16 further supports this highland origin, however, the site of Godin Tepe itself has not yielded any standard Proto-Elamite texts. The discovery of 38 economic tablets during a 1973 excavation at Godin Tepe can shed lights into the origin of Proto Elamite community (Map 2).

The tablets from Godin Tepe were inscribed with a variety of numerical notations, including circles, triangles, crescent and squares. These signs are thought to represent numbers, and the tablets were likely used for accounting or bookkeeping purposes. The tablets unearthed at Godin Tepe originate from Level VI1, within oval architecture complex (Fig. 1) which archaeological

investigations have placed within the approximate timeframe of 3500 to 3200 BCE, (Rothman & Badler, 2011), (Table 2).

This dating positions these Godin Tepe artifacts as either contemporaneous with or possibly predating the earliest written records discovered at the Mesopotamian site of Uruk, specifically those from its Level IVa. Uruk's Level IVa is currently estimated to date from around 3200 to 3100 BCE, a chronology that has been, in part, refined through comparisons with the Godin Tepe findings (Rothman, 2013).

However, the Uruk materials present certain challenges for establishing precise comparative dating. As noted by van Driel, there's a lack of published tablets from layers definitively earlier than Uruk IVa. This situation creates a potential circularity in dating, where the tablets themselves become the primary markers for dating the archaeological context, rather than being dated by it.




**Map 2: Map Showing the location of Godin Tepe and other Fourth-Millennium BC Sites in Iran (After: Matthews and Fazeli, 2022).**

Van Driel raises concerns that the use of writing may have been present before the construction of what are considered Uruk IVa-period buildings. Thus, while Uruk lends its name to the broader cultural period, its suitability for detailed comparative dating is limited due to these stratigraphic ambiguities.

Despite these challenges, the tablets from Godin Tepe are not isolated discoveries. Evidence of similar tablets has emerged from a broad geographical range, encompassing various sites across the Near East and even extending beyond this region. This widespread distribution suggests a more extensive and interconnected use of early recording systems than previously thought. A brief survey of these comparable findings will provide a broader context for understanding the significance of the Godin Tepe tablets in the development of early writing and the emergence numerical notation within Proto-Elamite context.

The Godin Tepe tablets, characterized by their exclusive use of numerical signs except one, find parallels in various sites, offering a glimpse into the broader context of early numerical notation. In Uruk itself, despite the chronological challenges posed by its Level IVa, a few tablets resembling the Godin type have been discovered. These include examples noted by van Driel (Driel, 1982:18, n. 6) and Schmandt-Besserat (Schmandt-Besserat, 1992: 130, nn. 25-31). Notably, the numerical signs within the more developed proto-cuneiform script of Uruk IVa exhibit striking similarities to those utilized at Godin. The extensive accounting texts from Uruk, where numerals play a vital role, have benefited from significant interpretive advances, particularly through the work of Nissen *et al.,* (1990, 1993), building upon earlier efforts by Falkenstein (1936) and Vaiman (1976).

In Iran, the comparative landscape expands considerably. Choga Mish has revealed clay balls and numerical tablets, mirroring the Godin findings to some extend (Nissen, 1977:19). Susa itself presents a rich sequence, beginning with bullae and Godin-type tablets. Other Iranian sites with archaic tablets include Tepe Sialk (Ghirshman, 1938: 65-68 & pls. xciif.), Tepe Meymanatabad (Yosefi et al., 2018) with its numerical tablet examples, and Tall-i-Ghazir (Weiss & Young, 1975:91 and n. 20). Northern Mesopotamia also contributes to this picture, with finds from Nineveh (Collon & Reade, 1983: 33f.), Tel Brak (Oates, 1982: 65; Matthews & Eidem, 1993; Oates *et al.,* 2001), Habuba Kabira (Strommenger, 1977; 1981), Jebel Aruda (Van der Leeuw, 1974: fac. p. 83; Van Driel, 1982), Mari (Parrot, 1965: 12), and Khafaje (Weiss and Young, 1975: 88 n. 16). These sites have yielded numerical tablets and bullae (Matthews, 1997: Nos. 117, 164, 201), indicating a widespread use of similar recording techniques.

## 7. The Godin Tablets

The Godin Tepe tablets exhibit a notable consistency in size. Excluding broken pieces, the tablets' height ranges from 2.7 cm to 5.0 cm, with the majority falling between 3.4 cm and 4.9 cm. In terms of width, they vary from 3.9 cm to 5.95 cm, most measuring between 4.7 cm and 5.75 cm. Thickness measurements spans from 1.3 cm to 2.7 cm, with the majority registering between 1.5 cm and 2.6 cm. The majority of the Godin Tepe tablets are unsealed. Among the seven tablets that

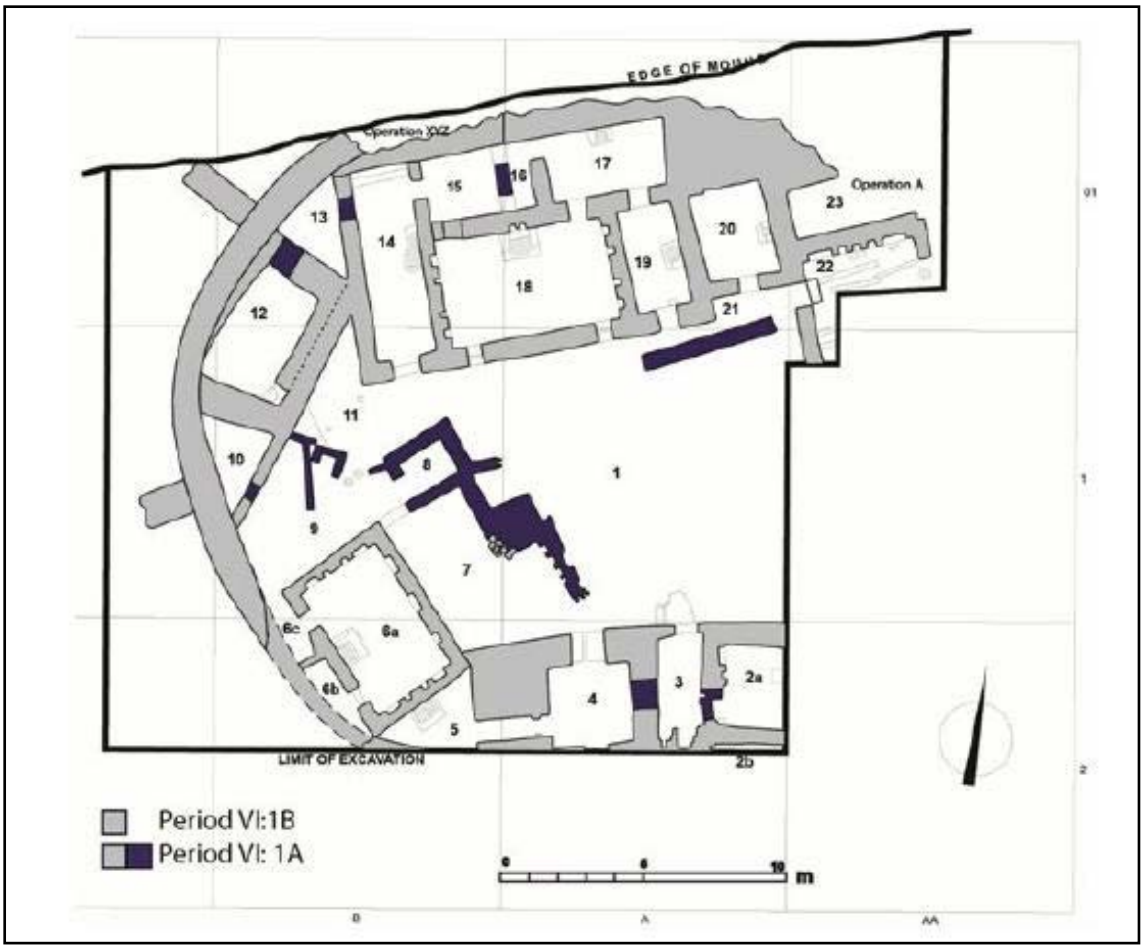



**Fig. 2: The Oval Architecture of Godin VI1 (After: Rothman and Badler 2011).**

are definitively sealed, three have corresponding unsealed duplicates. This observation sheds light on the sequence of seal impressions and inscribed numerical notations. The seals were applied first, as the numerical signs appear to be positioned to minimize disruption to the seal design. In some instances, the placement of signs in the center of the top line seems influenced by the pre-existing seal impression, a practice also noted in examples from Uruk.

One may read all the Godin tablets according to the only tablet with a vessel pictogram as if it was to be held with the top of the vessel pictogram at the top of the tablet. Their signs thus begin at the top of the tablet and either begin at the right end or are placed in the middle. If a second line is needed, it either follows immediately after the first line or, more rarely, is placed at the bottom of the tablet. With all these conventions, they may be compared to the earliest tablets from Susa, but there are deviations from these patterns, perhaps for the seal impressions (e.g. Amiet, 1972: 491, 642).

The arrangement of signs on the tablets reveals a strong emphasis on symmetry. This symmetry influences their placement, often positioned in the tablet's center, and extends to the alignment of signs on lower lines directly beneath those on higher lines. Examples of this can be observed in tablets from Godin and Uruk. In some instances, the arrangement creates an almost pictorial effect,

as seen in tablets from Brak, Habuba Kabira, and Jebel Aruda. The symmetrical arrangement supports the interpretation that the lines should be read from top to bottom rather than left to right. When a single line cannot accommodate all the signs of a particular magnitude, the remaining signs are moved to a second line.

The Mesopotamian convention of flattening the obverse to create what may be called the "plano-convex" tablet developed early. But this convention had not yet been fully adopted in the time of the Godin tablets, most of which are still slightly convex on both sides; two are flat on both sides and only four are plano-convex (Weiss & Young, 1975: 88). Except for the last, there are thus no easy criteria for distinguishing between obverse and reverse.

The direction of writing on the Godin tablets varies. Some tablets maintain the same writing direction on both sides (Susa II style), while others follow the later Proto-Elamite convention of opposite directions (Five tablets adhere to the later Proto-Elamite rule of opposite writing directions). This mirrors the variability seen in Proto-Cuneiform and Proto-Elamite scripts. Several tablets utilize both sides for inscription, with one tablet featuring additional margins. The writing direction is less clear on three tablets inscribed on the obverse and edge.

While most tablets use the obverse and reverse sides for writing, some employ the long edges or surfaces on the short edge. On one tablet, it is uncertain whether the deep impressions on the short edge are intentional signs. Like later proto-Elamite convention, two tablets have indentations encircling both sides, creating a frame or margin for the signs. One tablet has a frame only on the "obverse" side, and another features a dividing line that creates the effect of two distinct sections as the later Susa III text.

## 8. Interpretation of the Godin Tablets

The interpretation of the Godin Tepe tablets builds upon the foundational work of Weiss and Young (1975) and Schmandt-Besserat (1992). This analysis aims to provide a comprehensive view by examination of numerical tablets from Godin Tepe. These texts are categorized into two groups: 1 tablet with both a pictographic sign and numerical notations, 25 tablets with numerical signs only.

The tablet featuring a pictographic sign displays what is almost certainly a depiction of a pitcher or pottery vessel. This vessel is characterized by a pointed base and a neck that appears to have been added to the body following the rule of logogram or sign-object followed by numerical notations in standard Proto-Elamite texts (Fig. 3). This type of vessel is well-documented in archaeological finds and early sign forms. For instance, a limestone "crouching figure with vessel" from Susa, dated to the proto-Elamite period (Fig. 4), provides a comparative example consistent with the Godin Tepe tablet's period and origin. Furthermore, the pictographic sign resembles early sign forms, particularly the forerunner of the later M260 sign. This sign, a ligature of a vessel, is attested at many of later Proto-Elamite Tablets in Susa, Yahya, Malyan and Sofalin. The pictographic sign on this tablet is interpreted as a vessel standing on its pointed bottom. The three elongated signs to its left are described as notch. These verticals are topped by three circular signs

**Table 2: Comparative Chronology of Godin tepe and Adjacent Regions (After: Elendari 2024).**

| Godin Levels | Estimated Date (BC) | N. Mesopotamia | S. Mesopotamia | Central Plateau | Susiana |
|---|---|---|---|---|---|
| XI-X | 5500-4800 | Late Neolithic / E Chalcolithic | Halaf / Ubaid 1-3 | Sialk I.3-5 / L Neolithic II / E Trans Chalcolithic | Early and Middle Susiana |
| IX | 4800-4200 | E /M Chalcolithic | Ubaid 3-4 | L Trans Chalcolithic | Late Susiana / Susa 1-2 |
| VIII | 4200-4000 | LC 1 | Terminal Ubaid Uruk XIV-XV | E Chalcolithic | Terminal Susiana / Susa A (23-27) |
| VII & VI:3 | 4000-3800 | LC 2 | Early Uruk / Uruk X-XII | Sialk III.4-5 / M Chalcolithic | Susa 20-hiatus |
| VI:2 (VI in old sequence) | 4800 - 3300 | LC 3/ 4 | Middle Uruk / Uruk VI-IX | M / L Chalcolithic / Sialk III. 4-5 & Sialk III. 6-7 | Susa II (earlier) / Susa 18 / 19 |
| VI:1 (V in old sequence) | 3300 - 3000 | LC 5 | Late Uruk / Uruk IVA/B-V /Jemdet Nasr | Sialk IV.1-IV.2 | Susa II (later) Susa III / Susa 17 / Proto Elamite |
| IV | 3050-2700 | Bronze Age/ETC | Early Dynastic II | Sialk IV.2 / E Bronze I | Susa 13-15 |

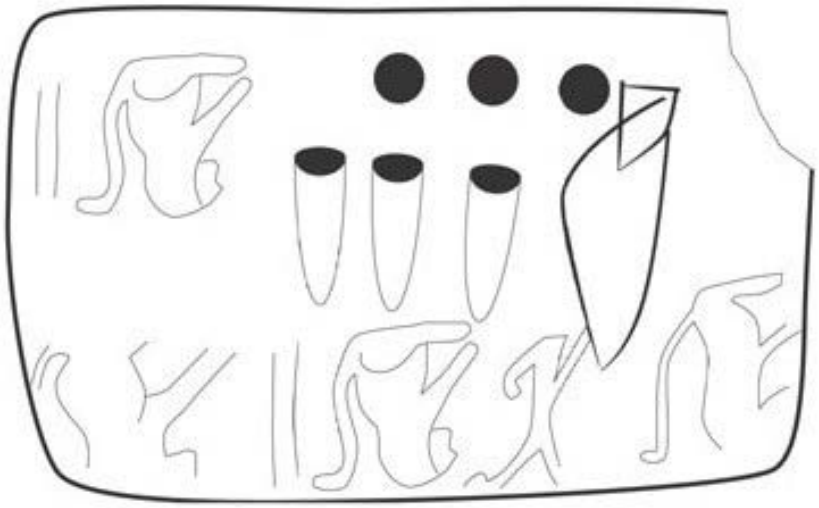


**Fig. 3: Formative Proto Elamite Tablet Featuring a Pictographic Sign Modified by Numeric (Taken from: Elendari, 2024: 126, Fig. 62-T295).**

above them, but in such a fashion that the first circular sign is to the right of the first vertical and the last vertical is to the left of the last circle. The sequence of writing on this tablet is as follows: the pictographic sign was written first, the circles next, and the verticals last.

This sequence provides an important clue to the meaning of the "numerical" signs, since it seems likely if not incontrovertible that the higher magnitude was written before the lower. On the analogy of later texts from the standard Proto Elamite text, we may tentatively assign to the circles the meanings "10" and to the verticals the meaning "1" within decimal system. We thus arrive at the sense "tablet containing 33 vessels of unknown substance."

The circles and verticals were impressed into the wet clay by means of tokens or of a stylus, while the pictographic sign was definitely drawn on it with some kind of stylus or other writing instrument. It seems more reasonable to attribute the resort to a drawing of the vessel to the fact that the tablet represents a step in the transition from impressed tokens to incised pictograms. The Godin Tepe tablets with impressed signs, devoid of pictograms, offer insights into an early decimal system. Among the 25 well-preserved tablets analyzed, numerical values are represented by large and small verticals, circles, crescents, and pairs of joined dots. The analysis suggests a hierarchical structure: large verticals ( ) potentially represent "100," circles ( ) represent "10," and small verticals ( ) represent "1." Fractions of "1" are indicated by crescents ( ), (hypothetically 1/5) and pairs of joined dots ( ), (hypothetically 1/10). For example, the tablet below (Fig. 5), with its arrangement of two large notches, four circles, and six small verticals, is interpreted as '246,' providing crucial evidence for the existence of a decimal-based numerical system in the region, a significant departure from Mesopotamian sexagesimal practices.

**Fig. 4: A Proto Elamite limestone "crouching figure with vessel" from Susa (Taken from Near Eastern Antiquities in Dialogue Catalog, Louvre Museum 2025).**

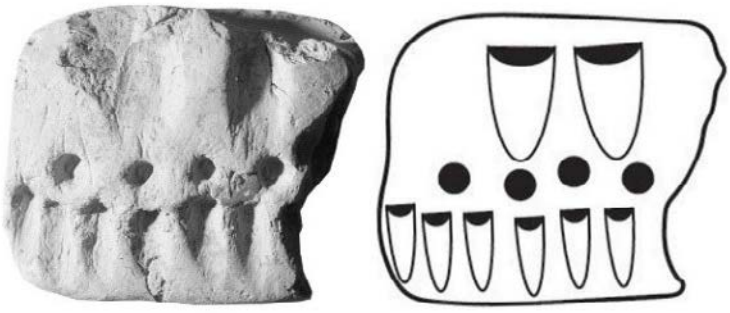


**Fig. 5: Formative Proto Elamite Tablet from Godin Tepe with Possible Decimal Numerical System (Drawn by: Authors, 2024).**

The next tablet (Fig. 6), with nine circles, is interpreted as "90." The arrangement of these signs, their alignment, and the presence of margins or seal impressions further contribute to the understanding of the numerical system employed in these early records. While most tablets feature a maximum of nine circles, exceptions exist.

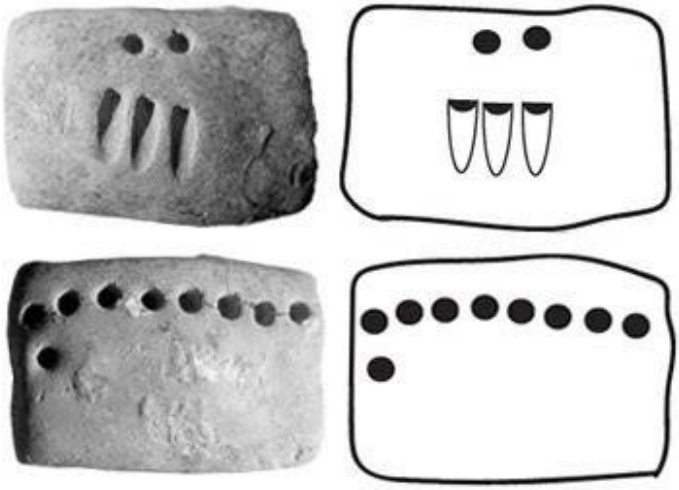


**Fig. 6: Formative Proto Elamite Tablet from Godin Tepe (Drawn by: Authors, 2024).**

At Jebel Aruda, one small tablet displays two rows of five circles, and a larger tablet shows two rows of eleven. Similarly, at Sialk, a tablet exhibits two rows of ten circles followed by a third row of three, deviating further by starting subsequent rows before the previous one is completed, a feature also seen at Susa and Godin.

These anomalies do not necessarily invalidate the theory of an initial decimal counting system. However, it is clear that a sexagesimal system soon superseded the decimal one in proto-Cuneiform texts, while the decimal system persisted within later Proto-Elamite tablets at Susa, Malyan, Yahya and Tepe Sofalin.

The next tablet (Fig. 7), a particularly significant artifact, stands unique as the earliest known practice of decimal system fractions inscribed along its edge. This tablet not only presents seal impressions depicting animals, indicative of ownership or administrative control, but also features a complex numerical notation: on one edge, a single circle is accompanied by four crescent-shaped impressions and a pair of joined dots, suggesting a fractional value within the decimal system.

The front side displays four distinct circular impressions, while the other main side reveals a series of additional circles, each uniquely marked with a dot in its center, potentially representing another set of numerical values or a distinct category of recorded information. This multifaceted tablet offers invaluable insights into the evolving numerical and administrative practices of the period, demonstrating an early understanding and application of fractional notation within a decimal framework.

This tablet (Fig. 8), exhibiting several features that prefigure standard Proto-Elamite tablets, include meticulously drawn margin lines, which likely served to delineate the recording space and enhance readability. Notably, this tablet also features a distinct dividing line running down

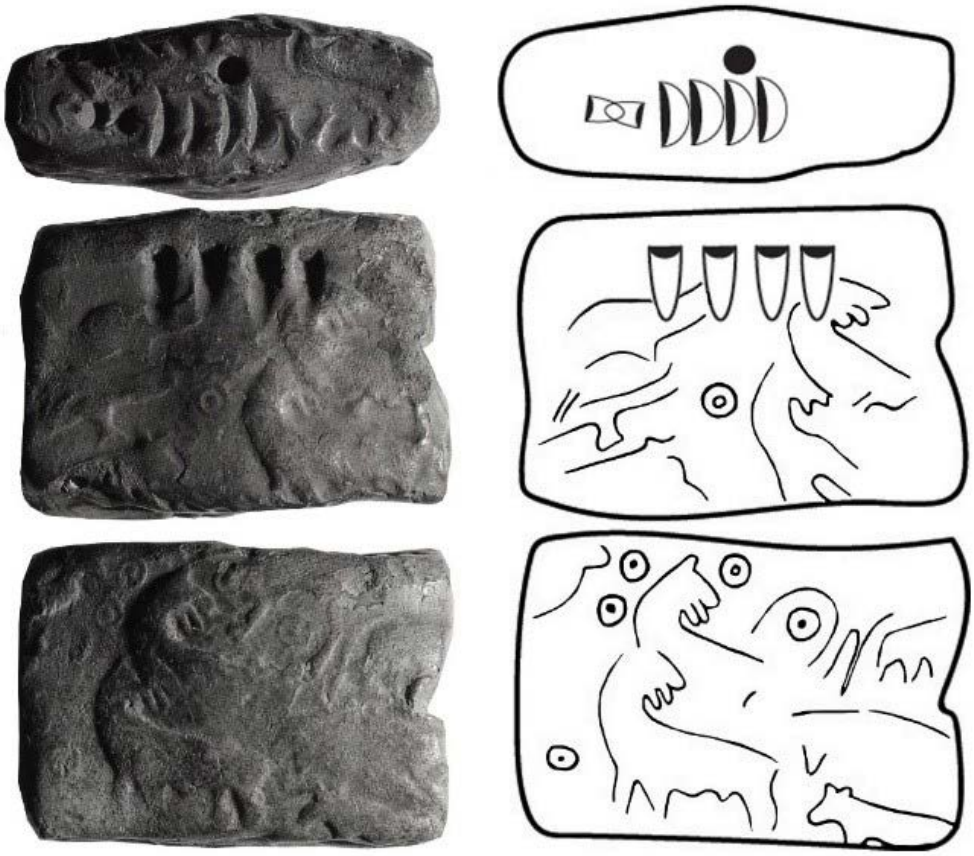


**Fig. 7: The Earliest Known Practice of Decimal System Fractions from Godin Tepe(Drawn by: Authors, 2024).**

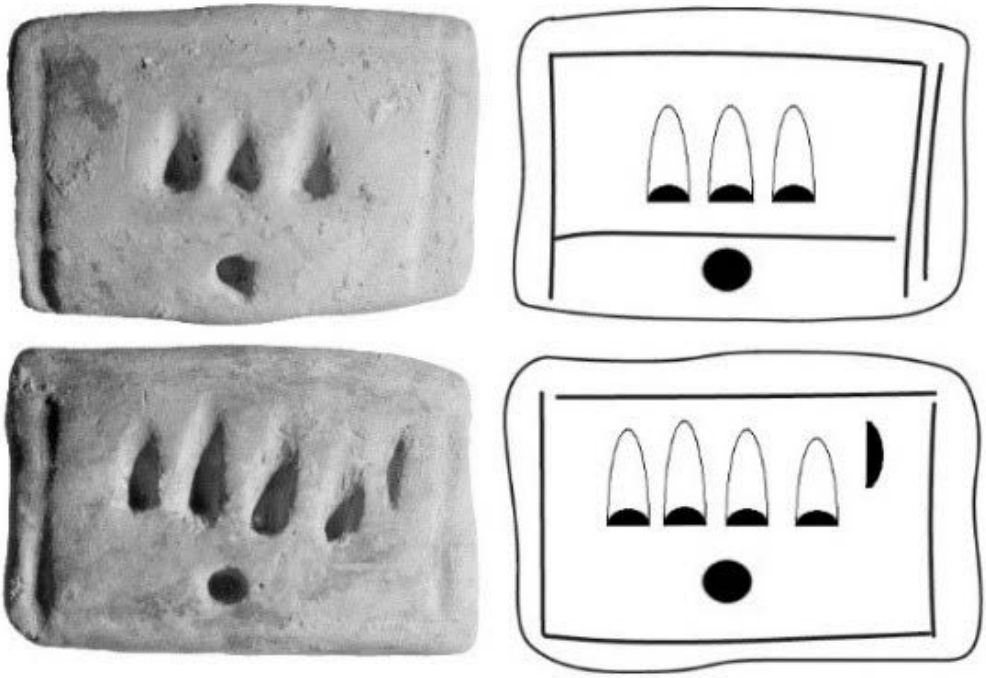


**Fig. 8: Formative Proto-Elamite tablets, include meticulously drawn margin lines from Godin Tepe (Drawn by: Authors, 2024).**

the middle of its obverse, potentially indicating a division of recorded information or a specific organizational structure. This technique of using a dividing line on the obverse is unique to Proto-Elamite tablet layouts, setting them apart from other contemporary recording systems. The tablet further displays horizontal dashes, which bear a resemblance to numerical signs, suggesting an early form of numerical notation or a related symbolic system. The obverse side of this tablet is intentionally reserved, acting as a surface for seal impressions depicting cross-tailed animals, possibly representing ownership, administrative authority, or the types of goods being recorded. On the bottom side, the tablet features additional numerical signs, indicating a multi-faceted recording system that integrated both numerical and symbolic elements, offering a glimpse into the evolving administrative practices of the period.

The architectural comparison between the Godin Tepe Oval Enclosure and the Malyan ABC/TUV and Susa (Desset, 2014) provides valuable insights into the possible connections between these sites and their role in the broader Proto-Elamite cultural sphere. Desset's work suggests that the architectural features of these sites share common traits, particularly in terms of their circular or oval-shaped structures, which could indicate similar administrative function. The Oval Enclosure at Godin Tepe, with its large, centrally located spaces and distinct architectural planning, has parallels with Malyan and Susa, where similar structural designs are found in contexts related to early urban organization and administration.

These architectural similarities might reflect a broader regional style or planning principle that was shared by multiple centers in the Proto Elamite period. This could suggest that the development of proto-Elamite writing and administrative systems was not only a cultural or technological diffusion from Uruk but also an indigenous evolution of urban and architectural practices in the Zagros highlands and surrounding regions.

The architectural evidence provides an additional layer to understanding the spread of Proto-Elamite culture, potentially supporting the theory that these sites, like Godin, were part of an interconnected highland culture that shared both architectural and administrative innovations. However, Desset's hypothesis also challenges the notion that Proto-Elamite was entirely derived from Urukian influences, offering instead the possibility of local, independent developments.

The relationship between the Godin Tepe tablets and proto-Elamite warrants a more thorough investigation. While the occupation of Godin's Oval Enclosure could have been by Urukian merchants, as Young suggests, the distribution of Godin-type number tablets across several sites southwards, within the region later known as Elam, prompts a deeper inquiry into their potential connection to proto-Elamite tablets from Sialk, Shahr-e Sokhta, and notably, Susa and Chogha Mish. Traditionally, proto-Elamite's emergence in Susa Acropol I Level 16-14B, contemporaneous with Uruk III, is attributed to a derivation from Uruk IV's fully developed script. However, alternative theories posit an independent origin and development for proto-Elamite, dating back to the mid-fourth millennium in highland central Zagros (Elendari, 2024).

Several points of comparison between Godin formative Proto Elamite tablets and early proto-Elamite tablets, absent in Uruk's archaic tablets, suggest a closer link. First, the placement of

numerical signs starting from the top right corner, as seen in Godin, contrasts with the symmetrical, central placement common in early Uruk tablet (Fig. 9).

Moreover, the placement of the commodity pictogram preceding the numerical signs, as in Godin tablets is mirrored in proto-Elamite tablets. Second, the prevalence of the "growing crescent" numerical sign in proto-Elamite, similar to Godin, differs from the "waning crescent" used at Uruk. Third, the apparent decimal numbering system in proto-Elamite, aligning with Godin, contrasts with Uruk's sexagesimal system (Fig. 10).


**Fig. 9: Numerical Tablet from Uruk (After: ©CDLI).**

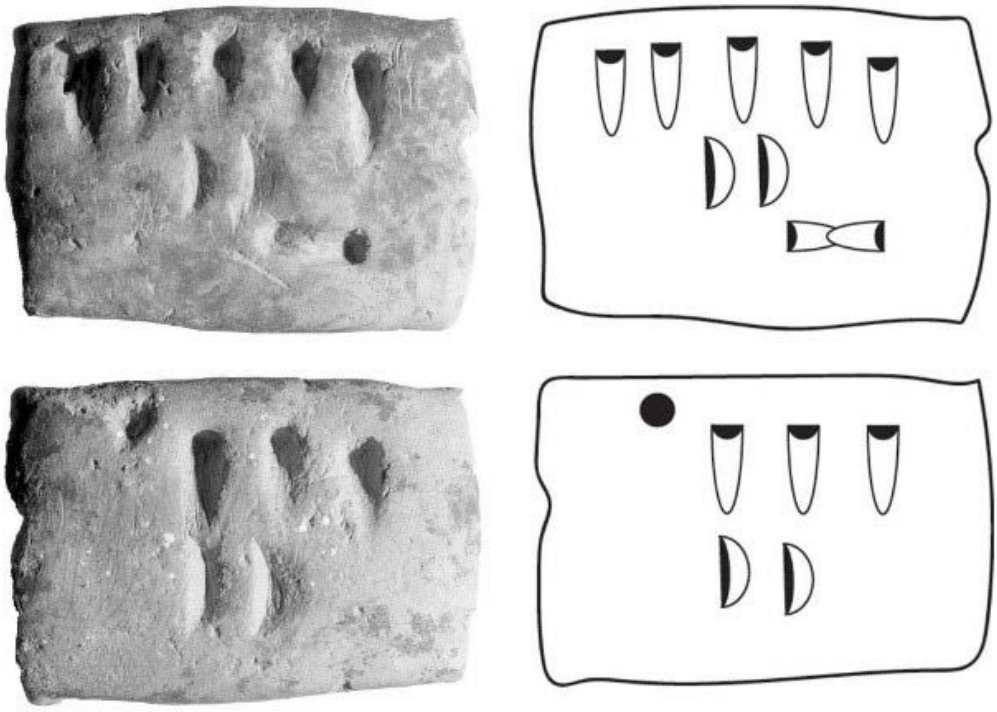


**Fig. 10: The Prevalence of the Growing Crescent Numerical Sign in Godin Tepe Formative proto-Elamite Tablets (Drawn by: Authors, 2024).**

## 9. Conclusion

The archaeological evidence at Godin Tepe does not reveal a strong presence of Uruk material culture, such as distinctive pottery, architecture, or administrative technologies. This suggests that the site was not primarily an Urukian trading outpost. The discovery of tablets very similar with Proto Elamite layout and structure at Godin Tepe indicates the presence of a local administrative system, possibly related to the management of highland communities' resources. These tablets suggest that Godin Tepe was integrated into the broader Proto-Elamite economic network. Pastoral nomadism and sedentary agriculture often form complementary economic systems. Nomads provide livestock products (meat, dairy, wool) and transport services, while settled communities offer agricultural produce and craft goods. Godin Tepe could have served as a crucial link in this exchange network. Pastoral nomads often gather seasonally at central locations for social, economic, and ritual purposes. Godin Tepe could have been one such gathering point, facilitating trade and exchange between different nomadic groups and the settled ones. The development of the Proto-Elamite script and administrative system suggests a degree of local autonomy and innovation. This challenges the notion that Godin Tepe was merely a peripheral outpost of the Urukian world-system. While the precise nature of the relationship between the Proto-Elamites and pastoral nomadism remains a subject of ongoing research, the available evidence suggests a strong association. Godin Tepe's location, archaeological findings, and socio-economic context support the argument that it was a marketing hub for Proto-Elamite pastoral nomads, rather than an Urukian trading outpost.

Godin Tepe during the mid and late fourth millennium BCE was a site of multicultural interaction, as evidenced by several archaeological findings. The presence of economic tablets alongside formative Proto-Elamite tablets indicates that Godin Tepe was a point of contact between different administrative systems and possibly different languages. This is further supported by the discovery of pottery originating from the highlands and the central plateau regions, demonstrating that Godin Tepe was a meeting point for various cultural groups. Moreover, the existence of standard Proto-Elamite architecture unearthed at Malyan, Tepe Yahya, Tepe Meymanatabad and Susa at the site suggests that Proto-Elamite groups were not just passing through but had established a significant presence there. These elements collectively suggest that Godin Tepe functioned as a central commercial hub where diverse ethnic groups converged to utilize the site as a marketing center. This marketing activity involved the exchange of various material goods, as well as the application of different administrative technologies, including the use of economic tablets and sealings. The site also featured large spaces where storage rooms with big jars were located, further indicating its role as a center for storage and trade.

In conclusion, the archaeological record at Godin Tepe does not support the interpretation of the site as a primarily Urukian/Susa II trading outpost. The paucity of Urukian material culture, including pottery, architecture, and administrative technologies, stands in contrast to the evidence for a local administrative system. Tablets bearing a strong resemblance to Proto-Elamite layouts and structure suggest that Godin Tepe was integrated into the early Proto-Elamite economic network,

likely involved in the management of pastoral resources. This interpretation is further supported by the complementary nature of pastoral nomadism and sedentary agriculture, with Godin Tepe potentially serving as a crucial nexus for the exchange of livestock products for agricultural produce and craft goods. The site's potential role as a seasonal gathering point for nomadic groups further solidifies its significance as a center for trade and exchange. The development of the Proto-Elamite script and administrative system at Godin Tepe implies a degree of local autonomy and innovation, challenging the view of the site as a mere peripheral extension of the Urukian world-system. The convergence of Susa II economic tablets, early Proto-Elamite tablets, pottery from highland and central plateau regions, and standard Proto-Elamite architecture at Godin Tepe collectively points to its function as a multicultural marketing hub. This hub facilitated the exchange of diverse material cultures and the application of administrative technologies, as evidenced by the presence of economic tablets, sealings, and storage facilities. While the precise relationship between the Proto-Elamites and pastoral nomadism requires further investigation, the available evidence, including Godin Tepe's location, archaeological findings, and socio-economic context, strongly indicates its role as a marketing hub for Proto-Elamite pastoral nomads, rather than an Urukian trading outpost.

Concerning the chronology of Susa after Susa II, Godin material culture specifically related to the administrative system plays a crucial role in bridging the gap between Susa II and Susa III, a period marked by the early stages of Proto-Elamite formation. The archaeological record at Godin Tepe, with its tablets bearing numerical signs within decimal system, linear entity of writing layout, advent of the object image prior to the numerical notations provides valuable data about the administrative practices of this transitional phase. These tablets, similar in layout and structure to standard Proto-Elamite tablets, are dated to approximately 3500-3200 BCE, placing them chronologically between Susa II and Susa III. Thus, Godin Tepe's material culture fills the chronological gap, offering evidence of the developmental stages of the Proto-Elamite culture and illuminating the evolution of its administrative system during this formative period.

Formative Proto-Elamite represents a crucial period of transformation and development leading to the fully developed Proto-Elamite civilization. This phase in Godin Tepe, occurring prior to later Proto-Elamite period in Susa and other sites with Proto Elamite material culture, was characterized by the formative Proto-Elamite administrative systems, including the development of writing from simple numerical tablets to those with fully developed Proto-Elamite script. It also involved increased cultural interaction and exchange, as evidenced by diverse pottery styles and economic tablets at Godin Tepe, indicating a convergence of various cultural influences. Formative Proto-Elamite was a time of experimentation and innovation in administration, communication, and economic organization, with regional variations in the manifestation of these developments. Ultimately, the concept of formative Proto-Elamite helps to understand and fill the chronological gaps in the archaeological record, recognizing this period as a dynamic phase in the trajectory of Proto-Elamite civilization.

The authors suggest that the formative Proto-Elamite culture coexisted with the Late Uruk/Susa II cultures, and Godin VI:1 bridges this time of overlap, a period characterized by the development and adaptation of administrative technologies. This period of coexistence at Godin VI:1 therefore provides critical insights into the formative Proto-Elamite phase and its relationship with the preceding Late Uruk/Susa II cultures (Table 3).

**Table 3: Chronological Progression of the Proto-Elamite Administration System**

| 3500-3350 | 3350-3100 | 3100-2800 |
|---|---|---|
| Formative Proto Elamite | Early Proto Elamite | Late Proto Elamite |
| Godin VI1 | Tepe Sofalin, Tepe Sialk, Ghesser, Malyan, Yahya, Shahr-e-Sokhteh | Tepe Sofalin Susa, Malyan, Yahya, Ozbaki |

This chronological chart outlines the development of the Proto-Elamite culture across three distinct phases: Formative, Early, and Late. The Formative Proto-Elamite phase (3500-3350 BCE) is primarily represented by Godin Tepe VI:1, indicating the nascent stages of this culture. The Early Proto-Elamite phase (3350-3100 BCE) witnesses a significant expansion, with evidence found at various sites including Tepe Sofalin, Tepe Sialk, Ghesser, Malyan, Yahya, Ozbaki, and Shahr-e-Sokhteh, suggesting a broader dissemination of Proto-Elamite practices. Finally, the Late Proto-Elamite phase (3100-2800 BCE) shows a concentration of sites, primarily Tepe Sofalin, Susa, Malyan, Yahya, and Ozbaki, indicating a possible shift or consolidation of Proto-Elamite centers. This progression from a single site to a widespread distribution and then a selective concentration highlights the dynamic evolution of the Proto-Elamite community, reflecting changes in settlement patterns, cultural influence, and possibly political or economic factors.

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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 no conflict of interest.

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# گودین‌تپه و خاستگاه نظام اداری آغازایلامی


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**چکیده**

بر پایهٔ شواهد باستان‌شناسی، گودین‌تپه در نیمه و اواخر هزارهٔ چهارم پیش‌ازمیلاد فاقد نشانه‌های بارز فرهنگ مادی اوروکی (مانند: سفال ویژه، معماری خاص، یا فناوری‌های اداری) بوده و بنابراین به‌عنوان یک پایگاه بازرگانیِ صرفِ اوروکی قابل شناسایی نیست. کشف لوح‌هایی با ساختار و چیدمان مشابه با متون آغازایلامی نشان می‌دهد که در این محوطه سامانه‌ای اداری بومی، مرتبط با مدیریت منابع جوامع کوهستانی، فعال بوده و گودین‌تپه در شبکهٔ اقتصادی گستردهٔ آغاز ایلامی ادغام شده است. کارکردهای مکمل اقتصاد کوچ‌نشینی (محصولات دامی و خدمات حمل‌ونقل) و کشاورزی یکجانشینی (محصولات زراعی و صنایع‌دستی) نشان می‌دهد که گودین‌تپه به‌عنوان حلقهٔ واسط در مبادلات منطقه‌ای و محل گردهم‌آیی فصلی کوچ‌نشینان عمل می‌کرده است. یافته‌هایی هم‌چون هم‌زمانی لوح‌های اقتصادی شوش II و نمونه‌های متون مربوط با مرحلهٔ شکل‌گیری فرهنگ آغازایلامی، حضور سفال‌های برآمده از کوهستان و فلات‌مرکزی، و معماری شاخص فرهنگ آغازایلامی، جایگاه این محوطه را به‌عنوان مرکز بازرگانی چندفرهنگی و نقطهٔ تلاقی فناوری‌های اداری (شامل: لوح‌های اقتصادی و مُهروموم‌ها) تقویت می‌کند؛ افزون‌بر این، انبارها و ظروف بزرگ ذخیره‌سازی نقش گودین را در انبارداری و توزیع کالا نشان می‌دهد. از منظر زمانی، مواد فرهنگی گودین VI:1 حلقهٔ اتصال میان شوش II و شوش III با عنوان مرحلهٔ آغازین شکل‌گیری فرهنگ آغازایلامی (حدود ۳۵۰۰ تا ۳۲۰۰پ.م.) را پُر می‌کند و گذار از لوح‌های صرفاً عددی به متون کامل آغازایلامی را مستندسازی می‌کند. این مرحلهٔ «شکل‌گیری فرهنگ آغازایلامی» با نوآوری‌های اداری، تنوع فرهنگی، و گسترش تعاملات منطقه‌ای تعریف می‌شود و نشان می‌دهد که شکل‌گیری این فرهنگ هم‌زمان با تداوم فرهنگ اوروک/شوش II رخ داده است. مجموعهٔ این شواهد، گودین‌تپه را نَه یک پایگاه فرعی اوروکی، بلکه یک محور فعال بازرگانی برای کوچ‌نشینان آغازایلامی با نقش محوری در تکامل سامانه‌های اداری تثبیت می‌کند.



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## Stone as Symbol in the Funerary Practice of the Srubnaya-Andronovo Cultural Sphere

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**Abstract**

This article is devoted to analyzing the role of stone as a symbolic substitute for the body of the deceased in the funerary practices of the Srubnaya-Andronovo cultural circle during the Late Bronze Age in the Southern Urals. The research is based on materials from the Kashkarovsky kurgan burial ground (Bashkir Trans-Urals), particularly Burial 3 of Kurgan 5, where an anthropomorphic stone stele was discovered and interpreted as the central element of a cenotaph. It is suggested that, in this context, the stone fulfilled a certain sacred function and also served as a substitute for the absent body of the deceased. The study presents a typology of similar complexes, distinguishing four groups based on the intentional placement and characteristics of stones in burial pits. Group A includes stele-like stones in burial pits; Group B consists of individual stones deliberately laid at the bottom of the burial pit, sometimes imitating a flexed body position; Groups C and D comprise cenotaphs with several stones or single slabs at the bottom of the grave. The burial pit with a stone stele at the Kashkarovsky burial ground is, in fact, a unique funerary cenotaph complex in which the deliberate placement of a stone at the bottom can be confidently associated with the ritual of substituting for the bodies of the deceased. The limited number of analogies points to the atypical nature of this rite in the funerary practice of the Srubnaya-Andronovo population of the Late Bronze Age Southern Ural forest-steppe. The origin of the tradition remains unclear; however, its connection with the Alakul-Fedorovo funerary traditions of sites in the Southern Urals and Kazakhstan has been identified. Confirmation of this hypothesis requires an expansion of the archaeological source base.

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## 1. Introduction

The question of the use of stone in the funerary rites of the Srubnaya-Andronovo cultural and chronological horizon is primarily considered in studies on the construction methods of burial and above-ground structures. In this context, its application as a component of the ritual among the Late Bronze Age populations of the region has traditionally been associated with the Alakul and Fedorovo (Kozhumberdy) cultural traditions.

However, cases exist in which the stone itself served as an item of sacralization and/or as the central element of the ritual. Without delving into semantic interpretations, we should highlight one key point: researchers have noted a special attitude of ancient people toward stone as a link between the world of the living and the world of spirits (Petrin, 1992). The role of stone as a sacred item in the worldview of the Andronovo tribes has been the studied by Usmanova (2005: 124–126; 2007; 2013: 113–118). It has been observed that stone in the Andronovo funerary rite was used to symbolize the idea of human death and served as one of the earliest images and forms of a substitute for the deceased.

## 2. Materials and Methods

### Topography and General Characteristics

The Kashkarovsky burial mound is located on the eastern slope of the forest-steppe Zilair Plateau, at the southern extremity of the Ural-Tau Ridge, on a flattened, forested summit of the primary terrace on the left bank of the Krepostnoy Zilair River. This site is situated at the narrowing, meridionally oriented watershed between the Krepostnoy Zilair and Sakmara rivers. The burial ground consists of 20 kurgan mounds and two groups of menhirs (see: Fig. 1).

The burial complex was discovered during the investigation of kurgan 5 in the western group of the necropolis. Three burials with stone superstructures and two later earth graves were identified. The burials with stone coverings were located in the northern sector of the mound (Burials 1–3), while the earth graves were recorded beneath its central part (Burials 4–5). All interments were arranged along a west–east axis and oriented in a meridional direction.

The earlier complexes consist of burial pits with coverings made of stone slabs laid at the level of the ancient ground surface (Burials 1–3). The total depth of the pits, taking into account the ancient surface, reached 0.85–0.9 meters. Thus, a ground necropolis was initially formed on the site, bounded to the west and east by outcrops of two rock formations. Such a situation is not unique; in particular, the “integration” of burial components into the structure of natural rock outcrops is clearly evident at the Alakul-Fedorovo burial ground Urefty I in the forest-steppe Trans-Urals (Stefanov and Korochkova, 2006).

The highlighted text continues the preceding section. During the construction of Burials 1–3, the site functioned as a flat cemetery without a mound. The kurgan mound was constructed only later, when Burials 4–5 were added. This explains their location beneath the central part of the mound. It is likely that both burials were made within a short time span, as indicated by the preservation of their linear arrangement (along a west–east axis) and their simultaneous coverage by the mound.


**Fig. 1: Map of Eurasia showing the location of the Kashkarovsky Kurgan Burial Ground (WGS 52°21.028 N, 57°47.232 E).**

## 3. Description of the Complex

The stone slab of burial 3, with a fracture along its longitudinal axis of symmetry, was found at the level of the ancient ground surface. The dimensions of the slab (measured at the extreme points) are 2.05 × 0.9 meters. During the cleaning of the natural soil at the southern edge of the slab, the clear outlines of a burial pit were found. Part of the eastern and western walls at the southern edge of the burial pit were lined with stone slabs (see: Fig. 2).

The grave itself is of an irregular sub-rectangular shape (1.45×0.8 meters), with its long axis oriented north–south. It is recessed into the natural subsoil to a depth of 0.55–0.6 meters. The floor of the pit is flat. The northern and southern walls are vertical, while the eastern and western walls widen toward the bottom. The fill of the pit is homogeneous, with no signs of later disturbance (such as looting pits, animal burrows, etc.). The break in the slab did not disrupt the fill of the pit. The fracture area was located 0.1 meters above the spot. It gives the impression that the interior space of the grave remained unfilled for some time, forming a kind of crypt. The humus backfill of the burial pit and the break in the slab are likely associated with the period of the kurgan mound's construction.

At the bottom of the grave, in its northeastern part, a massive stele-like stone was discovered, elongated along a northwest–southeast axis. The stone showed no traces of working, yet it differed from the slabs used in the construction of the superstructure by its relief configuration. Most likely, the choice of this stone was deliberate and determined by its resemblance to an anthropomorphic form. The base of the stele is wedge-shaped and narrow, while the middle and upper parts of the stone widen. The length of the stele is 90 centimeters, the maximum width is 42 centimeters, and the greatest thickness is 15–18 centimeters. To the west, almost adjacent to the slab, was a squat, pot-shaped vessel (see: Fig. 2).

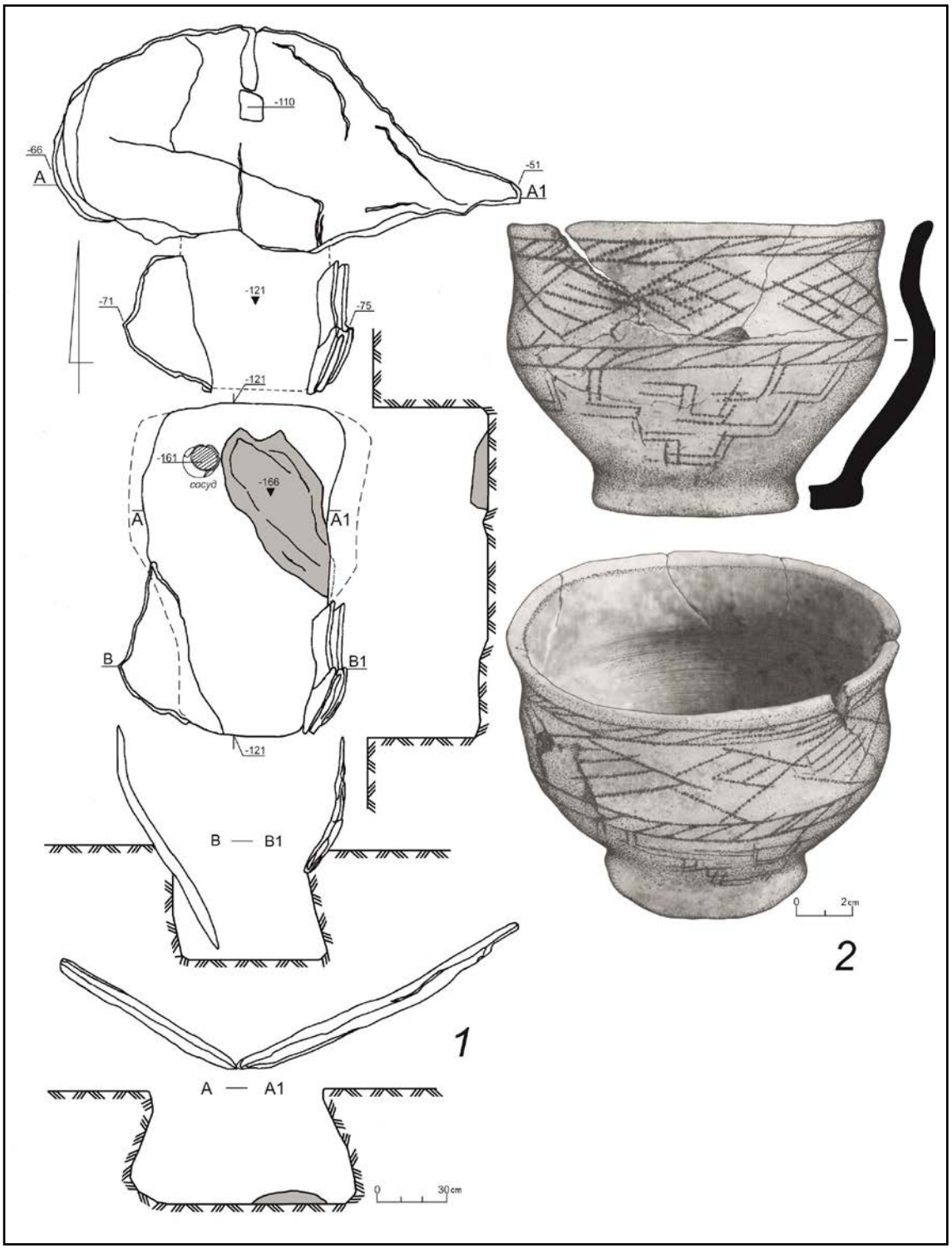


**Fig. 2: Kashkarovsky Kurgan Burial Ground. Kurgan 5: 1. Plan and section of burial 3; 2. Vessel from burial 3.**

The profiling of the vessel is smooth. At the transition from the body to the base, a basal protrusion (rim) is observed. The neck, as well as the slightly pointed rim, are gently flared outward. The surface is well-smoothed, with traces of burnishing visible in certain areas.

**Table 1: Main Parameters of the Vessels.**

| | Rim Diameter | Neck Diameter | Maximum Body Diameter (at shoulder) | Base Diameter | Vessel Height | Neck Height | Body Height |
|---|---|---|---|---|---|---|---|
| Burial 3 | 14 | 13,5 | 14 | 7,5 | 10,5 | 4 | 6,5 |

With the exception of the base and the area near the bottom, nearly the entire surface of the vessel is covered with ornamentation. The decorative technique consists of impressions made with a fine-toothed stamp. Along the upper part of the neck, two parallel horizontal lines run. The space between them is filled with oblique, right-leaning segments. The neck is further decorated with a row of filled diamonds. In one of the diamonds, the fill consists of parallel oblique strokes. The shoulder zone is marked by the same ornament as that found at the top of the neck. On the body, the ornamentation takes the form of a two-part stepped pyramid with its apex pointing downward.

## 4. Results

### Cultural and Chronological Attribution

Turning to the cultural interpretation of the kurgan, it can be stated that all the burials exhibit a mixture of Srubnaya and Alakul-Fedorovo features in both ritual and grave items. The closest parallels for the construction of the burial pits and above-ground structures, as well as for the vessel discovered, are found in Srubnaya-Alakul complexes of the Southern Trans-Urals and the steppe regions of the Pre-Urals, which are characterized by diverse combinations of cultural traits. For example, stone coverings are a rare phenomenon in the steppe and forest-steppe zones of the eastern foothills of the Southern Urals. In terms of territorial proximity, the most similar burials with stone slab coverings are found in kurgan necropolises of Bashkir Trans-Urals: IV Bekeshevsky (Kurgan 2), III Komsomolsky (Kurgan 2, Burial 3), (Morozov & Pshenichnyuk, 1976); II Tavlykaevsky (Kurgan 2, Burials 1, 3, 10; Kurgan 3, Burial 1; Kurgan 4, Burial 1), (Morozov, 1984); and Sibaysky II (Kurgan 11), (Rutto, 1995: 46). Burials with stone coverings have also been recorded in Srubnaya-Alakul cemeteries of the steppe Trans-Urals, such as the kurgans near the Sistema station (Kostyukov & Alaeva, 2004), Ak-Mulla I (Gavrilyuk *et al.,* 2006), Ilyaska I (Lyubchansky & Ivanova, 1996), and Peschanka-3 (Alaeva & Markov, 2009).

In general, the meridional orientation of burial pits is also a typical feature for the territory of Trans-Ural Bashkiria.

A distinctive feature of the vessel under consideration is the combination of several pottery traditions: Srubnaya (Srubnaya-Alakul?) and Kozhumberdy. The latter is evidenced by the smooth profiling, overall ornamentation, use of a comb stamp, and signs of surface burnishing. The carelessness in the application of the ornament and its slight asymmetry correspond to the Srubnaya tradition of ceramic decoration.

The stepped pyramid motif observed on the vessel is quite clearly associated with the Alakul ornamental tradition (Kuzmina 1994: 113, fig. 2, 12–13; Matveev, 1998: 271, 273, Table 9).

At the same time, the motif in the form of two-part or nested pyramids is rather rare. In this regard, a direct analogy to the ornament in question can be found in the Komsomolsky III burial ground (Kurgan 1, Burial 2), located 25 km northeast of the Kashkarovsky kurgans (Morozov and Pshenichnyuk, 1976: fig. 5, 6).

Overall, the Kashkarovsky barrow necropolis is a multi-grave cemetery. The burial rite practiced within it demonstrates stability: there is no pronounced manifestation of professional or social stratification in the funerary ritual or material culture, and the ceramic vessels recovered from the burials are highly standardized. The chronological framework is associated with the spread of the Srubnaya-Andronovo community in the Ural-Kazakhstan region (the developed stage of the Srubnaya culture, Alakul, Fedorovo, Cherkaskul, Srubnaya-Alakul cultures, and others). The absolute dates for this period fall within the 18th-16th centuries BCE (Epimakhov *et al.,* 2005: 26, 28; Epimakhov *et al.,* 2024). Dates for the Alakul-Fedorovo complexes also lie within this range, illustrating the interaction between the two traditions. Modeling results have been compared with the dates of Andronovo monuments in Kazakhstan, the Baraba forest-steppe, and southern Siberia. The dating values are closely aligned, except for an earlier series from Kazakhstan. When compared with the results of dating Alakul sites in Trans-Urals (19-16$^{th}$ centuries BCE), their chronological priority and a prolonged period of coexistence between Alakul and Fedorovo traditions were established (Epimakhov & Alaeva, 2024). Complexes of the Srubnaya culture, as well as mixed Srubnaya-Alakul sites of the Cis-Urals, are also synchronous with the Alakul and Fedorovo antiquities, most of them arising in the 18-17$^{th}$ centuries BCE (Kuptsova *et al.,* 2018: 103–105). More precise chronological attribution of the material is possible after conducting radiocarbon dating.

## 5. Discussion

### Stone as Symbol: Analogies and Classification

The investigation of kurgan 5 at the Kashkarovsky burial mound has demonstrated that burial 3 represents an original funerary complex: a cenotaph with the symbolic interment of a stone as a substitute for the deceased.

Based on the tradition of placing vessels at the upper part of burials in the cultures of the steppe and forest-steppe zones of Central Eurasia, the vessel adjacent to the stele likely marks the northern orientation of the presumed buried individual. With a certain degree of caution, it may be suggested that the placement of the stone slab at an angle to the longitudinal axis of the burial pit indicates the arrangement of the body in a flexed position on its side (see: Fig. 3, 2). The cenotaph is part of the overall system of arrangement of the other burials (nos. 1–2). All are positioned strictly along a west–east line and oriented northward. The stone in the cenotaph is likewise “oriented” to the north.

The manifestation of the cult of the stone-substitute for the deceased within the Srubnaya-Andronovo milieu becomes increasingly pronounced in the sites of the steppe Pre-Urals, the forest-steppe Trans-Urals, and the Upper Tobol region. However, to date, there is only one close analogy

to the Kashkarovsky complex: an anthropomorphic stele discovered in the Alakul burial ground of Ishkinovka III in eastern Orenburg. Here, in the center of the main burial, a vertically positioned stele with highly schematic anthropomorphic outlines was found in situ, at the base of which were discovered two slab mortars, tools associated with mining and metallurgical production (Tkachev, 2012). Thus, these two typologically similar complexes, located approximately 100 km apart, form a distinct group (Group A) that is, in fact, integrated into the structure of a unified historical and cultural space. The meridional orientation of the upper courses of the Ural and Sakmara rivers, along with the natural barrier of the Ural-Tau Ridge, historically ensured a high level of communication between the steppe and foothill regions of the Trans-Urals and the Orenburg-Kazakhstan steppes (for more details, see: Saveliev, 2011). A characteristic feature of this group is quite clear: intentionally installed or laid stele-like stones in the burial pit without any evidence of a buried individual (cenotaph), which can be confidently associated with the ritual of substitution for the deceased (see: Fig. 4, 1–2).

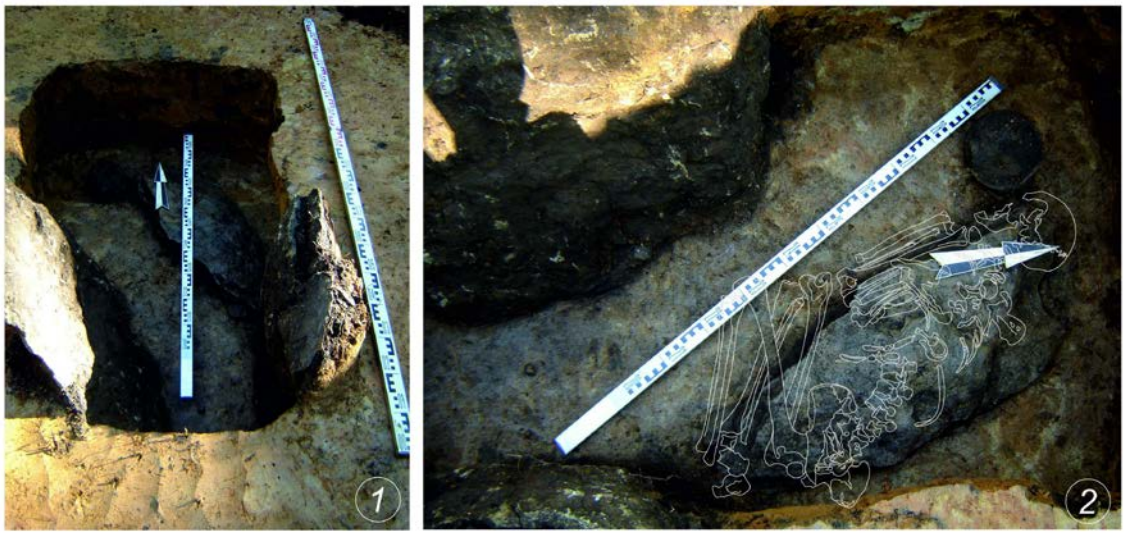


**Fig. 3: Kashkarovsky Kurgan Burial Ground. Burial 3. The Stone as a Substitute for the Deceased: 1. General view from the south; 2. Top view (reconstruction of the arrangement).**

Further search for analogies to the ritual in question revealed a significant number of burial pits that do not contain skeletal remains but do include archaeological material and individual stones not related to above-ground constructions. In most cases, the archaeological context of the stones' presence in the burials is ambiguous, and the absence of a skeleton could be explained by several factors: decomposition of bone material in infant or child burials, the activity of scavenging animals, looting, etc. Thus, the formation of the source base was carried out according to several criteria, the primary of which are the following: the undisturbed state of the complex, the original absence of a skeleton, and the non-random placement of a stone or stones in the grave. For objective reasons, the latter two parameters involve a certain degree of assumption. The absence of one of these features, or ambiguity in its interpretation, served as grounds for excluding a complex from the source base. As a result, a significantly reduced database was

obtained compared to the original version, including only thirteen burials distributed across five necropolises: those already mentioned (Kashkarovo and Ishkinovka III) as well as Lisakovsky I and Urefty I. All of the sites, with the exception of Urefty I, are located in open steppe and forest-steppe areas of the eastern foothills of the Southern Urals and Tobol, and are situated almost along the same latitude, 52° ± 1° N.

**Table 2. Source Base.**

| № | Burial grounds | Geographical Region | Reference | Ritual Group |
|---|---|---|---|---|
| 1 | Kashkarovsky, Kurgan 5, Burial 3 | Bashkir Trans-Urals | | Group A |
| 2 | Ishkinovka III, Kurgan 1, Burial 4 | Steppe zone of the Southern Trans-Urals | (Tkachev, 2012) | Group A |
| 3 | Lisakovsky I, Group B, Enclosure 6, Burial 2 | Tobol | (Usmanova, 2005: 46, fig. 24, *11*) | Group B |
| 4 | Lisakovsky I, Group A, Enclosure 13, Burial | « – » | (Usmanova, 2005: 23, fig. 12, *8*) | Group C |
| 5 | Lisakovsky I, Group B, Enclosure 6, Burial 1 | « – » | (Usmanova, 2005: 46, fig. 24, *5*) | Group C |
| 6 | Lisakovsky I, Group B, Enclosure 12, Burial | « – » | (Usmanova, 2005: 48, fig. 25, *7*) | Group C |
| 7 | Lisakovsky I, Group B, Enclosure 5, Burial | « – » | (Usmanova, 2005: 46, fig. 24, *4*) | Group C |
| 8 | Lisakovsky I, Group Г, Enclosure 12, Burial | « – » | (Usmanova, 2005: 59, fig. 33, *9-10*) | Group C |
| 9 | Urefty I, “Kurgan” 13, Burial 2 | « – » | (Stefanov and Korochkova 2006: 60, fig. 41, *7, 9*) | Group C |
| 10 | Lisakovsky I, Group A, Burial 15 | « – » | (Usmanova, 2005: 25, fig. 13, *3*) | Group D |
| 11 | Lisakovsky I, Group A, Burial 24 | « – » | (Usmanova, 2005: 26, fig. 16, *2*) | Group D |
| 12 | Lisakovsky I, Group Г, Enclosure 11, Burial | « – » | (Usmanova, 2005: 59, fig. 35, *6–8*) | Group D |
| 13 | Urefty I, Kurgan 2, Burial 9 | Forest-Steppe Trans-Urals | (Stefanov and Korochkova 2006: 19, fig. 11, *6*) | Group D |

The next group, of analogous complexes (eleven in total) includes cenotaphs with symbolic stones from the Lisakovsky I and Urefty I burial grounds. In her study of the manifestation of the stone cult in the materials from the Lisakovsky I cemetery, Usmanova identifies a group of cenotaph graves that show no signs of looting, at the bottom of which stone slabs were found (Usmanova, 2007: 89; 2013: 117–118). In some cases, the slabs were placed one on top of another. The care with which these slabs were arranged in the burial pit led to the conclusion that these stones were used as symbolic substitutes for the deceased (Usmanova, 2005: 125–126).

When analyzing the materials from the Urefty I burial mound, researchers also note the presence of so-called sacred burials (cenotaphs) in the Alakul section of the necropolis (Stefanov & Korochkova, 2006: 72–73) . In the present study, their observations regarding the use of stone in the arrangement of Alakul burials are of particular interest. Three types are distinguished:

– Stone as a commemorative marker. It was installed at the edge of the grave, near the sod mound constructed above the pit, or on top of it;

– Stones on the covering. After the covering was destroyed, they ended up in the pit or in the fill;

– Stones intentionally laid at the bottom of the pit.

Three variants of using stone as a symbolic substitute for the deceased are thus noted. A separate group (Group B) is comprised of the unique Burial 2, discovered in enclosure 6, group B of the Lisakovsky I burial ground (see: Fig.4, 3). Here, within a rectangular pit, a curved stone arrangement was recorded, which, in our view, imitates the presumed flexed position of a skeleton on its left side. The "head area" is marked by a vessel and a large stone (Usmanova, 2005: 46, fig. 24, 11). This group occupies an intermediate position between cenotaphs with stele-like stones as substitutes for the deceased and burial groups where the symbols are represented by individual small stones or slabs, or several stones placed in a specific area of the burial chamber floor.

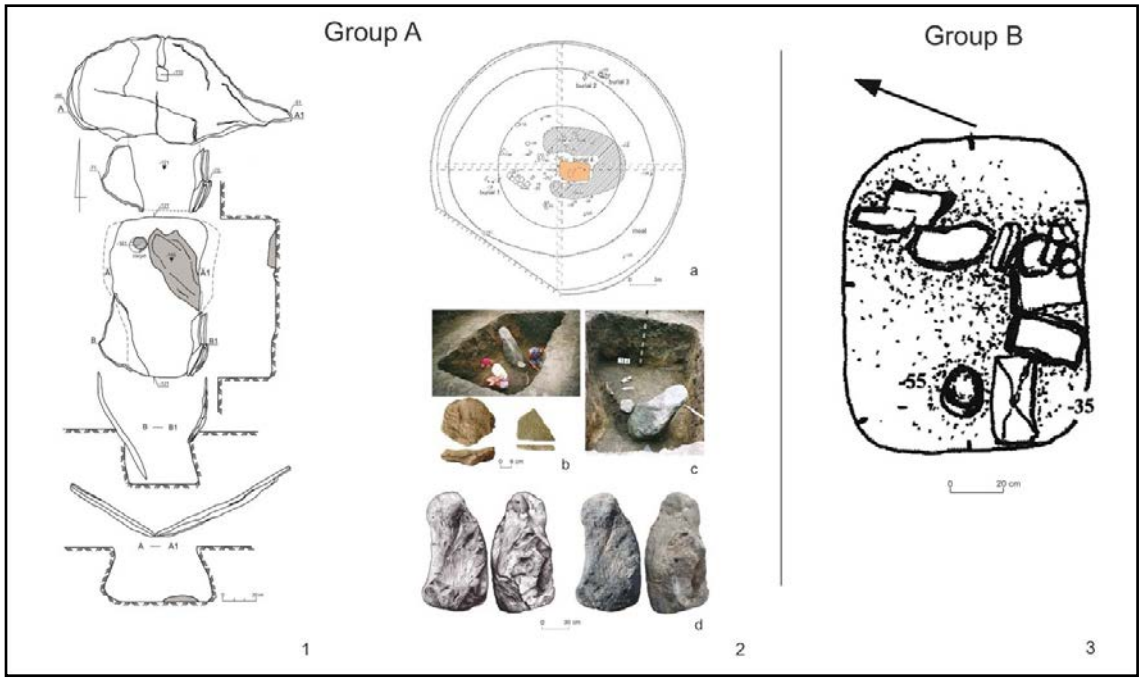


**Fig. 4: Ritual Groups (A and B) of Cenotaph Burials with Stones as Substitutes for the Bodies of the Deceased. Bronze Age. Ural-Kazakhstan Region. 1. Kashkarovsky, Kurgan 5, Burial 3; 2. Ishkinovka III, kurgan 1, burial 4 (Tkachev, 2012: fig.1, 3), 2a. plan of the kurgan; 2b. stone tools from the burial; 2c. photographs of the burial pit; 2d. stone anthropomorphic stele from the Burial Pit 3 – Lisakovsky I, Group B, Enclosure 6, Burial 2 (Usmanova, 2005: 46, fig. 24, 11).**

Group C includes six burials: five from the Lisakovsky I burial ground and one from the Urefty I burial mound (see: Fig. 5). The main difference from the previous group is that here, the substitute for the deceased is represented by 2–4 individual stones or stone slabs measuring 0.15–0.2 × 0.3–0.5 meters. The placement of the stones tends to be toward the center of the burial chamber in three complexes from the Lisakovsky I burial ground (Group A, Enclosure 13, Burial; Group B, Enclosure 6, Burial 1; and Enclosure 12, Burial), (Usmanova, 2005: 23, fig. 12, 8: 46, fig. 24, 5: 48, fig. 25, 7).

In two burial pits at the Lisakovsky I burial ground, the stones were found near one of the short walls. In the burial of Enclosure 5, Group B, four stones were arranged in a row along the wall (Usmanova, 2005: 46, fig. 24, 4), while in the burial of Enclosure 12, Group Г, the stones were positioned in the rounded corners of the burial chamber (Usmanova, 2005: 59, fig. 33, 9–10).

Only in one case can it be stated with sufficient certainty that the stones were laid along the long wall of the pit at the Urefty burial mound, "Kurgan" 13, Burial 2. Here, three large stones were uncovered in a row along the long western wall of the chamber (Stefanov & Korochkova, 2006: 60, fig. 41, 7, 9).

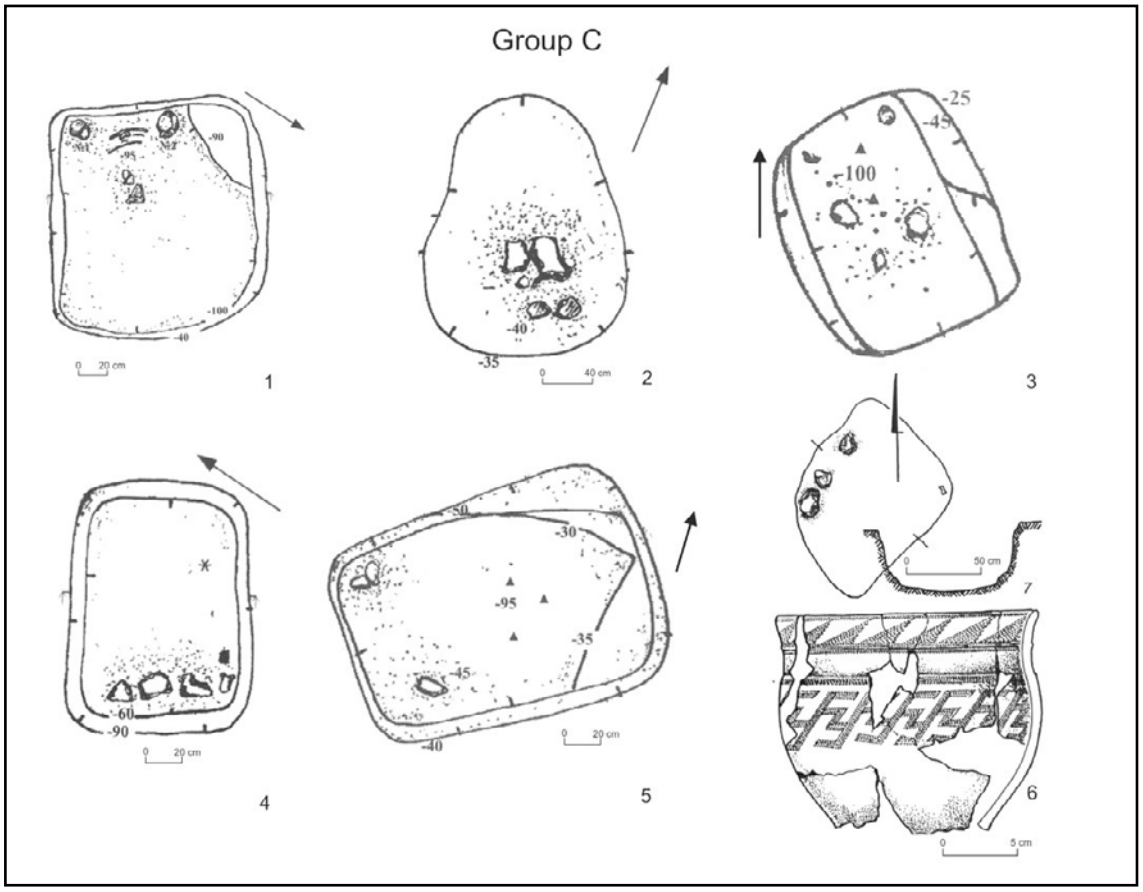


**Fig. 5: Ritual Group C of Cenotaph Burials with Stones as Substitutes for the Bodies of the Deceased. Bronze Age. Ural-Kazakhstan Region: 1. Lisakovsky I, Group A, Enclosure 13, Burial (Usmanova, 2005: 23, fig. 12, 8); 2. Lisakovsky I, Group B, Enclosure 6, Burial 1 (Usmanova, 2005: 46, fig. 24, 5); 3. Lisakovsky I, Group B, Enclosure 12, Burial (Usmanova, 2005: 48, fig. 25, 7); 4. Lisakovsky I, Group B, Enclosure 5, Burial (Usmanova, 2005: 46, fig. 24, 4); 5. Lisakovsky I, Group Г, Enclosure 12, Burial (Usmanova, 2005: 59, fig. 33, 10); 6. Urefty I, "Kurgan" 13, Burial 2 (Stefanov & Korochkova, 2006: 60, fig. 41, 9).**

Group D consists of cenotaph burials in which a single stone, measuring 0.2–0.25 × 0.3–0.4 meters, was placed at the bottom. A total of four such complexes have been identified: Group A, Burial 15; Burial 24; Group D, Enclosure 11, Burial at Lisakovsky I burial ground (Usmanova, 2005: 25, fig. 13, 3; 26, fig. 16, 2; 59, fig. 35, 6–8) as well as Kurgan 2, Burial 9 of the Urefty I burial mound (Stefanov & Korochkova, 2006: 19, fig. 11, 6). In all cases, the stone was located near the short wall of the burial chamber, opposite the wall where vessels were placed (see: Fig.6).

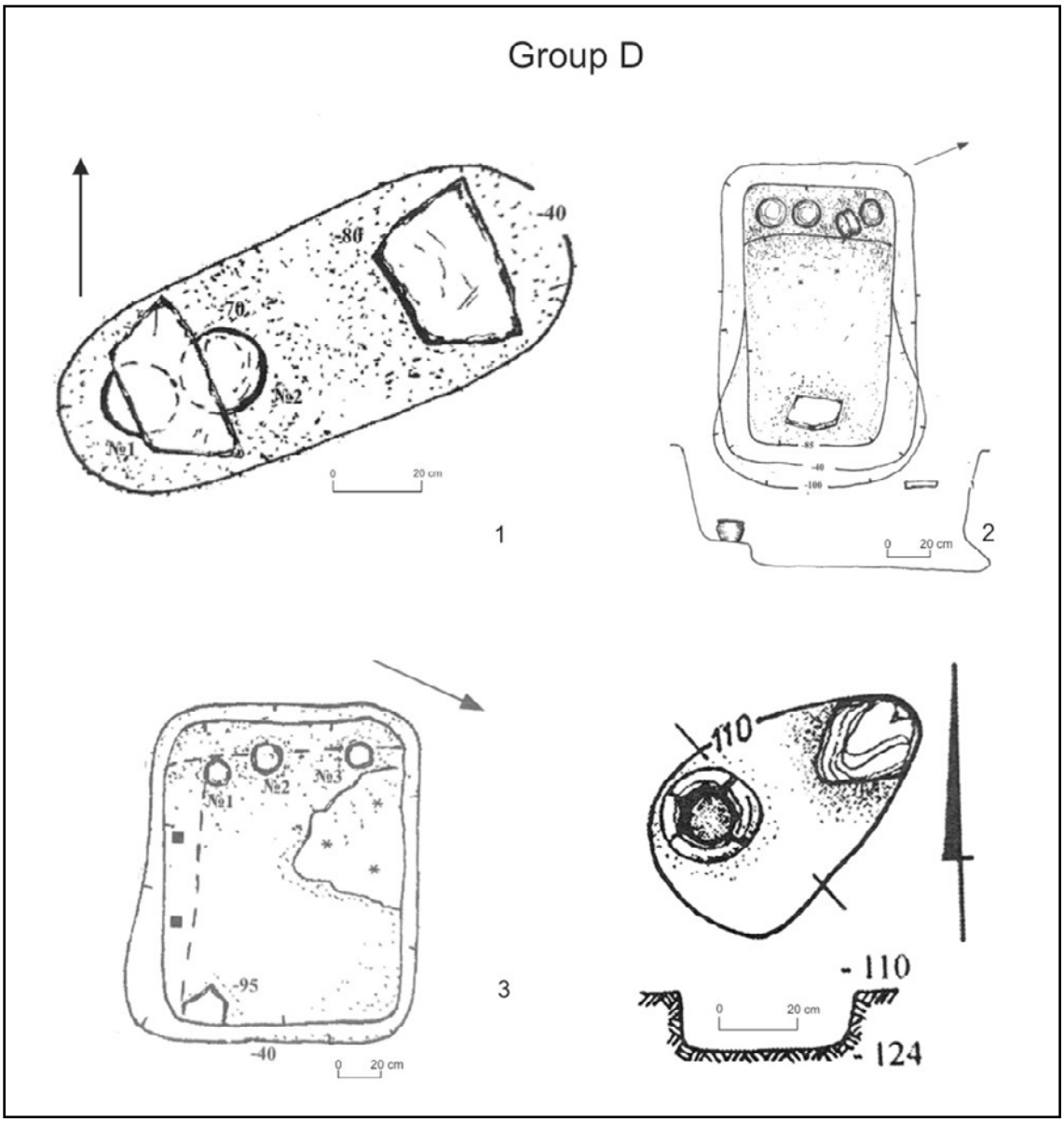


**Fig. 6: Ritual Group D of Cenotaph Burials with Stones as Substitutes for the Bodies of the Deceased. Bronze Age. Ural-Kazakhstan Region: 1. Lisakovsky I, Group A, Burial 15 (Usmanova, 2005: 25, fig. 13, 3); 2. Lisakovsky I, Group A, Burial 24 (Usmanova, 2005: 26, fig. 16, 2); 3. Lisakovsky I, Group Г, Enclosure 11, Burial # (Usmanova, 2005: 59, fig. 35, 6); 4. Urefty I, Kurgan 2, Burial 9 (Stefanov & Korochkova, 2006: 19, fig. 11, 6).**

## 6. Conclusions

These specific forms of funerary ritual among the Late Bronze Age populations of the Southern Urals and Tobol are not unique to the steppe zone of Central Eurasia. Only a few examples will be mentioned here. For instance, in catacomb funeral rites, amorphous anthropomorphic stone stelae are present, often found in the shaft at the entrance to the chamber. Studies distinguish three interpretations of their function in burials: utilitarian (as structural supports), sacred or protective functions, and as symbols of human sacrifice (Feshchenko, 2014).

Recent studies of ritual sites with deer stones and structures in the khirigsuur kurgans of Tuva and Mongolia have demonstrated that these served as symbolic substitutes for real individuals

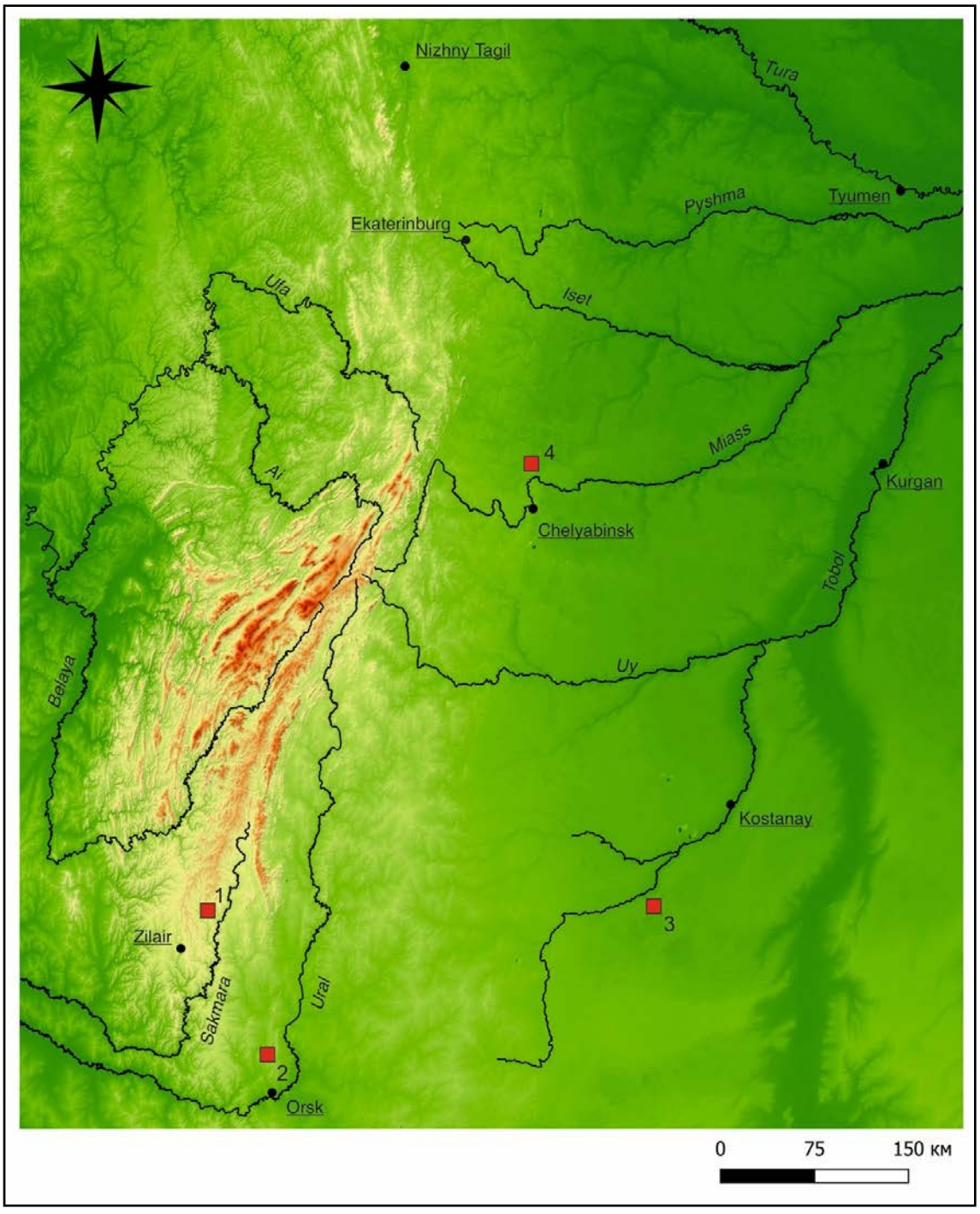


**Fig. 7: Map of sites. 1. Kashkarovsky; 2. Ishkinovka III; 3. Lisakovsky I; 4. Urefty I.**

within such complexes (Kovalev and Erdenebaatar, 2007: 104; Kovalev et al., 2014: 50). Fedorov-Davydov (1976: 92) defined ancient Turkic stone statues not only as temporary receptacles but also as substitutes or doubles of the deceased. Kubarev (2007), following Fedorov-Davydov, does not consider the tradition of making or installing stone statues to be a widespread cult, restricting the sphere of veneration to relatives.

The most specific ethnographic examples of the use of symbolic substitutes for the deceased in funerary rites are found among the peoples of the Sayan-Altai region: the Khanty, Mansi, Nenets, Enets, Nganasans, and Yakuts (Gurvich, 1980). A similar rite has been recorded among the peoples of the Lower Amur: the Nanais, Ulchis, Negidals, and Orochis (Kuzmin, 2008). Regarding the peoples of the Volga-Ural region, the observations of Vasiliev (1904: 467) on the funeral rites of the Chuvash are of particular interest. Specifically, the use is noted, during the fortieth-day commemoration, of a substitute for the deceased in the form of a wooden or stone (emphasis added by us) block with crudely carved facial features.

Thus, the burial pit with a stone stele at the Kashkarovsky burial mound is, in fact, a unique funerary cenotaph complex, in which the deliberate placement of a stone at the bottom can be confidently associated with the ritual of substituting for the bodies of the deceased. The presence of only a small number of analogies points to the atypical nature of this rite in the funerary practice of the Srubnaya-Andronovo population in the southern Ural forest-steppe in Late Bronze Age. The question of the time of appearance and the origins of this tradition remains unclear. For now, it can only be stated that there is a clear Alakul-Fedorovo cultural dominance. However, confirmation of this hypothesis is possible only with the expansion of the source base.

The expansion of the source base and research field is a necessary condition for reconstructing the origins of this burial practice and for verifying hypotheses about the ways in which this specific funerary tradition spread among the Bronze Age pastoralists of the steppe and forest-steppe zones of Central Eurasia.

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# مـطالعات باسـتان‌شـنـاسی

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# سنگ به‌عنوان نماد در آئین‌های تدفینی حوزهٔ فرهنگی اسروبنایا-آندرونوو


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**چکیده**

این پژوهش به بررسی نقش سنگ به‌عنوان جانشین نمادین پیکر متوفی در آئین‌های تدفینی حوزهٔ فرهنگی اسروبنایا-آندرونوو در اواخر عصر مفرغ در منطقهٔ اورال جنوبی می‌پردازد. مبنای پژوهش، داده‌های به‌دست‌آمده از گورستان تپه‌ای کاشکاروفسکی (واقع‌در بخش ماورالنهر از اورالِ باشقیرستان) است، به‌ویژه گور شمارهٔ ۳ از تپهٔ شمارهٔ ۵ که در آن یک استل سنگی انسان‌نما کشف شد و به‌عنوان عنصر مرکزی یک «سنوتاف» (قبر یادبود بدون جسد) تفسیر گردید. به‌نظر می‌رسد که در این بستر، سنگ علاوه‌بر داشتن کارکردی مقدس، جایگزین بدن غایب متوفی نیز بوده است. این پژوهش گونه‌شناسی مجموعه‌های مشابه را ارائه کرده و آن‌ها را بر اساس نحوهٔ قرارگیری عمدی و ویژگی‌های سنگ‌ها در گودال‌های تدفین به چهار گروه تقسیم می‌کند؛ گروه A سنگ‌های شبیه استل که در گودال‌های تدفین قرار داده شده‌اند. گروه B سنگ‌های منفرد که به‌طور عمدی در کف گودال گذاشته شده‌اند و گاه حالت بدن خمیده را شبیه‌سازی می‌کنند. گروه‌های C و D شامل سنوتاف‌هایی با چند سنگ یا یک تخته‌سنگ منفرد در کف قبر قرار گرفته است. گودال تدفین با استل سنگی در گورستان کاشکاروفسکی درواقع یک مجموعهٔ تدفینی سنوتاف منحصربه‌فرد است که در آن قرار دادن عمدی سنگ در کف گودال را می‌توان با اطمینان به آئین جایگزینی بدن متوفی نسبت داد. تعداد اندک نمونه‌های مشابه، نشان‌دهندهٔ غیرمعمول بودن این رسم در آئین تدفینی مردم اسروبنایا-آندرونوو در جنگل‌استپ اورال جنوبی در اواخر عصر مفرغ است. خاستگاه این سنت هم‌چنان نامشخص است، اما پیوند آن با سنت‌های تدفینی آلاکول-فدوروفو در محوطه‌های اورال جنوبی و قزاقستان شناسایی شده است. برای تأیید این فرضیه، لازم است دامنهٔ منابع باستان‌شناسی گسترش یابد.



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## Nebuchadnezzar II and the Jews: A Critical Reassessment of Archaeological, Historical, and Religious Narratives

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**Abstract**

The figure of Nebuchadnezzar II continues to fascinate scholars precisely because of the striking contradictions in how different sources remember him. While Babylonian records celebrate a pious king and master builder, biblical texts cast him alternately as God's instrument of judgment and a symbol of tyrannical pride. This study aims to unravel these competing narratives, examining how the trauma of exile has shaped Jewish memory and how theological concerns have influenced historical accounts. Rather than simply cataloging different perspectives, I argue that understanding Nebuchadnezzar requires recognizing how the Babylonian exile became a defining moment that fundamentally transformed Jewish identity. The destruction of the First Temple was not merely a political catastrophe—it forced an entire people to reimagine their relationship with the divine. The figure of Nebuchadnezzar, whether depicted as a divine agent or an arrogant tyrant, served the needs of different communities to make sense of this upheaval. Through careful analysis of Babylonian administrative records, biblical literature, and the later Islamic sources, this research reveals how historical memory gets constructed and reconstructed across cultures. The supposed "religious conversion" of Nebuchadnezzar in Daniel, I contend, tells us more about the theological struggles of the exiled Jews than about any genuine spiritual transformation of the Babylonian king.

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## 1. Introduction

### - Why Nebuchadnezzar Still Matters

When I first encountered the story of Nebuchadnezzar's supposed madness in the Book of Daniel, I was struck by how dramatically it differed from the confident royal inscriptions found in Babylon. Here was a king who, according to one tradition, crawled on all fours eating grass like an animal, while according to another, he was building magnificent temples and expanding a glorious empire. This contradiction sparked my interest in how different communities remember the same historical figures in fundamentally different ways.

Nebuchadnezzar II governed the Neo-Babylonian Empire between 605 and 562 BCE, a time marked by major political and cultural developments in the ancient Near East (Wiseman, 1985: 1). His military campaigns reshaped the regional balance of power, while his architectural projects transformed Babylon into one of the ancient world's most magnificent cities (Beaulieu, 2018: 123; Lundbom, 2017b: 45; Pedersén, 2021: 89). Yet for many readers today, his name is inextricably linked with one particular act: the destruction of Jerusalem and the exile of its inhabitants.This event was not simply another imperial conquest. For the Jewish people, it marked a crisis that would reshape their entire understanding of God, covenant, and identity (Lipschits, 2005: 25; Albertz, 2003: 112). The loss of land, the Temple, and political independence forced profound questions: Had God abandoned his people? Could faith survive without a homeland? How should communities that are scattered maintain their traditions in foreign lands (Smith-Christopher, 2002: 56; Grabbe, 2006: 88).

## 2. The Challenge of Competing Narratives: Problem Statement

The central problem this research addresses is not just historical but also methodological. How do we approach sources that tell fundamentally different stories about the same events? The Babylonian chronicles present Nebuchadnezzar's campaigns as legitimate responses to rebellions. Biblical accounts portray them as a divine judgment on a sinful population. Later Islamic traditions suggest the possibility of King Nebuchadnezzar's eventual conversion to monotheism.

Each tradition serves different purposes and emerges from distinct contexts. The Babylonian royal inscriptions were designed to legitimize imperial power and demonstrate divine favor (Beaulieu, 2018: 150; Wiseman, 1985: 20; Da Riva, 2014: 78). Biblical narratives sought to explain the catastrophe while maintaining faith in God's ultimate justice (Collins, 2008: 34; Bandstra, 2004: 112; Sack, 2004: 67). Islamic accounts attempted to integrate earlier traditions into a broader monotheistic framework. Rather than simply choosing one narrative over others, this study examines how these different memories developed and what they reveal about the communities that preserved them. I am particularly interested in how the experience of exile shaped Jewish interpretations of Nebuchadnezzar and how these interpretations, in turn, influenced the development of post-exilic Judaism.

## 3. Research Questions and Methodology

**- Several key questions guide this investigation**

First, what can we know about the historical Nebuchadnezzar beyond the competing religious and political interpretations? While complete objectivity remains impossible, careful analysis of contemporary sources can help us distinguish between documented events and later theological elaborations.

Second, how did the experience of exile influence Jewish perceptions of Nebuchadnezzar and the meaning of their suffering? The biblical portrayal of the king was shaped not just, by what happened but also by how displaced communities sought to understand and cope with their loss.

Third, what role did the figure of Nebuchadnezzar play in the broader transformation of Jewish religious life during and after the exile? I suggest that narratives about the king served as vehicles for working through fundamental theological questions about divine justice, human agency, and the nature of the covenant.

Finally, how do later traditions—particularly Islamic sources—reinterpret earlier narratives about Nebuchadnezzar, and what does this tell us about the ongoing construction of religious memory?

My approach combines historical analysis with attention to the literary and theological dimensions of ancient sources. I treat religious texts not as simple historical records but as complex documents that reveal how communities understood their past and envisioned their future. This requires careful attention to the genre, audience, and historical context.

## 4. Significance of the Research

This research sheds light on a pivotal period in the history of the ancient Near East, which witnessed significant political and civilizational transformations. It provides an in-depth analysis of an influential historical figure, Nebuchadnezzar II. The research provides a platform for a comparative study of different religious narratives and interpretations of a single historical event and a single figure, which helps in understanding the evolution of religious thought and the relationships between the three religions. The research encourages critical engagement with historical and religious sources, distinguishing between historical facts and ideological interpretation, which is essential in the study of ancient and religious history. The research seeks to compile and synthesize scattered knowledge from multiple studies (including the attached research papers) on this topic, presenting it within a comprehensive and organized academic framework, thereby enriching the world's library in this field. The research helps in understanding the deeper roots of certain stereotypes or prejudices about historical figures and events, and contributes to building a more balanced and objective view of the shared history of the region's peoples. Through this comprehensive and comparative study, we hope to make a valuable contribution to the understanding of the complex relationship between Nebuchadnezzar II and the Jews and the implications of this relationship on the course of history and civilization in the ancient Near East.

## 5. Historical Context: Assyria's Collapse and The Rise of Neo-Babylonian Power

The political landscape of the ancient Near East underwent a dramatic transformation during the late seventh century BCE. For centuries, the Assyrian Empire had dominated the region through a combination of military might and administrative efficiency (Grayson, 1975: 47-49; Oded, 1979: 134-137). Yet by the 640s BCE, internal succession disputes and external pressures were weakening Assyrian control. The death of Ashurbanipal around 627 BCE triggered a crisis that would reshape the entire region. Various subject peoples saw an opportunity to assert independence, while ambitious rulers sought to fill the emerging power vacuum. Among these was Nabopolassar, who declared Babylonian independence in 626 BCE and began building what would become the Neo-Babylonian Empire.

What made Nabopolassar's revolt different from earlier Babylonian attempts at independence was his ability to forge strategic alliances, particularly with the Medes. The coordinated assault on Assyrian strongholds culminated in the capture of Nineveh in 612 BCE—an event that sent shockwaves throughout the ancient world (Sack, 1983: 88-92; Lundbom, 2017a: 210). The great capital that had once struck terror into subject people lay in ruins, its palaces burned, and its inhabitants scattered.

This collapse created opportunities but also dangers. While Babylon was now free to pursue its own imperial ambitions, it faced competition from Egypt, which sought to expand its influence northward (Wiseman, 1956: 111-113; Novotny & Weiershäuser, 2024: 22-24). The struggle between these emerging powers would profoundly affect the smaller kingdoms caught between them, particularly Judah. Nabopolassar emerged as a central figure in this transformation (Oded, 1979: 145-147; Grayson, 1975: 52-53; Frame, 1995: 279-281). He was of Chaldean descent—part of the Aramean tribes settled in southern Mesopotamia—and proved himself both an ambitious ruler and a skilled military commander. Taking advantage of the chaos following Ashurbanipal's death, he declared Babylonian independence from Assyria in 626 BCE and claimed the title "King of Babylon."

The alliance with the Medes proved crucial for eliminating Assyrian power. This partnership, reportedly reinforced by the marriage of Nabopolassar's son Nebuchadnezzar to Amitis, daughter of the Median king, enabled coordinated attacks that led to the fall of Nineveh (Wiseman, 1956: 15). Nabopolassar not only liberated Babylonia but also actively sought to inherit Assyrian territories, particularly in Mesopotamia and Syria.

## 6. Judah's Precarious Position

The Kingdom of Judah in the late seventh century BCE was a small state facing enormous challenges. Since the fall of the northern kingdom of Israel in 722 BCE, Judah had served as the sole repository of Israelite identity and tradition (Lipschits, 2005: 30; Grabbe, 2006: 115). Yet its location between major powers made independence extremely difficult to maintain. Some kings, like Hezekiah, had adopted policies of resistance against Assyrian domination, though these efforts ultimately failed and led to heavier tribute payments (Grabbe, 2006: 120). Manasseh, by

contrast, had accommodated Assyrian influence and provided temporary stability, but coincided with what biblical texts describe as a period of religious deviation (2 Kings 21).

King Josiah had attempted to take advantage of Assyrian weakness by implementing religious reforms aimed at centralizing worship in Jerusalem while expanding the kingdom's influence (Bright, 2000: 290). His death at Megiddo while attempting to block Egyptian advances marked the end of Judah's brief period of relative autonomy. Subsequently, Judah fell under Egyptian influence, becoming entangled in the struggle for hegemony over Syria and Palestine between Egypt and Babylon (Bernd, 2010: 55; Kent, 2013: 88). Internally, the kingdom faced deep political and religious divisions. Prophets like Jeremiah opposed reliance on political alliances and advocated for repentance—a stance that would prove prophetic as the kingdom faced collapse and exile (Jeremiah 1-9; Miller & Hayes, 1986: 380; Tantlevskij, 2020: 110).

## 7. The Battle of Carchemish: A Turning Point

The confrontation at Carchemish in 605 BCE marked a decisive shift in regional power (Bernd, 2010: 60). The battle pitted Nebuchadnezzar, and then the crown prince, against Egyptian forces allied with Assyrian remnants under Pharaoh Necho II. The crushing Babylonian victory near the Euphrates River effectively ended Egyptian territorial ambitions in the Levant and established Babylon as the dominant regional power (Wiseman, 1956: 20; Fantalkin, 2017: 150: Holloway2018: 75-77). For Judah, the implications were immediate and dire. King Jehoiakim, who had been within Egypt's sphere of influence, was compelled to declare submission to Babylon and begin paying tribute (2 Kings 24: 1; Bernd, 2010: 65). Following his victory, Nebuchadnezzar was forced to return to Babylon upon the news of his father's death, beginning a reign that would witness complete Babylonian domination and Judah's eventual destruction (Lundbom, 2017b: 90; Novotny & Weiershäuser, 2024: 112).

## 8. Nebuchadnezzar II: Military Genius and Imperial Strategy

Nebuchadnezzar's rise to power in 605 BCE came at a crucial moment. Fresh from his victory at Carchemish, he was conducting military operations in the Levant when the news of his father's death arrived. The speed with which he returned to Babylon and secured the throne suggests both the loyalty of his key supporters and his own political acumen (Wiseman, 1956: 25; Beaulieu, 2018: 190). The new king inherited an empire still in formation. While Nabopolassar had successfully thrown off Assyrian rule and established Babylonian independence, the territorial extent and administrative structures of the new state remained fluid. Nebuchadnezzar faced the challenge of consolidating these gains while expanding the Babylonian influence. His origins have been subject to historical debate. Contemporary Babylonian inscriptions clearly identify him as Nabopolassar's eldest son, placing him within the Chaldean-Aramaic tribal confederation (Wiseman, 1985: 30; Roux, 1992: 345; Beaulieu, 2018: 180). His Akkadian name, "Nabû-kudurri-uṣur," meaning "O Nabu, protect my heir," reflects devotion to the Babylonian god Nabu (Eph'al, 2003: 78; Da Riva, 2014: 110). Later Islamic sources sometimes attribute different origins to

him, but these accounts lack archaeological corroboration and likely reflect later interpretive traditions rather than historical fact (Al-Tabari, 1967, vol. 1: 500; Mahmood & Nori, 2019: 45).

From the outset, Nebuchadnezzar confronted substantial challenges. He needed to complete the expulsion of Egyptian influence from the Levant and subjugate rebellious kingdoms such as Ashkelon and Sidon (Sack, 2004: 80). The effective governance of the vast and newly acquired territories required the development of robust administrative frameworks, building upon the systems inherited from the defunct Assyrian Empire. Additionally, he faced persistent rebellions, particularly in western provinces, often instigated or supported by Egypt, necessitating continuous military campaigns (Lundbom, 2017b: 100). Nebuchadnezzar's military campaigns reveal sophisticated strategic thinking. Rather than simply pursuing conquest for its own sake, he sought to create a stable imperial order that would secure Babylon's borders and economic interests (Novotny & Weiershäuser, 2024: 63-67). After his decisive victory at Carchemish, he embarked on systematic campaigns aimed at expanding imperial borders, stabilizing Babylonian hegemony in the Levant, and deterring Egyptian resurgence. His focus on the "Hatti" region, the Levantine territories, was particularly intense. He subdued Phoenician coastal cities and various Aramaic, Hebrew, and Edomite kingdoms. Ashkelon was destroyed in an early campaign in 604 BCE, demonstrating Babylonian power (Novotny & Weiershäuser, 2024: 63-67). The siege techniques employed by the Babylonian forces were highly advanced for their time, combining engineering expertise with psychological warfare.

Judah became a major flashpoint due to its frequent rebellions, often with Egyptian support. An inconclusive confrontation with Egypt in 601 BCE was followed by King Jehoiakim's rebellion, prompting Nebuchadnezzar to besiege Jerusalem in 598/597 BCE, resulting in the first Babylonian exile (Albertz, 2003: 441-444). The second rebellion under Zedekiah proved more destructive, culminating in a prolonged siege that ended in 587/586 BCE with Jerusalem's destruction and the Temple's burning, leading to the second and more extensive Babylonian exile (Lipschits, 2005: 89-93; Tantlevskij, 2020: 304-308). The thirteen-year siege of Tyre demonstrates both Nebuchadnezzar's persistence and his strategic adaptability. While he never stormed the city, he ultimately received its political submission and tribute (Shahar, 2015: 144-146; Dixon, 2022: 165-199; Belsky, 2023: 212-215). Scattered sources also refer to campaigns in Anatolia and the Arabian Peninsula, although the details remain limited.

Beyond his military achievements, Nebuchadnezzar transformed Babylon into one of the ancient world's most magnificent cities. The Ishtar Gate, the Hanging Gardens (whose historical existence remains debated), and numerous temples he constructed or restored testified to both his ambition and the empire's wealth (Dalley, 1994: 12; Reade, 2000: 183). These projects served multiple purposes beyond mere display. They demonstrated the king's piety and his special relationship with the gods, particularly Marduk and Nabu—a traditional means of legitimizing royal authority in Babylonian culture (Novotny & Weiershäuser, 2024: 140). They provided employment and economic stimulus for Babylon's population while projecting power to foreign visitors.

The scale of these undertakings was unprecedented. Advanced construction projects, financed from imperial resources, contributed to economic dynamism and job creation, promoting social stability (Wiseman, 1985: 75-78; Beaulieu, 2018: 94-101). The king's royal inscriptions consistently portray him as a pious ruler serving the gods, supervising the restoration and construction of major temples to ensure political legitimacy through religious patronage.

## 9. The Destruction of Judah: Politics, Strategy, and Catastrophe

### Understanding the Babylonian Motivations

The Babylonian campaigns against Judah were not random acts of aggression but calculated responses to specific political and strategic challenges. Judah's location made its loyalty crucial for maintaining communication between Babylon and its western territories (Lipschits, 2005: 40). Egyptian efforts to regain influence in the Levant often focused on encouraging rebellion among Babylonian vassals, with Judah being a frequent target of such diplomatic overtures. From Nebuchadnezzar's perspective, Judah's repeated rebellions represented not just political defiance but threats to imperial stability. His primary objective was strengthening his empire and eliminating potential threats to its stability. Judah's flirtations with Egypt, despite explicit warnings from Babylonian authorities and even its own prophets like Jeremiah, were perceived as direct challenges to Babylonian hegemony.

The initial deportations, such as that of King Jehoiachin and the elite in 597 BCE, were likely intended as punitive measures and a means of removing influential figures who might incite further rebellion, while simultaneously integrating skilled labor into the Babylonian economy (Younger, 1998: 55). However, persistent defiance under King Zedekiah, culminating in his alliance with Egypt, forced more drastic action. The final siege and destruction of Jerusalem in 587/586 BCE were not merely acts of vengeance but calculated strategies to neutralize a persistent geopolitical irritant and send an unequivocal message to other vassal states about the futility of resistance (Albertz, 2003: 130). The destruction of the Temple served both symbolic and practical purposes—dismantling the spiritual heart of the Jewish national identity while demonstrating Babylonian power. The systematic deportation of skilled populations was a deliberate policy to weaken conquered territories while enriching the imperial core (Oded, 1979: 80).

## 10. The Role of Egypt

Egyptian involvement in Judean affairs proved consistently destabilizing (Bernd, 2010: 112-115). With Babylon's rise, Egypt attempted to regain influence in the Levant by exploiting small kingdoms like Judah. Although Judah had been subjugated after Carchemish, a pro-Egyptian political current within the Jewish court continued to see Egypt as a potential ally against Babylonian domination. Biblical texts, especially Jeremiah and Ezekiel, show how the prophets warned against relying on Egypt, calling it an unreliable ally or "bruised reed" (Jeremiah 2: 18; 37: 5-10; Ezekiel 17: 15-17). However, Zedekiah chose this dangerous course, sending

delegations requesting Egyptian support, to which Egypt responded by sending an army north to break the Babylonian siege of Jerusalem (Daniel, 2014: 156-158; Belsky, 2023: 221-223).

Although the Babylonian army temporarily withdrew to face this Egyptian threat, the intervention failed to yield decisive results. The Egyptians withdrew quickly, allowing Nebuchadnezzar to resume the siege until the city fell in 586 BCE. Judah's dependence on Egypt proved a costly strategic mistake, as Egypt was unable to provide decisive support and even exacerbated the crisis by giving Babylon additional justification for destroying the kingdom as punishment for allying with its largest regional enemy (Eph'al, 2003: 117-120; Lipschits, 2005: 89-91).

## 11. The First Campaign (597 BCE): Elite Deportation

The first Babylonian campaign against Judah in 597 BCE resulted directly from King Jehoiakim's rebellion, taking advantage of Babylon's preoccupation with Egypt in 601 BCE. After reorganizing his forces, Nebuchadnezzar sent an army to besiege Jerusalem, but Jehoiakim died under mysterious circumstances before the army arrived. His son Jehoiachin, who succeeded him, was forced to surrender after only three months to spare the city from destruction (2 Kings 24: 10-12). Nebuchadnezzar's response was firm but measured. Rather than complete destruction, he looted temple and palace treasures and took Judah's political, military, and economic elite to Babylon, including Jehoiachin and his family, military leaders, skilled craftsmen, and senior officials (Wiseman, 1956: 32). Biblical texts estimate 10,000 exiles, while Jeremiah refers to a lower figure of 3,023 (Jeremiah 52: 28). Nebuchadnezzar's annals confirm this event, dated to the twelfth month of his seventh regnal year.

Nebuchadnezzar appointed Mattaniah, Jehoiachin's uncle, as the new king, changing his name to Zedekiah and requiring an oath of allegiance (2 Kings 24: 17). This policy aimed to weaken Judah while maintaining its vassal status. However, Jehoiachin continued to be viewed as the legitimate monarch, and Babylonian documents show he received relatively privileged treatment as a royal captive (Weidner, 1939: 7-8; Laurie & Cornelia, 2014: 232-235), contributing to continued hopes for resistance that would later lead to Zedekiah's rebellion.

## 12. The Second Campaign (587/586 BCE): Complete Destruction

Zedekiah's rebellion, despite being appointed by Nebuchadnezzar, directly triggered the second Babylonian campaign. With Egyptian support and instigation, Zedekiah revoked his oath of allegiance to Babylon around 589 BCE, prompting a swift Babylonian response. The army imposed a prolonged siege lasting two and a half years under tragic humanitarian conditions (2 Kings 25: 1-3; Jeremiah 52: 4-6). Although Egyptian forces attempted to break the siege, their intervention failed, and the Babylonians resumed their attack until breaking through the city walls in the summer of 587/586 BCE (Jeremiah 39: 2). Zedekiah fled but was captured and taken to Riblah, where Nebuchadnezzar ordered his sons to be executed before him, then blinded him and took him to Babylon (2 Kings 25: 4-7).

A month after the city's fall, Nebuzaradan arrived to conduct systematic destruction. The Temple was burned, and the palaces and walls demolished—a spectacle that shocked Jewish consciousness (2 Kings 25: 8-10). This was followed by mass exile, including Jerusalem's remaining inhabitants and religious and administrative elites, while poor peasants were left in the land (Jeremiah 52: 29; 2 Kings 25: 11-12). Gedaliah ben Ahikam was appointed to govern the remnant, but his assassination led to an administrative breakdown and mass exodus to Egypt (Jeremiah 41-43). A third exile of approximately 745 people was recorded in 582 BCE (Jeremiah 52: 30). Thus ended the Kingdom of Judah as a political entity, beginning the exile period that would profoundly affect Jewish religious and cultural identity (Lipschits, 2005: 103-106; Albertz, 2003: 452-455; Levine, 2009: 28-30).

## 13. How Different Communities Remembered Nebuchadnezzar

### - The Babylonian Perspective: Royal Propaganda and Religious Devotion

Babylonian sources present Nebuchadnezzar in consistently positive terms, although we must remember that most texts were produced under royal patronage. The royal inscriptions emphasize his piety, building projects, and military victories, portraying him as the chosen representative of the gods, particularly Marduk and Nabu (Beaulieu, 2018: 200; Da Riva, 2014: 120).

These sources highlight temple restoration projects, including Esagila (Marduk's primary temple) and the Ziggurat of Etemenanki (associated with the Tower of Babel). Military successes are presented as necessary measures to maintain order and punish rebellious vassals, thereby ensuring stability and prosperity. There is no suggestion of divine punishment or personal arrogance; rather, they emphasize wisdom, power, and divinely appointed leadership.

Mentions of Jerusalem's destruction and population deportation are construed within imperial policies concerning rebellious subjects, without moral or theological judgment against Nebuchadnezzar himself. This represents state-sponsored historiography, carefully crafted to project absolute power, divine favor, and unwavering commitment to Babylonian welfare (Bandstra, 2004: 286-288; Sack, 2004: 72-76; Collins, 2008).

## 14. Biblical Narratives: The Divine Instrument and Arrogant Tyrant

Biblical depictions of Nebuchadnezzar are complex and seemingly contradictory. In Jeremiah, he appears as God's "servant," chosen to punish Judah for covenant violations (Jeremiah 25: 9). This portrayal serves crucial theological functions, maintaining divine sovereignty even in defeat by casting Babylonian victory as part of God's plan rather than evidence of divine weakness. Second Kings provides detailed accounts of the siege, wall breaching, temple burning, and deportations, describing Nebuchadnezzar as a direct agent in Judah's destruction (2 Kings 25). While historically factual, the essential theological message emerges clearly: this represents fulfilled prophecy and concrete evidence of God's righteous judgment. The narrative focuses not on Nebuchadnezzar's character or motives but on his role as an instrument fulfilling God's plan.

Ezekiel emphasizes Nebuchadnezzar's role as God's instrument against Tyre and Egypt,

presenting him as a tool for God to fulfill decrees against nations opposing Him (Ezekiel 29: 17-20). This demonstrates that history remains under God's control, with even foreign rulers serving His purposes. The Book of Daniel presents the most sophisticated psychological portrait. Initially appearing as an exceedingly powerful though pagan king who recognizes Daniel's supernatural wisdom, Nebuchadnezzar undergoes a dramatic transformation. In Daniel 2, he becomes troubled by dreams only Daniel can interpret, establishing the motif of conflict between royal power and Israel's God, who repeatedly challenges his pagan worldview.

The most remarkable development occurs in Daniel 4 with his sudden fall into madness and subsequent restoration. He is depicted as one consumed by tyrannical pride, boasting of his achievements while forgetting their divine source. His period of insanity, during which he behaves like an animal, continues until he recognizes the supremacy of the Highest God. His restoration depends on humble confession: "Now I, Nebuchadnezzar, praise and exalt and glorify the King of heaven, because everything he does is right and all his ways are just. Furthermore, those who walk in pride he is able to humble" (Daniel 4: 37).

This account serves profound theological purposes rather than providing a historical biography. It represents an allegorical tale demonstrating God's absolute sovereignty over earthly rulers and kingdoms. The narrative of Nebuchadnezzar's madness and restoration likely serves as a theological construction showing that even the mightiest pagan king must bow to Israel's God, carrying a message of hope and consolation for exiled Jewish communities that their suffering was part of a divine plan and that God remained active even in desperate circumstances.

## 15. Islamic Perspectives: Integration and Reinterpretation

Islamic sources provide varied perspectives on Nebuchadnezzar, often drawing on earlier Jewish and Christian traditions while adapting them to Islamic theological frameworks. The Quran does not mention Nebuchadnezzar by name, though it alludes to Jerusalem's destruction in ways later commentators connected to the Babylonian conquest. Surah Al-Isra (17: 4-7) discusses two periods of corruption by the Children of Israel followed by divine punishment, with many exegetes interpreting the first punishment as Jerusalem's destruction by the Babylonians. Later Muslim historians and exegetes, such as al-Tabari (d. 923) and Ibn al-Athir (d. 1233), provided elaborate accounts often blending material from Jewish (Israelite) traditions that entered Islamic literature (Al-Tabari, 1967, vol. 1: 500; Mahmood & Nori, 2019: 45). These accounts sometimes assign non-Babylonian origins to Nebuchadnezzar, such as Persian or Israeli descent, unsupported by contemporary evidence but reflecting cultural assimilation and reinterpretation processes.

One interesting aspect of the Islamic portrayal concerns his possible conversion or interaction with prophets. While not clearly indicating conversion to monotheism, some traditions refer to his encounters with figures like Daniel or Jeremiah and his ultimate acknowledgment of God's supremacy. This fits within broader Islamic themes regarding universal divine revelation and the possibility for even non-believers to perceive truth when confronted with divine signs. The Islamic treatment demonstrates how religious communities adapt earlier narratives to serve new

theological and cultural purposes. The emphasis on potential conversion fits within Islamic themes about revelation's universality and divine guidance's possibility for all peoples, though these narratives often reflect later traditions prioritizing theological coherence and moral lessons over historical accuracy.

## 16. Comparative Analysis: Discrepancies and Theological Interpretations

Comparative analysis of Nebuchadnezzar's image across the three monotheistic religions reveals general agreement that he was a powerful Babylonian king who destroyed the First Temple and exiled Israelites—an event all religions considered divine punishment for the people's deviation from God's teachings (Bandstra, 2004: 286-288). Despite this agreement, religious images differ in several theological and interpretive aspects. In Judaism, texts such as Jeremiah and Second Kings feature Nebuchadnezzar as a divine instrument of punishment while describing him as a cruel tyrant, despite some positive glimpses in Daniel (Collins, 2008: 52-58; Levine, 2009: 32-35). Christianity preserved this image but evolved it symbolically, with Babylon representing the forces of evil and spiritual decay, reducing emphasis on Nebuchadnezzar's individual figure in favor of symbolic dimensions.

Islam presents the event within a broader Quranic context without direct name mention, seeing Nebuchadnezzar among the "servants of great power" whom God sent to discipline the Children of Israel (Quran, Al-Isra 17: 4-7). Later Islamic accounts show diversity in his portrayal, ranging from a mighty king to a potential believer, reflecting overlap with Jewish and Christian sources (Al-Tabari; Ibn Kathir). The traditions also differ in symbolism versus historical emphasis. Judaism offers a detailed historical narrative requiring critical review, while Daniel tends toward symbolic character. The Islamic tradition integrates mythological and ethical elements into the general historical narrative. These disparities reflect theological and historical contexts in which each religion originated: Judaism was influenced by direct exile experience, Christianity by symbolic dimensions in light of its message, while Islam provided a monotheistic interpretation linking events to general perspectives on God's relationship with nations (Wiseman, 1956: 29-35; Morrison, 2010: 117-120).

## 17. Life in Exile: Transformation and Survival

The popular image of the Babylonian exile as unmitigated suffering requires significant qualification. While deportations were certainly traumatic and homeland loss devastating, recent archaeological and textual evidence reveals a more complex picture of exile life. Administrative documents from Babylon, including the famous "Judean" or "Yehudite" archives, show that many exiles achieved considerable economic success (Daniel, 2014: 163-168; Laurie & Cornelia, 2014: 211-219; Tantlevskij, 2020: 296-300). Some became prominent merchants, others served in administrative positions, and a few gained access to the royal court. The survival of distinctly Jewish names and customs in these documents suggests that cultural assimilation was neither required nor universal.

Despite relatively favorable material conditions, we should not minimize psychological and spiritual challenges. Temple loss eliminated the primary focus of religious life, while land separation called into question fundamental beliefs about divine promises. Psalms and Lamentations preserve the emotional impact of these losses, expressing grief, anger, and confusion that must have been widespread among exile communities. Conditions were not uniformly harsh exiles were allowed to practice rituals and establish semi-independent communities. Some, like Jehoiachin, received privileged treatment. However, spiritual and theological shock was profound, as exile raised questions about covenant meaning and God's existence outside the Temple (Smith-Christopher, 2002: 64-68; Albertz, 2003: 457-460).

## 18. Religious Innovation and Adaptation

The exile period witnessed remarkable religious creativity as Jewish communities struggled to maintain their identity without traditional institutional supports. Unable to offer sacrifices at the destroyed Temple, the exiled communities developed new worship forms centered on prayer, scripture study, and observance of distinctive practices like Sabbath and circumcision. Synagogue worship development likely began during this period, although evidence for early synagogues remains limited. More certain is the increased importance placed on preserving and interpreting sacred texts. Much of the Hebrew Bible appears to have been compiled, edited, and finalized durthe exilexile and early post-exile periods. The prophetic literature from this time reveals ongoing theological reflection about exile's meaning and restoration prospects. Figures like Ezekiel and the Second Isaiah reinterpreted traditional covenants and election themes in ways that provided hope to displaced communities. Their emphasis on spiritual renewal and eventual return would prove enormously influential for later Jewish thought.

This crisis contributed to crystallizing a new religious identity: increased emphasis on Torah, Sabbath, and prayer as worship centers, and the emergence of prophetic figures who reinterpreted catastrophe and offered salvation hope. The experience forced fundamental changes in how the Jewish identity was conceived and maintained, with geographic connection to Israel supplemented by emphasis on textual study, legal observance, and community solidarity (Smith-Christopher, 2002: 64-68; Albertz, 2003: 457-460). Perhaps the most significant long-term consequence was the creation of a sustainable model for Jewish life outside Israel. Exile communities developed institutions and practices that allowed Jewish identity to survive and flourish in diaspora settings. This transformation required fundamental changes in how the Jewish identity was conceived and maintained. The geographical connection to Israel, while remaining important, was supplemented by emphasis on textual study, legal observance, and community solidarity. These developments would prove crucial for Jewish survival during subsequent dispersion periods.

The success of this adaptation is evident in the fact that when the Persian policy allowed return to Judah, many exile families chose to remain in Babylon. The thriving Mesopotamian Jewish communities would continue playing important roles in Jewish life for centuries, producing

influential religious literature and maintaining connections with communities throughout the ancient world.

## 19. Assessing the Evidence: History versus Theology - The Question of Nebuchadnezzar's Conversion

The account of Nebuchadnezzar's madness and conversion in Daniel 4 raises fundamental questions about the relationship between historical fact and theological narrative. The vivid description of the king's psychological breakdown and eventual recognition of divine sovereignty serves clear literary and religious purposes, but did anything resembling these events occur? Several factors suggest caution about accepting this account as historical. First, the complete absence of any reference to such events in the Babylonian sources is striking. Royal inscriptions from throughout Nebuchadnezzar's reign consistently present him as a devoted follower of traditional Babylonian deities (Beaulieu, 2018: 200; Da Riva, 2014: 120). If he had experienced conversion to monotheism, we might expect some trace in his official records.

Second, the literary structure and theological themes of Daniel 4 suggest that the narrative serves symbolic rather than historical purposes. The progression from pride to humiliation to restoration follows patterns common in ancient Near Eastern wisdom literature. The king's proclamation of divine sovereignty addresses concerns specific to Jewish communities under foreign rule. This does not necessarily mean that the entire account is fictional. Some scholars suggest that the narrative might preserve memories of illness or temporary absence from royal duties, later interpreted through theological lenses. However, the specific details of conversion to monotheism appear to serve the narrative's religious purposes rather than reflect historical events.

The scientific controversy surrounding Nebuchadnezzar's religious conversion, especially whether he underwent genuine conversion as depicted in Daniel 4, forms a major point of contrast between history and theology. While the biblical account musters moral and narrative strength, emphasizing his humiliation and praise of the Highest God, historical and archaeological work on Babylonian sources provides no substantiation for such personal transformation.

## 20. Distinguishing the Historical Core from Theological Interpretation

More broadly, varying accounts of Nebuchadnezzar illustrate the challenges of extracting historical information from religiously motivated sources. Each tradition—Babylonian, Jewish, and Islamic—presents the king in ways that serve particular ideological and theological purposes. This does not mean these sources lack historical value, but requires careful analysis to distinguish between documented events and interpretive frameworks. Basic facts of Nebuchadnezzar's military campaigns, building projects, and role in Jerusalem's destruction can be established through multiple sources. The interpretation of these events and their ultimate significance remains contested. Understanding how different communities remembered Nebuchadnezzar may be as historically significant as is determining what actually happened. These competing

narratives reveal how traumatic events get processed, interpreted, and transformed into sources of meaning and identity. They show us not just what occurred in the past, but how the past continues to shape community self-understanding.

Contemporary historians are inclined to regard Daniel's account as a theological narrative bearing serious messages about divine sovereignty and human humility rather than a historical account. The narrative serves as a serious theological tool illustrating God's complete control over earthly rulers while providing frameworks to understand the suffering of exiled Israelites as part of a larger divine scheme.

## 21. The Long Shadow of Exile: Transforming Disaster into Meaning

The Babylonian exile represents one of those historical events whose significance extends far beyond the immediate political and military consequences. While Jerusalem's destruction was devastating for those who experienced it, exile's long-term impact on Jewish thought and practice proved transformative in ways original victims could hardly have anticipated. Theological innovations developed during exile—particularly the emphasis on divine sovereignty over all nations and the possibility of maintaining a covenant relationship without a temple or homeland—would prove crucial for Jewish survival in subsequent dispersion periods (Albertz, 2003: 449-452). The diaspora community model developed in Babylon provided a template adapted and refined throughout Jewish history.

Literary and religious creativity stimulated by exile produced texts and traditions that influenced not only Judaism but also Christianity and Islam. Exile period prophetic literature, with themes of judgment, restoration, and universal divine sovereignty, would be repeatedly reinterpreted by later religious communities facing their own challenges. The exile also stimulated intense literary and theological activity. Most of the Hebrew Bible was compiled, edited, and finalized during this period. This experience gave powerful impetus to preserving and interpreting sacred traditions that helped understand the past, grasp present suffering, and formulate future visions. Prophetic voices of Ezekiel and Second Isaiah incorporated strong messages of hope, consolation, and divine promises that served exiles and interpreted exile catastrophe as a necessary preamble to a more glorious future restoration (Albertz, 2003: 463-466).

## 22. Nebuchadnezzar's Unexpected Legacy

Ironically, Nebuchadnezzar's efforts to eliminate Jewish political independence may have contributed to developing a more resilient and adaptable Jewish identity. By destroying the Temple and forcing exile, his policies inadvertently encouraged theological and institutional innovations, allowing Judaism to survive the later Second Temple destruction and adapt to diaspora life. This unintended consequence illustrates the complex relationship between political events and religious development. What appears as a catastrophe from one perspective may, over time, prove to be a catalyst for renewal and transformation. The exile that Nebuchadnezzar

imposed as punishment became, in Jewish memory, a necessary stage in the divine education of the people.

Nebuchadnezzar's figure was transformed in this process. From the sixth-century Judean perspective, he was primarily a destroyer and oppressor. Later traditions found in him a more complex figure, sometimes an instrument of divine will, sometimes an example of human pride humbled by divine power, sometimes even a potential convert to true faith. His legacy as one of the most powerful and influential ancient Near Eastern rulers was an accomplished military strategist and visionary builder who left an indelible imprint on Babylon (Beaulieu, 2018: 33-36). The Neo Babylonian Empire reached its zenith during his reign, a period of unprecedented power and affluence. His architectural achievements, such as the Ishtar Gate, Procession Road, and numerous temples, remain testimony to his ambition and the empire's enormous wealth (George, 1999: 161-168).

However, his historical reputation has always been associated with bringing destruction to Jerusalem and the Babylonian exile. In Western and Jewish traditions, Nebuchadnezzar's memory often characterizes him as a tyrant, destroyer of nations, and emblem of pagan pride. This negative image, built mostly from biblical accounts, has usually overshadowed his contributions to the Babylonian civilization. A more balanced historical appraisal recognizes his character's complexities and the practical, if often brutal, nature of ancient Near Eastern statecraft (Lipschits, 2005: 89-92). Like many of his historical contemporaries, he used conquest and coercion tools to build and maintain his empire. His actions, while destructive to conquered nations, were compatible with his time's general imperial ideologies (Sack, 2004: 76-80).

## 23. Conclusion

This investigation of Nebuchadnezzar II and the Jews reveals the complex ways in which historical events become sources of religious and cultural meaning. The Babylonian king emerging from contemporary sources—a capable military leader and ambitious builder devoted to traditional deities—differs significantly from the figure preserved in Jewish and later religious traditions. These differences reflect not simply errors or biases but natural processes by which communities interpret traumatic experiences. Jerusalem's destruction and its inhabitants' exile required theological explanation. How could a faithful God allow such a catastrophe? What did it mean for divine promises in the covenantal relationship? How should displaced communities maintain their identity and hope?

Various portrayals of Nebuchadnezzar provided frameworks for addressing these questions. As a divine instrument, he demonstrated that God remained sovereign even in defeat. As an arrogant tyrant, he embodied earthly power's temporary nature. As a potential convert, he suggested that even foreign rulers might ultimately recognize divine truth. My analysis suggests that Nebuchadnezzar's supposed conversion described in Daniel serves primarily theological rather than historical purposes. The narrative addresses concerns of Jewish communities under foreign rule, offering hope that their oppressors might eventually acknowledge their God's

superiority. This interpretation does not diminish the text's significance but clarifies its function within its original context. More broadly, this study illustrates the importance of understanding ancient sources within their historical and literary contexts. Religious texts often serve multiple purposes simultaneously preserving historical memory, providing theological interpretation, and addressing contemporary concerns. Recognizing these various functions allows for more nuanced historical analysis while appreciating the texts' religious significance. The Babylonian exile's legacy extends far beyond the sixth century BCE. Theological innovations and institutional adaptations developed during this period would prove crucial for Jewish survival through subsequent challenges (Albertz, 2003: 462-466). The diaspora community model pioneered in Babylon provided a foundation for Jewish life that would endure for millennia.

Perhaps most significantly, the exile experience fundamentally transformed Jewish understanding of divine action in history. Jerusalem's destruction catastrophe was reinterpreted as part of a larger plan encompassing judgment, purification, and eventual restoration. This theological framework would influence not only Jewish thought but also Christian and Islamic understandings of historical meaning and divine purpose. Nebuchadnezzar's figure continues to fascinate because he embodies these larger questions about power, faith, and historical interpretation. His story reminds us that the same events can be understood very differently depending on one's perspective and purposes. It challenges us to think carefully about how we construct historical narratives and what purposes those narratives serve. In our contemporary context, marked by cultural conflict and competing claims about historical truth, Nebuchadnezzar's example offers valuable lessons. It suggests the importance of acknowledging multiple perspectives while maintaining commitments to careful analysis and evidence-based conclusions. It reminds us that historical figures often become symbols serving purposes beyond their original context. Most importantly, it demonstrates that historical study involves not just determining what happened but understanding how events acquire meaning and continue to shape community identity across generations. Jerusalem's destruction was a discrete historical event, but its interpretation and reinterpretation continue to influence how religious communities understand themselves and their relationship to divine purpose.

The scholarly challenges posed by sources such as Daniel 4 require acknowledgment that some questions may resist definitive answers. Did Nebuchadnezzar actually experience religious conversion? The evidence suggests skepticism about this account's historical accuracy while affirming its theological significance within Jewish tradition. Such conclusions require intellectual humility and the recognition that historical inquiry has both possibilities and limitations. Despite the comprehensive treatment provided by this study, issues remain that deserve academic investigation and represent research prospects. The most prominent include continuing archaeological investigations in Babylon, Nippur, Jerusalem, and Lachish to reveal new data the Babylonian rule and its impact on Judah. Comparative analysis between Babylonian inscriptions and biblical texts may reveal cultural overlaps and help understand the differences between the two narratives. Study of oral and religious traditions about Nebuchadnezzar

represents a means of understanding collective memory formation, while exploring neighboring cultures' responses to Babylonian exile opens the way for a broader understanding of regional influence. These issues underscore the importance of continuing critical and interdisciplinary research in this area.

The relationship between Nebuchadnezzar II and the Jews ultimately illustrates the complex interactions between political power and religious meaning in the ancient world. It shows how historical events become sources of identity and interpretation, extending far beyond their immediate political consequences. It is a reminder that history is often written from multiple perspectives and that understanding the past requires an ongoing effort to compare, critique, and synthesize. Most importantly, it demonstrates the human capacity to find meaning and hope even amid catastrophe—a capacity that continues to shape religious and cultural life today.

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# نبوکدنصر دوم و یهودیان: بازنگری انتقادی روایت‌های باستان‌شناختی، تاریخی و دینی


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**چکیده**

شخصیت نبوکدنصر دوم همچنان پژوهشگران را مجذوب خود می‌کند، درست به دلیل تضاد چشمگیری که در چگونگی یادکرد او در منابع مختلف وجود دارد. در حالی که اسناد بابلی او را پادشاهی دیندار و سازنده‌ای برجسته معرفی می‌کنند، متون کتاب مقدس، گاه او را به عنوان ابزار داوری خداوند و گاه به عنوان نماد غرور استبدادی به تصویر می‌کشند. هدف این پژوهش، گشودن گره این روایت‌های متعارض است؛ با بررسی این‌که چگونه آسیب روانی ناشی از تبعید، حافظه جمعی یهودیان را شکل داده و چگونه دغدغه‌های الهیاتی بر روایت‌های تاریخی اثر گذاشته است. این مطالعه، به جای صرفاً فهرست کردن دیدگاه‌های متفاوت، استدلال می‌کند که درک نبوکدنصر مستلزم آن است که تبعید بابلی به عنوان نقطه عطفی شناخته شود که به شکلی بنیادین هویت یهودی را دگرگون ساخت. ویرانی معبد اول صرفاً یک فاجعه سیاسی نبود، بلکه ملتی را واداشت تا رابطه خود با امر الهی را از نو بازاندیشی کنند. چهره نبوکدنصر، چه در قالب یک عامل الهی و چه به شکل یک ستمگر مغرور، پاسخی بود به نیازهای جوامع مختلف برای معنا بخشیدن به این دگرگونی بزرگ. از طریق تحلیل دقیق اسناد اداری بابلی، متون کتاب مقدس و منابع متأخر اسلامی، این پژوهش نشان می‌دهد که چگونه حافظه تاریخی در فرهنگ‌های گوناگون ساخته و بازساخته می‌شود. «تبدیل دینی» نبوکدنصر که در کتاب دانیال روایت شده است، به باور نویسنده، بیش از آنکه بازتاب‌دهنده یک تحول معنوی واقعی در پادشاه بابل باشد، بازتابی از کشمکش‌های الهیاتی یهودیان تبعیدی است.



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## AMS Radicarbon (C14) Dating of Human Skeletal Remains from the Mersinchal Cemetery, Semnan, Iran

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**Abstract**

Radiocarbon dating is a fundamental method employed in archaeological, historical, and paleographic research to determine the chronological framework of findings. This article discusses the results of radiocarbon dating analyses conducted on human remains recovered from six graves excavated during the fourth season of the Mersinchal Archaeological Project. The Mersinchal Cemetery is located in Telajim Village, Mehdi Shahar County, Semnan Province, Iran. Four seasons of archaeological excavations have been conducted at this site, leading to the proposal of a relative dating for the cemetery, attributed to the late first millennium BC, based on the analysis of the findings. This article adopts a research methodology that integrates both fieldwork and laboratory analysis. During the fieldwork phase, burial practices and graves Finds were carefully examined and systematically documented. Human samples were selected for further scientific analysis. In the laboratory phase, six human skeletal samples discovered during the fourth season of excavations at the Mersinchal cemetery were analyzed for absolute dating using radiocarbon (14C) techniques and employing the Accelerator Mass Spectrometry (AMS) method. The main purpose of this article is to establish an absolute chronology for the Mersinchal cemetery and answer some fundamental questions, including: To which cultural periods does this cemetery belong? What do burial practices and the associated findings within the graves? And what insights can be gained about their diet? The radiocarbon dating results indicate that this cemetery was used between 409 BC to 51 BCE, corresponding to Achaemenid, Seleucid, and Parthian periods. Interestingly, the burial practices and objects inside the graves remained consistent throughout these periods, showing no significant change over time. The isotopic values of the individuals indicated that their diet, influenced by local agriculture, consisted of both C3 and C4 plants. Animal proteins, including meat and dairy products, were also included in the diet.

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## 1. Introduction

The northern part of the central plateau of Iran exhibits distinct geographical and climatic characteristics. Over time, factors such as topography, precipitation patterns, and vegetation cover have significantly influenced the lifestyle and settlement patterns of its inhabitants. The favorable geographical conditions and relatively suitable climate of the central plateau of Iran have been among the main factors in the growth of human settlement and population concentration in this region. The presence of mountains, foothills of intermountains plains, and fertile lands of the rivers made this region one of the gathering places for human groups in the past. The Central Plateau of Iran served as a crossroads of ancient trade routes. The communication routes in this area facilitated interregional interactions in three principal directions: eastward, westward, and southward. Consequently, the area has historically served as a hub for nomadic populations, military campaingns, and commercial as well as cultural exchanges. One of the notable archaeological sites in this context is the Mersinchal cemetery, located in the northern part of the central Iranian plateau, within the north of Semnan province, along the southeastern margin of the Caspian Sea. This cemetery was in use during three distinct historical periods: the Achaemenid, Seleucid, and Parthian eras. Semnan Province, historically known as Qumis or Hecatompylos, served as the capital of the Parthian Empire and was situated along the Great Khorasan Road, a branch of the Silk Road. This strategic geographical position has contributed to the region's historical significace (Sharifi, 2019: 145). The Mersinchal cemetery is of interest for three reasons. First, it represents the first site from the Achaemenid period to be excavated in this part of of Iran, located on the southeastern coast of the Caspian Sea (Malekzadeh *et al.,* 2023: 14). Second, it lies in proximity to the Qumis cultural region, the former Parthian capital. Third, the site provides valuable data for understanding the socio-political and cultural transitations from the Achaemenid to Parthian empires at the regional level.

Establishing a precise chronological framework and a clear understanding of the cultural sequence of each region is a fundamental prerequisite for conducting rigorous archaeological research. The application of absolute dating methods, such as radiocarbon dating, has significantly enhanced archaeological research. Unlike traditional dating techniques, radiocarbon dating provides more accurate and reliable age estimates for ancient finds, thereby improving the precision, credibility, and scientific rigor of Archaeology research.

Given the absence of absolute chronological data for cemeteries located along the southeastern shore of the Caspian Sea, obtaining a precise radiocarbon date for the mersinchal site is essential for reconstructing the long-term patterns of human habitation in the region. Moreover, absolute dating for this cemetery spanning the Achaemenid, Seleucid, and Parthian periods will provide a valuable reference point for establishing relative chronologies at other contemporaneous sites. During the fourth season of the Mersinchal cemetery archaeological excavations, 34 graves were excavated in Trench E13, and samples from six of these graves were selected for radiocarbon analysis. Therefore, the primary aim of this research is to employ scientific analysis to determine the absolute chronology and dietary habits of the individuals interred at the mersinchal cemetery.

To achieve this, six human bone samples were collected from selected graves and analyzed for radiocarbon datingand stable isotopic ratios ($\delta^{13}C$ and $\delta^{15}N$). The questions that can be raised in this research are as follows: What cultural periods are represented in the Mersinchal Cemetery? What were the burial practices and the types of objects found in each period? What dietary patterns can be inferred for individuals buried at the site?

## 2. Research methods

This research is primarily carried out using a descriptive-analytical approach. The methodology of this research combines both fieldwork and laboratory analysis. During the fieldwork phase, the findings from the excavation were systematically documented and studied, after which appropriate samples were selected for further laboratory analysis. In the second phase, samples were taken from the skeletal remains of six individuals buried in six distinct graves discovered during the fourth season of the Mersinchal cemetery excavations. These samples were subjected to absolute dating using radiocarbon techniques. The analysis was conducted at a radiocarbon laboratory in China, employing accelerator mass spectrometry (AMS) methods for high-precision results.

## 3. Research background

The Mersinchal cemetery is located in the eastern part of Telajim village, within the Poshtkoh district in the northern part of Semnan province, situated on the Iranian central plateau (Fig. 1). It was identified in 2010 during a survey of the Finesk Dam conducted by Ali Maleki (Maleki, 2010). To date, four seasons of archaeological excavations have been conducted at this site. The first and second seasons of the excavations were conducted in 2014 and 2020, respectively, under the direction of Mehrdad Malekzadeh (Malekzadeh *et al.,* 2015), The third season (Fig. 3) took place in 2021 and two archaeological teams under direction of Mohammad Reza Nemati (Nemati, 2021) and Ata Hassanpour (Hassanpour, 2021). The fourth season (Fig. 4) was completed by Mohammad Reza Nemati (Nemati, 2022).

## 4. Description of the Site

The Mersinchal cemetery (36°02’36”N, 53°25’56”E) is situated approximately 250 meters southwest of Telajim village, 300 meters southeast of Tom village, two kilometers southeast of Moladeh village and three kilometers southwest of Finesk village in northwestern Semnan province, and 70 kilometers north of the city of Semnan (Figs. 1-2). Topographically, the site can be divided into three distinct sections. The first section lies on a relatively flat terrace on the northern slope of Mount Sartala and at the southern edge of the Sefidrud river, at an elevation of 1626 meters above sea level. This section is bounded by a shallow valley to the east and west and by a river to the north. It has an approximately rectangular shape, with a maximum length of 120 meters and a maximum width of 55 meters along the east-west axis. The terrain slopes from north to south and from west to east, and the majority of the graves are concentrated in this area (Nemati, 2021: 469). The second section lies to the south of the first section and is situated on the steep

northern slope of Mount Sar tala. It covers an area of approximately one hectare and is located at an elevation of 1,663 meters above sea level (Nemati, 2020: 12). Based on the 2014 excavations, the steep gradient and ongoing soil erosion have led to the disappearing or significant shallow of many grave surfaces (Malekzadeh *et al.,* 2014: 464). The third section is positioned west of the first and second sections, separated from them by a shallow valley, it extends northward toward the Sefidrud river and southward toward the steep mountain slope. Locally known as "Gharash mal khil", this area covers approximately 15,000 square meters and features a slope from south to north. Due to agricultural activity, a considerable number of stones have been gathered from the surface and deposited in various parts of the area. A limited number of pottery fragments are scattered across the surface, some of which are of the clinky ware type. This section appears to have functioned as a seasonal, nomadic settlement (Nemati, 2020: 13).

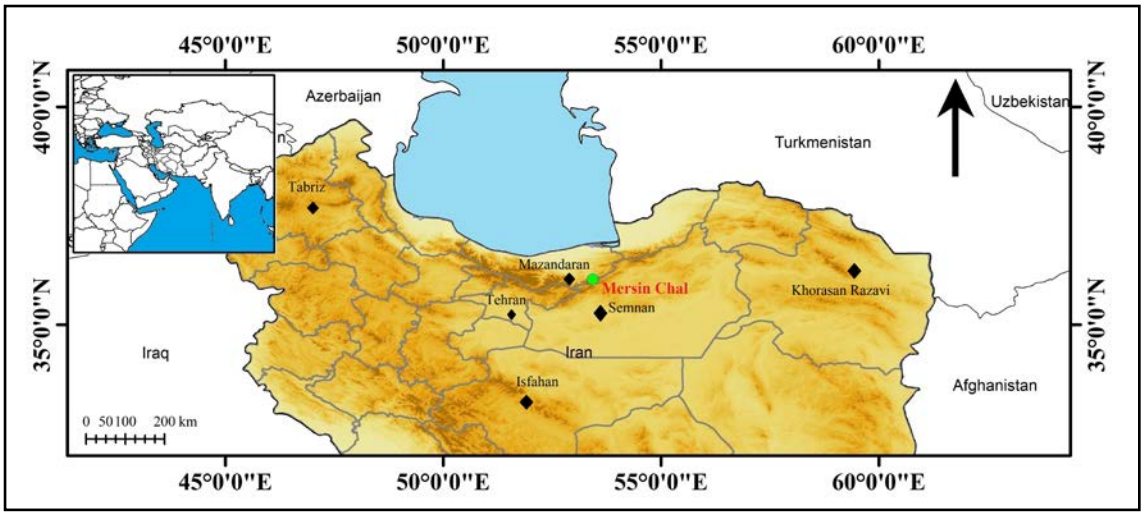



**Fig. 1: Map showing the location of Mersinchal (based on Google Maps, drawn by: S. Bakhtiari).**


**Fig. 2: The location of the Mersinchal cemetery in the aerial image (Google Earth, 2024).**

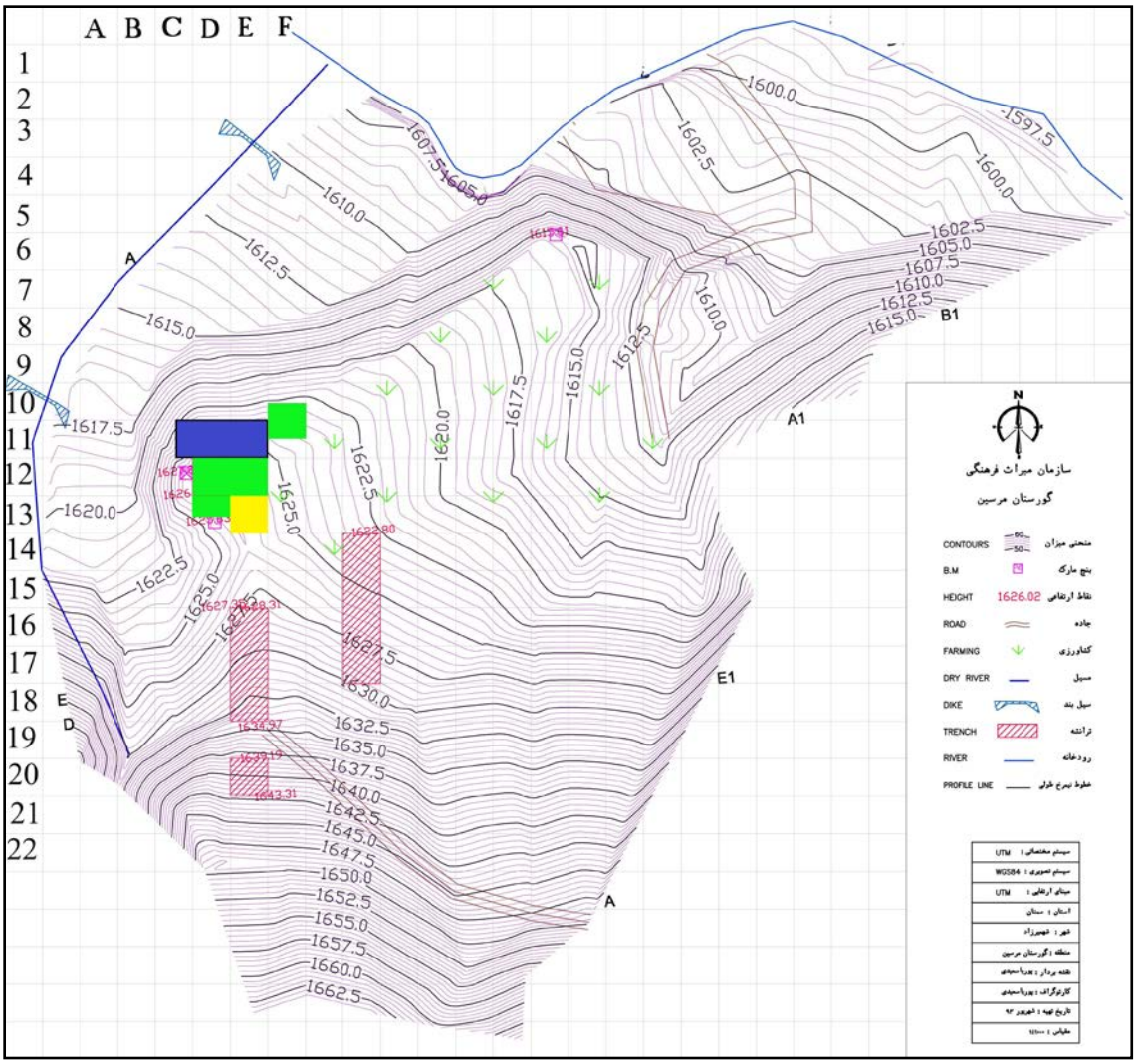



**Fig. 3: Topographic map of the Mersin Chal cemetery and the location of the excavated trenches in the third and fourth seasons (Authors, 2013).**

## 5. Materials

Bone collagen serves as the primary material of radiocarbon dating and paleodietary reconstruction (Talamo *et al.,* 2021). The quality of collagen preservation is affected by various factors, including the method of extraction, burial practices, soil composition, extreme pH levels, organic acids, temperature, and groundwater infiltration (Afshar, 2014: 123; Fetner, 2015: 88). Standard criteria for evaluation collagen quality in human skeletal remains include the Carbon-to-nitrogen (C:N) atomic ratio, which should range between 2.9 and 3.6 (Ambrose, 1990: 443; DeNiro, 1985: 808), along with minimum thresholds for carbon (> than 13%) and nitrogen (> than 4.8%) content (Ambrose, 1990: 447). Based on these criteria all collagen samples from the Mersinchal skeletal remains exhibit good preservation. Sex estimation of the individuals was conducted using morphological features of the pelvis (e.g., subpubic angle, greater sciatic notch) and skull (e.g., glabella, mastoid process, frontal and parietal eminences, occipital protuberance, supra-orbital margin, and mental eminence), (Buikstra & Ubelaker, 1994; Hager, 1996; Mays, 1998; Tague,

1995; White & Folkens, 2005). Age-at-death estimation was based on skeletal maturation, morphological changes in the pubic symphysis and sternal ends of the ribs, transformation of the auricular surface of the ilium, and dental wear patterns (Buikstra & Ubelaker, 1994; Işcan *et al.,* 1984; Lovejoy *et al.,* 1985; Meindl & Lovejoy, 1985; Oliveira *et al.*, 2006; White & Folkens, 2005), (Table 1).

## 6. Methods

All samples selected for radiocarbon dating were analyzed using the Accelerator Mass Spectrometry (AMS) method at the China Radiocarbon Laboratory. Samples preparation followed the standardized protocols of the Oxford Radiocarbon Accelerator Unit, as outlined by Brock *et al.,* (2010). Collagen extraction was performed using a modified Longin method (Longin, 1977). The analytical process involved several steps: initially, macro-contaminants were removed from the bone samples and the surfaces were cleaned under a light microscope. Further cleaning was performed to eliminate any potential chemical contamination. The prepared samples were then combusted in sealed quartz tubes to convert organic material into $CO^2$. The resulting $CO^2$ was reduced to elemental carbon (graphite) using hydrogen gas and an iron catalyst. The graphite-iron mixture was pressed into target holders and stored under an argon atmosphere until AMS measurement, following the method described by Czernik & Goslar (2001: 284). Radiocarbon (C14) concentrations were measured by comparing the ion beam intensities of C12, C13 and C14 in the samples relative to known standards (Goslar *et al.,* 2004). The calibration of radiocarbon dates was performed using OxCal software, version 4.4 (Bronk Ramsey, 2001, 2021), based on the intcal 20 atmospheric calibration curve (Reimar *et al.,* 2020). The calibrated results are reported with a 95.4% probability (20 range) and are illustrated in Figures 2-3. Stable isotope analysis (δC13 and δN15) was conducted on extracted bone collagen using an isotope Ratio Mass Spectrometer (IRMS). For this purpose, "collagen preparation followed a modified Longin protocol as described by Fetner (2015). Initially, bone samples were cleaned using an air blaster with aluminum oxide particles and then manually ground into powder. The powdered samples were demineralized by immersion in a 0.5 M hydrochloric acid (HCl) solution for several days. Fallowing demineralization, samples were rinsed three times Milli-Q water. The remaining material was then heated with Milli-Q water adjusted to PH3 at 65- 70ºC for 48 hours to gelatinize the organic fraction of the bone. the gelatinized solution was filtered using an Ezee Filter separator, frozen in liquid nitrogen, and subsequently freeze-dried" (Fetner, 2015: 67-68). Stable isotope ratios for nitrogen and carbon are reported relative to international standards (δN15 AIR‰ and δC13 VPDB‰) using delta (δ)notation, expressed in parts per mil(%). The isotopic values are summarized in Table 1.

## 7. Stable Isotope Analysis of Humans

The analysis of stable carbon and nitrogen isotopic signatures is a well-established method for understanding and reconstructing past human diets and subsistence strategies. The stable carbon

**Table 1: AMS 14C dates, calibrated ranges, and δ13C and δ15N isotope values of human bone from Mersinchal cemetery (Authors, 2021).**

| Mersinchal Cemetery | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Submitter No** | **Trench** | **Context** | **Grave** | **Material** | **Sex** | **Age at Death** | **$^{14}$C Date BP** | **Cal BCE Calibrated Date 2σ Range** | **IRMS δ13C** | **IRMS δ15N** | **CN** | **Wt %C** | **Wt %N** |
| T2304-5 | E13 | 410 | G5 | Human Bone | Female | Adult (?) | 2240 +/- 30 | 320-202 calBCE (69.4%) 390-343 calBCE (26.1%) | -17 | 11/3 | 3/2 | 40/27 | 14/6 |
| T2304-6 | E13 | 411 | G6 | Human Bone | Female | Middle Adult | 2270 +/- 30 | 304-208 calBCE (51.9%) 398-350 calBCE (43.5%) | -17 | 10/84 | 3/2 | 41/83 | 15/13 |
| T2304-7 | E13 | 412 | G7 | Human Bone | Female | Young Adult | 2200 +/- 30 | 368-173 calBCE (95.4%) | -18 | 10/71 | 3/2 | 41/08 | 14/84 |
| T2304-8 | E13 | 417 | G12 | Human Bone | Female | Middle Adult | 2130 +/- 30 | 205-51 calBCE (84.6%) 346-316 calBCE (10.9%) | -17 | 9/76 | 3/2 | 37/94 | 13/82 |
| T2304-9 | E13 | 425 | G20 | Human Bone | Female | Middle Adult | 2200 +/- 30 | 368-173 calBCE (95.4%) | -22 | 10/33 | 3/2 | 41/27 | 15/14 |
| T2304-10 | E13 | 438 | G33 | Human Bone | Female | Young Adult | 2300 +/- 30 | 409-353 calBCE (70.2%) 286-228 calBCE (24.6%) 217-211 calBCE (0.7%) | -16 | 9/33 | 3/2 | 40/83 | 14/82 |

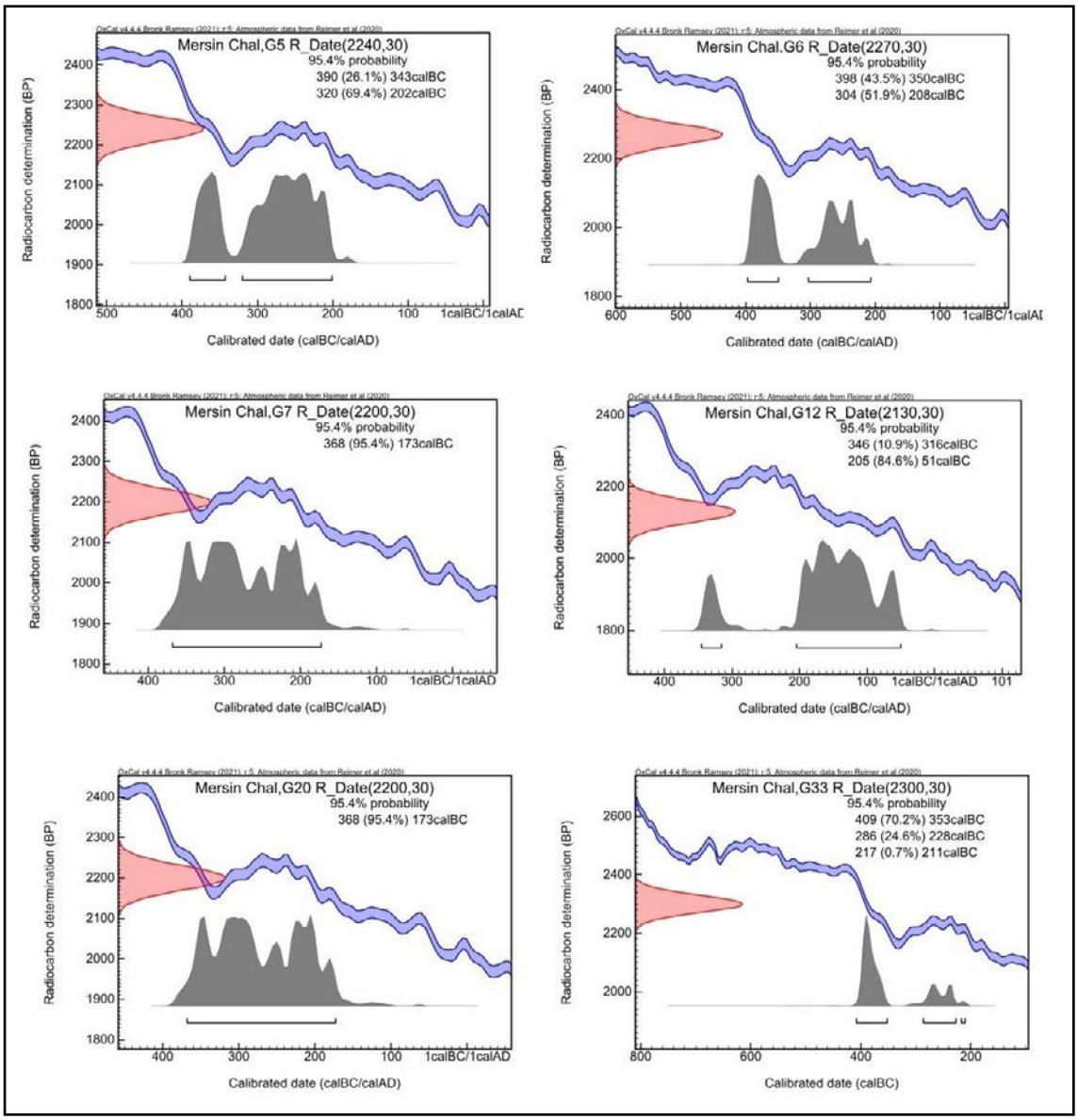



**Fig 4. Calibrated age graphs of radiocarbon dates of Mersinchal Cemetery (Authors, 2021).**

isotope ratio (δC13) is particularly useful in distinguishing the relative dietary contributions of C3, C4, and CAM (Crustacean Acid Metabolism) plants consumed by humans and animals. C3 plants- such as wheat, barley, rice, most fruits, vegetables, legumes, trees, and shrubs-are characterized by more negative δC13 values in human collagen, typically ranging from -20 to -35‰ (per mille). In contrast, diets incorporating significant amounts of marine resources or C4 plants- such as millet, maize(corn), and teff- result in more enriched (less negative) δC13 values, generally falling within the range of -14 to -9‰ (Agarwal & Glencross, 2011: 414, Price, 2015: 73, Katzenberg, 2008: 423-424, Ambrose, 1986: 711, Ambrose & Lynette, 1993: 2-3). CAM plants utilize both C3 and C4 plants remain clearly distinguishable due to their distinct physiological processes. The separation allows for δC13 values. (Schoeninger & Moore, 1992: 255-256; Ambrose, 1986: 711; Ambrose & Lynette, 1993: 2-3; Kelly, 2000: 4-5; Agarwal & Glencross, 2011: 414). Nitrogen

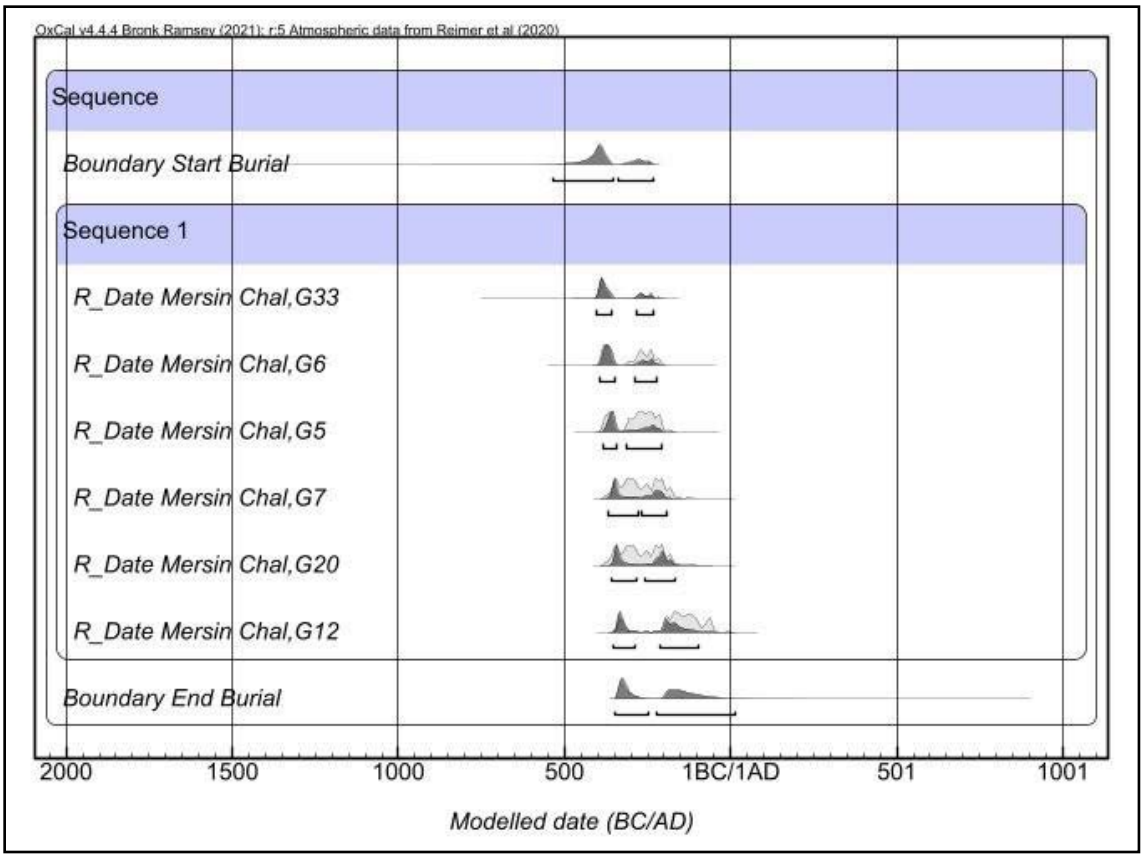



**Fig 5. Calibrated age of the radiocarbon dates from Mersinchal Cemetery (Authors, 2021).**

isotope analysis (δC13) of bone collagen provides complementary information by reflecting an individual's trophic level and the protein content of their diet. δC13 values typically increase by 3-5 with each step up the food chain, enabling differentiation between marine and terrestrial diets and the detection of nitrogen-fixing plant consumption (Kelly, 2000: 14, Budd *et al.,* 2017: 5). The ratio of stable carbon isotope abundance differs depending on diet, whereas the ratio of stable nitrogen isotope abundance is influenced by both diet and habitat (Katzenberg, 2008: 430-431). Consequently, "nitrogen isotope values (δ15N), alongside trophic levels, provide insight into environmental factors such as aridity resulting from water stress or human activities (indicated by higher δ15N), as well as animal management practices involving manuring (resulting in higher δ15N)". (Sołtysiak & Schutkowski, 2018: 1). As shown in table 1, the isotopic values for the Mersinchal cemetery range from -16% to -22% for δC13 and from 11.3% to 9.3% for δ15N. These results suggest a predominantly mixed diet centered on C3 plants- such as cultivated cereals, legumes, vegetables, and fruits- with a minor contribution from C4 plants, likely millet. The primary sources of dietary Protein appear to have come from herbivores feeding mainly on C3 plants, including goats, sheep, and camels. In addition, consumption of animals with mixed C3 and C4 plants, based on diets-such as cattle, gazelles, and equines-was also likely. There is also evidence of a small contribution from carnivorous species to the overall protein intake.

## 8. Discussions

To establish a chronological framework for the Mersinchal cemetery, a bone sample from Grave No.13 discovered during the second season of excavations was selected for radiocarbon dating. The results of the C14 analysis of bone collagen indicated a date to be corresponding to the Achaemenid period (Malekzadeh *et al.,* 2023: 1). Hassanpour provides an interpretive overview of the cemetery's period of use, stating: "There are several indicators regarding the chronological span of the cemetery's use. These include iconographic elements on the rings-such as the depiction of Hercules-along with diagnostic pottery types including Clinky ware, Rhytons, and other characteristic vessels. Additionally, burial customs and typological comparisons with neighboring archaeological sites such as Gandab, Kharand, Velem, Qumis, and Vestemin suggest that the mersinchal cemetery was likely in use from the Seleucid period and continued into the Parthian period" (Hassanpour, 2022: 291). Nemati based on the archaeological evidence recovered from both surface survey and excavated graves including pottery discovered during the excavation season argues that the cemetery was in use from the Iron Age III to the early Parthian period, with relatively consistent burial pratices observed throughout (Nemati, 2022: 472). Following the fourth excavation season, six human bone samples were collected from six separate graves for radiocarbon dating (Fig. 6). The results of this analysis are presented below.

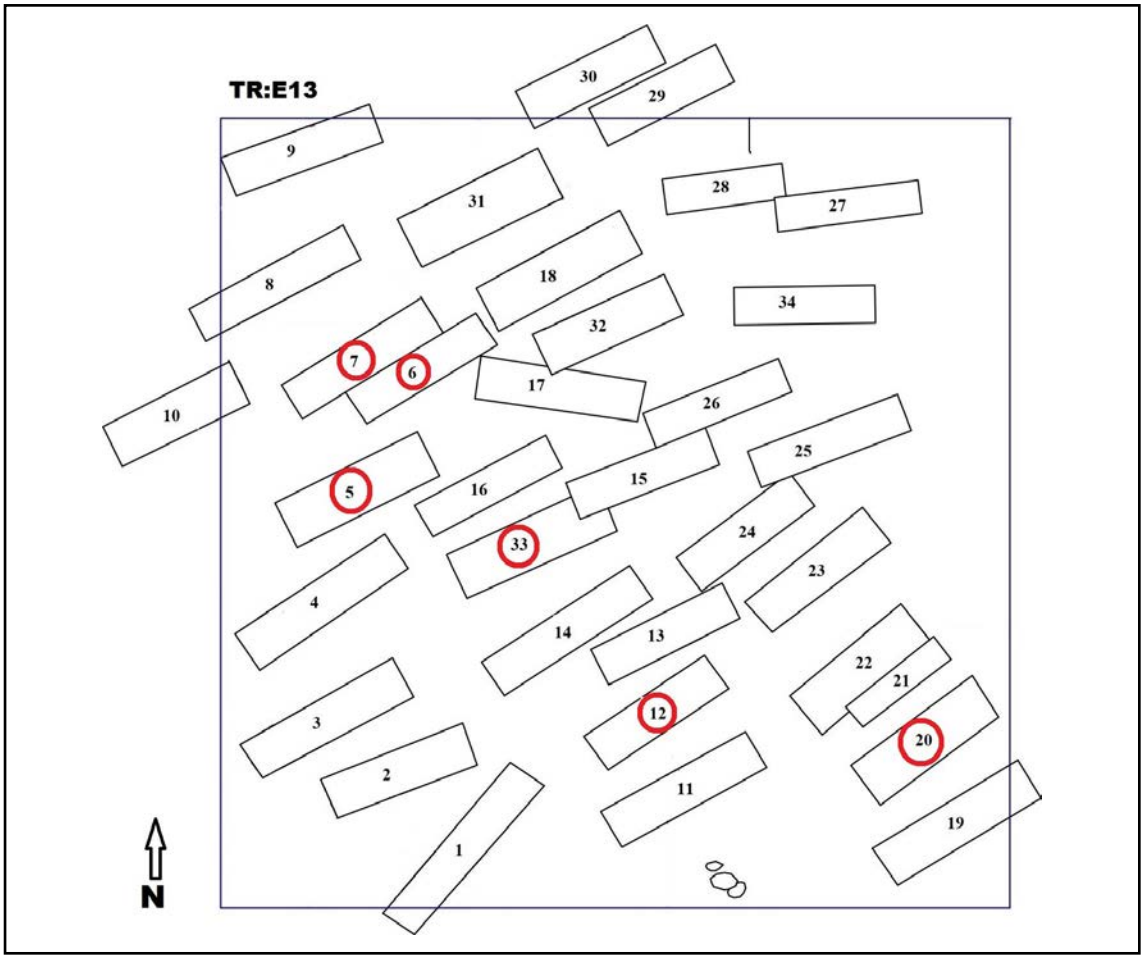


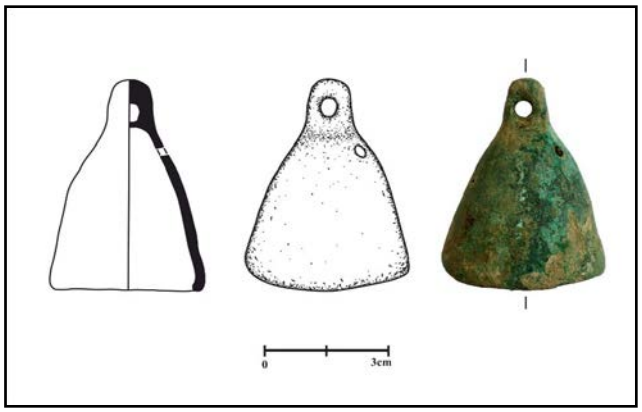

**Fig. 6: Plan of the excavated graves from Trench E13 and the graves from which samples were taken (Authors, 2021).**

**Grave 5:** The results of the radiocarbon analysis indicate a conventional C14 age of 2240±30 BP. The calibrated calendar date suggests that the sample from Grave G5 most likely (69.4%) dates to the Seleucid or Parthian periods (320–202 calBCE), while there is a lower probability (26.1%) that it belongs to the late Achaemenid period (390–343 calBCE), (Figs. 2–3). A comparative analysis of the pottery assemblage from Grave 5 (Fig. 4) reveals notable similarities with pottery materials from Parthian sites in the Damghan Plain, including Tepe Dibaj (Sharifi, 2011: 48, 50), Kesht Dasht Tepe (Sharifi, 2019: 21), and Shahr-i Qumis (Stronach *et al.,* 2019: 26, Fig. 12:3). Both the absolute and relative chronologies support the attribution of this grave to the Parthian period.

Historically, this phase represents a transitional era in Iranian history. During the early stages of the Parthian period, Iran was under Seleucid control. However, the Seleucid Empire faced persistent political and military challenges, which gradually undermined its central authority. As a result, various regions within Iran sought autonomy, contributing to the decline of Seleucid dominance and the concurrent rise of the Parthian Empire. The Parthians eventually established control over large parts of eastern Iran and effectively countered Seleucid influence. Consequently, this period may be characterized as a transformative epoch marked by the waning of Seleucid power and the emergence and territorial expansion of the Parthian state (Figs. 7–9).

**Fig. 7: Burial of Grave No. 5 and the objects inside it (Authors, 2021).**

**Grave 6:** Radiocarbon (C14) analysis of the sample from Grave G6 yielded a conventional radiocarbon age of 2270±30 BP, as reported by the Chinese Radiocarbon Laboratory (Table 1, column “Date BP”). The calibrated calendar age indicates that the burial most likely dates to the




**Figs. 8-9: A pottery vessel and a bronze bell obtained from Grave 5 (Authors, 2021).**

Seleucid or early Parthian periods (304–208 calBCE; 51.9% probability), with a lesser probability of belonging to the late Achaemenid period (398–350 calBCE; 43.5%), (Figs. 2–3).

The pottery assemblage recovered from Grave 6 (Fig. 4) exhibits typological similarities with Parthian pottery from Shahr-i Qumis, as documented in various contexts (Stronach *et al.,* 2019: 22, Fig. 8:4; 38, Fig. 24: 12; 42, Fig. 28: 12). In addition to the pottery, a seal ring was discovered in the grave (Fig. 5), further supporting the chronological attribution to the Seleucid or early Parthian period.

This timeframe corresponds to a significant transitional phase in Iranian history, during which the weakening of Seleucid rule coincided with the emergence of Parthian political and military power in eastern Iran. The gradual decline of the Seleucid Empire and the rise of the Parthians laid the foundation for a new imperial structure, marking a pivotal moment of transformation in the sociopolitical landscape of ancient Iran (Figs. 10-12).

**Fig. 10: Burial of Grave No. 6 and the funerary objects (Authors, 2021).**

**Graves 7:** Radiocarbon ($^{14}C$) analysis of the sample from Grave G7 yielded a conventional $^{14}C$ age of 2200±30 BP. The calibrated calendar dates for the samples from Graves G7 and G20


**Fig 11 - 12: A pottery bowl and a bronze bracelet discovered from Grave 6 (Authors, 2021).**

fall within the range of 368–173 calBCE, with a 95.4% probability (Figs. 2–3). The pottery assemblages recovered from these graves (Fig. 4) exhibit close typological affinities with Seleucid and Parthian pottery found at Shahr-i Qumis (Stronach *et al.,* 2019: 22, Fig. 8:12; 24, Fig. 10: 19; 25, Fig. 11: 2), as well as material from Qizlar Qal'eh on the Gorgan Plain (Puschnigg *et al.,* 2019: 33, Fig. 9:2). The morphological and stylistic characteristics of the pottery clearly align with ceramic traditions associated with the Seleucid and early Parthian cultural spheres.

Both the absolute radiocarbon data and relative ceramic typology support the attribution of these burials to the Seleucid–Parthian transitional period. Historically, this era in Iran was marked by the decline of Seleucid control and the concurrent rise of the Parthian Empire. Specifically, it coincides with the reign of Phraates I (Farhad I), under whom the Parthian state expanded its territory and solidified its political and military strength (Figs. 13–15).

**Fig. 13: Burial of Grave No.7 and the funerary objects (Authors, 2021).**

**Figs. 14-15: A pottery vessel and a bronze figurine Discoverd from Grave No 7. (Authors, 2021).**

**Grave 12:** Radiocarbon (C14) analysis of the sample from Grave G12 yielded a conventional age of 2130±30 BP. The calibrated calendar age provides two possible date ranges: the most probable (84.6%) falls between 205–51 calBCE, while a less probable range (10.9%) spans 346–

316 calBCE (Figs. 2–3). Based on the absolute chronology, the burial is most likely associated with the early to middle Parthian period. This interpretation is further supported by the ceramic assemblage from Grave G12 (Fig. 4), which closely resembles pottery types documented at Shahr-i Qumis (Stronach *et al.*, 2019: 24, Fig. 10: 16, 19). These typological parallels strengthen the attribution of the grave to the period between 205–51 calBCE.

This timeframe corresponds to a critical phase in Iranian history when the Parthians, having emerged as a dominant regional power, consolidated their authority across the Iranian plateau. During this period, the Seleucid presence was effectively eradicated, marking the full establishment of Parthian political and territorial control (Figs. 16–18).

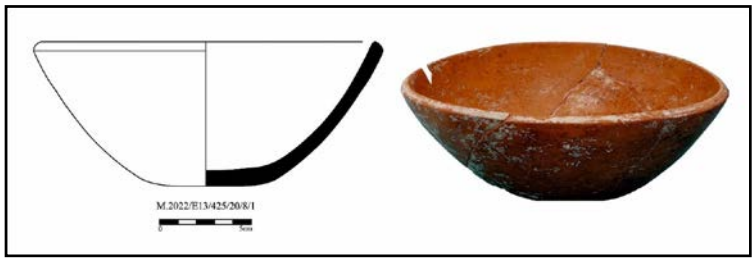
**Fig. 16: Burial of Grave No 12 and funerary objects (Authors, 2021).**

**Fig. 17-18: A footed bowl and a handled vessel Discoverd from Grave No 12 (Authors, 2021).**

**Grave 20:** Radiocarbon ($^{14}C$) analysis of the sample from Grave G20 yielded a conventional age of 2200±30 BP. The calibrated calendar age places the samples from Graves G7 and G20 within the range of 368–173 calBCE, with a 95.4% probability (Figs. 2–3). The pottery assemblages recovered from Graves 7 and 20 (Fig. 4) display clear typological similarities to ceramic materials attributed to the Seleucid and Parthian periods, particularly those found at Shahr-i Qumis (Stronach *et al.,* 2019: 22, Fig. 8:12; 24, Fig. 10:19; 25, Fig. 11: 2) and at Qizlar Qal'eh in Bandar Torkaman (Puschnigg *et al.,* 2019: 33, Fig. 9: 2). These stylistic correspondences suggest strong cultural connections with sites located within the Seleucid–Parthian cultural sphere.

Both the absolute chronology, provided by radiocarbon dating, and the relative dating based on pottery typology, confirm that these graves belong to the Seleucid–Parthian period. Historically, this era in Iran represents the decline of the Seleucid Empire and the concurrent rise of Parthian political dominance. The dating of these graves corresponds specifically to the reign of Phraates I (Farhad I), under whom the Parthian Empire significantly expanded its territorial boundaries and consolidated its power and influence in the region (Figs. 19–21).

**Fig. 19: Burial of Grave No 20 and the funerary aobjects (Authors, 2021).**



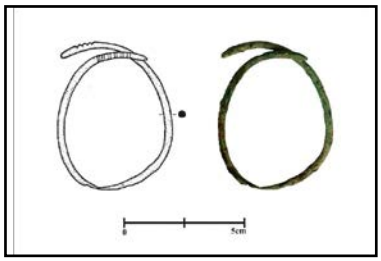



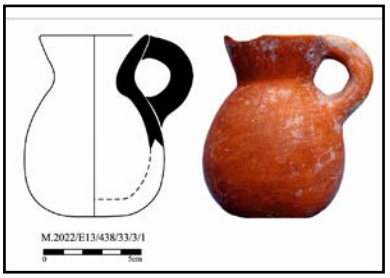
**Fig. 20: The bronze bracelet discovered from Grave No. 20 & Fig. 21: A pottery bowl discovere d from Grave No. 20. (Authors, 2021).**

**Grave 33:** Radiocarbon analysis of the sample from Grave G33 yielded a conventional age of 2300±30 BP. The calibrated calendar age provides three possible ranges: the most probable range (70.2%) corresponds to the Achaemenid period (409–353 calBCE); a secondary possibility (24.6%) falls within the transitional phase between the Seleucid and Parthian periods (286–228 calBCE); and a minor probability (0.7%) is associated with the period 217–211 cal BC (Figs. 2–3).

The absolute chronology strongly supports the attribution of this burial to the Achaemenid period (409–353 calBCE), with a high degree of confidence. This timeframe coincides with the

final stages of the Achaemenid Empire, a period marked by increasing political instability, internal rebellions, and expanding involvement in Greek affairs. Despite these challenges, the Achaemenid central authority remained largely functional. Nevertheless, this era reflects the beginning of the empire's gradual decline and the erosion of its administrative and military cohesion.

**Fig. 22: Burial of Grave No 33 and the funerary objects (Authors, 2021).**



**Figs. 23-24: A tripod bowl and a small pottery jar discovered from Grave No 33 (Authors, 2021).**

## 9. Conclusion

During the second season of excavations at the Mersinchal Cemetery, based on the analysis of a human skeletal sample, the site was initially attributed to the Achaemenid period. In the third season, comparative analysis of pottery and burial features with those from sites in the Shahr-i Qumis region and northern Iran extended the chronological framework to include the Achaemenid through Parthian periods. To achieve more precise dating during the fourth excavation season, six human samples were selected from among 34 excavated graves for radiocarbon analysis.

Accelerator Mass Spectrometry (AMS) radiocarbon ($^{14}C$) dating revealed that the cemetery was in use from the late fifth century (409 BCE) to the mid-first century BCE (51 BCE), indicating continuous activity over a span encompassing the Achaemenid, Seleucid, and Parthian periods. This temporal range reflects the site's cultural vitality and strategic importance, likely attributable to its favorable environmental conditions and geographic position. Significantly, Mersinchal is the first archaeological site in the shire of Qumis and the southeastern Caspian Sea littoral definitively attributed to the Achaemenid period. The $^{14}C$ results affirm the relative dating inferred from

ceramic comparisons with contemporaneous sites in northern and northeastern Iran, including Qiz Qalʿeh in Bandar-e Torkaman, Tepe Dibaj, Tepe Kesht, and Shahr-i Qumis in Damghan, as well as Vestemin Cemetery in Kiasar, Shahneh Poshteh in Babol, and the Velem Cemetery in Behshahr. The burial traditions observed in Mersinchal including grave architecture, burial type, and associated grave goods remained largely consistent throughout the Achaemenid, Seleucid, and Parthian periods. This continuity suggests that despite shifts in political power, cultural and funerary practices persisted with minimal disruption. Furthermore, stable isotope analysis (characterized by a decrease in $\delta^{15}N$ and an increase in $\delta^{13}C$ values) indicates a mixed diet. The individuals likely consumed both animal-derived proteins (meat and dairy) and a significant quantity of $C_4$ plants, such as millet. The isotopic signatures also suggest the consumption of animal products from livestock raised on $C_4$ plant-based fodder.

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## Observation Contribution

The percentage of authors' participation Was equal.

## Conflict of Interest

In adherence to ethical publication standards, the authors affirm that there are no conflicts of interest.

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**چکیده**

استفاده از گاهنگاری مطلق با روش سالیابی رادیوکربن یا کربن ۱۴در مطالعات باستان‌شناسی امروزی در جهان به‌طور چشمگیری متداول شده است. گورستان مرسین‌چال در روستای تلاجیم، شهرستان مهدی‌شهر، استان سمنان واقع شده است. تاکنون چهار فصل کاوش در این محوطه انجام گرفته و کاوشگران بر پایهٔ یافته‌های حاصل از گورهای کاوش شده، تاریخ‌گذاری نسبی آن به اواخر هزارهٔ اول پیش‌ازمیلاد پیشنهاد داده‌اند. این پژوهش دارای ماهیت بنیادی با رویکردی توصیفی-تحلیلی و روش گردآوری آن دارای دو بخش میدانی و آزمایشگاهی است. در مطالعات میدانی یافته‌های حاصل از کاوش مورد مستندنگاری و مطالعه قرارگرفتند و سپس نمونه‌های آزمایشگاهی انتخاب شدند. در مرحلهٔ دوم برای تاریخ‌گذاری مطلق نمونه‌هایی از بقایای شش اسکلت انسانی از شش گور که در طول فصل چهارم کاوش گورستان مرسین‌چال کشف شده بودند، انتخاب شدند. این نمونه‌ها با استفاده از تکنیک‌های رادیوکربن (C۱۴) و با استفاده از روش طیف‌سنجی جرمی شتاب‌دهندهٔ (AMS)، مورد تجزیه و تحلیل قرار گرفتند؛ بنابراین هدف اصلی این پژوهش گاهنگاری مطلق گورستان مرسین‌چال و یافته‌های داخل گورهاست. پرسش‌های قابل طرح در این پژوهش عبارتنداز: گورستان مرسین‌چال مربوط به چه دوره‌های فرهنگی است؟ و شیوه‌های تدفین و نوع اشیای داخل گورها در دوره‌های به چه شکلی بوده است؟ و افراد دفن شده در این گورستان دارای چه نوع رژیم غذایی بودند؟ نتایج تاریخ‌گذاری نشان‌داد که این گورستان در بازهٔ زمانی ۴۰۹ تا ۵۱ پ.م. هم‌زمان با ادوار هخامنشی، سلوکی و اشکانی مورداستفاده قرار گرفته و شیوه‌های تدفین و اشیای درون گورها در تمام این دوره‌ها ثابت مانده و تغییر چشمگیری در گذر زمان نداشته‌اند. بررسی ترکیب ایزوتوپی کربن (δ13C) و نیتروژن (δ15N) کلاژن این افراد با روش IRMS، بیانگر مصرف ترکیبی مواد غذایی گیاهی و حیوانی در رژیم غذایی افراد مورد مطالعه است.



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## Onomastics of Persepolis in Historical Documents and Texts: From the Beginnings to the Qajar Period

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**Abstract**

This article investigates the historical evolution of the names attributed to Persepolis, one of Iran's most prominent archaeological sites. The study addresses a central problem in historical and cultural scholarship: how the shifting nomenclature of ancient monuments reflects broader transformations in collective memory, ideology, and identity. The primary aim is to trace how various names—from *Pārsih* in Achaemenid inscriptions to the popular *Takht-i Jamshīd*—were shaped by different historical, religious, and cultural discourses over time. Using a multidisciplinary research method that integrates philological analysis, historical contextualization, and archaeological interpretation, the article draws on diverse sources, including royal inscriptions, classical and Islamic historiography, travelers' narratives, and mythological literature. Special emphasis is placed on the reinterpretation of Persepolis in Persian epic traditions and Islamic texts, where the site was often portrayed as the throne of the mythic king Jamshīd or a symbol of divine kingship. The research highlights a major turning point in the modern period, when advances in archaeology—particularly the decipherment of cuneiform inscriptions—corrected long-standing misconceptions and re-established the site's original name, *Pārsih*, as used by its Achaemenid builders. The findings underscore that the naming history of Persepolis is not merely a semantic curiosity, but a vital lens through which societies recall, reinterpret, and reconstruct their past. By situating this onomastic history within broader debates on heritage, memory, and historiography, the article contributes to a deeper understanding of the cultural processes that define and redefine historical identity.

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## 1. Introduction

*On Jam's throne, whose crown reaches the summit of the sky,*
*Behold the resolve of the ant that, in its insignificance, dared to ascend.*
- "Ḥāfiẓ" (1315-1390), (Ḥāfiẓ, 1999: 116).

The study of onomastics—particularly the historical evolution of place names—offers valuable insights into the linguistic, cultural, and political transformations that shape the identity of historical sites. Among Iran's archaeological landmarks, Persepolis stands out not only for its architectural and artistic significance but also as a symbolically rich site whose evolving names reflect broader shifts in memory and meaning.

From the Old Persian *Pārsih* (following the IJMES transliteration system for Arabic, Persian, and Turkish, published by Cambridge University Press; see: IJMES Transliteration Chart) attested in Achaemenid inscriptions to the widely used *Takht-i Jamshīd* shaped by Islamic-era myths and literary traditions, the site has carried multiple identities. These names have functioned not merely as designations but as cultural constructs—intertwined with ideology, national narratives, and religious reinterpretation.

Despite significant scholarly focus on the architecture and iconography of Persepolis, the onomastic dimension remains understudied. A few references exist in broader archaeological literature, yet a systematic analysis of the names and their transformations across historical periods is lacking. This study aims to fill that gap by examining the site's evolving nomenclature from the Achaemenid period to the Qajar era, drawing on textual, archaeological, and epigraphic evidence.

Using a multidisciplinary approach that combines philological analysis, cultural history, and archaeological interpretation, the article highlights how naming practices have preserved, reinterpreted, or at times contested the legacy of Persepolis. In doing so, it illustrates the importance of onomastics not only as a linguistic discipline but also as a meaningful analytical tool in archaeological scholarship.

The article opens with a historical overview that contextualizes the broader cultural and political landscape of the region. It then turns to Persepolis itself, outlining its historical, architectural, and symbolic significance. Building upon this foundation, the study presents a comprehensive analysis of the various names attributed to the site over time, exploring the linguistic, mythological, and religious dimensions of its evolving identity. This is followed by an examination of scholarly efforts to identify and restore the site's original name. The article concludes by reflecting on the broader implications of onomastic change in the interpretation of historical memory and cultural heritage.

## 2. Historical Context

The roots of the Achaemenid Empire trace back to Cyrus the Great, who overthrew the preceding Median state and founded a new Persian dynasty. With his unprecedented imperial vision, Cyrus launched a series of successful campaigns that laid the foundation for an empire

which, under his successors—particularly Cambyses—eventually stretched from the Nile to the Indus.

Cyrus the Great, the founder of the Achaemenid dynasty, left a legacy admired by many nations, despite his extensive conquests and his policy of opening up to the world. His policies were marked by tolerance and moderation, even towards adversaries and conquered peoples. He never came across as a totalitarian king and was known for his cultural and religious tolerance with subordinate nations. As Richard Frye notes in *The Heritage of Persia*, Cyrus not only freed the Jews after his conquest of Babylon and became their hero but also refrained from alienating the Babylonian populace, portraying himself as a patron of their city. To honor Marduk, the supreme god of Babylon, he avoided invoking his own gods.

> Cyrus' policy of mildness towards the erstwhile subject peoples of Babyionia, at we see in the Old Testament, must have helped greatly in the consolidation of Persian rule in Syria and Palestine. The Book of Ezra is eloquent testimony to the actions of Cyrus in attempting to win support for Persian rule, and he was on the whole successful (Frye, 1962: 82).

## 3. Persepolis

Persepolis has witnessed a fascinating and, at times, tragic history. The story of this grand 2,500-year-old structure is one of highs and lows, fractures and splendor. Once hailed as "the richest city under the sun" (Diod. XVII.70), it eventually became a ruin inhabited by mice and snakes. Persepolis, which for nearly 200 years hosted the kings of 30 nations in the presence of the King of Kings,[1] astonishing all with its beauty, grandeur, and wealth, was ultimately reduced to ruins by Alexander's flames. The ruins of Persepolis not only became a source of pride for the monarchs of later dynasties, who sought to leave their own marks on it,[2] but also fell victim at times to the ignorance of vandals who inflicted wounds upon it for their amusement. Now, standing firm and steadfast atop its massive, man-made terrace after centuries of enduring the ravages of time, it holds the distinction of being the first Iranian historical site to be inscribed on the UNESCO World Heritage List (UNESCO World Heritage Convention, 1979).

But what was the motivation and reason behind the construction of this magnificent and extraordinary structure, and by whose order and by whom was it built? Pasargadae was chosen by Cyrus, the founder of the Achaemenid dynasty, as the first capital of this empire. However, in addition to Pasargadae, three other capitals are also mentioned: Ecbatana, Susa, and Persepolis (Imanpour et al., 2015). Archaeological evidence suggests a practical rationale behind the seasonal use of the Achaemenid capitals. For instance, Susa—an ancient settlement inhabited since the fourth millennium BCE—appears to have held a particularly prominent position and may have served as the king's main residence. However, due to the extreme summer heat in Susa, the royal court likely relocated to cooler regions such as Ecbatana or Persepolis during that season (see: Cook, 1983). From the perspective of military and geopolitical experts, other factors, such as the political and military significance of these locations, also played a role. From the perspective of

military and geopolitical experts, other factors, such as the political and military significance of these locations, also played a role. Major General Nosratollah Bakhturtash, a military strategist and historian who, in addition to his military education and ranks, held a PhD in Political Science from the University of Tehran and left behind valuable works on Achaemenid history, politics, and military strategy, considered this matter from a military viewpoint as evidence of the tactical insight of the Iranians, who were adept at understanding local conditions and aligning military activities accordingly. In his view,

> The same necessity that justified the creation, establishment, and development of outposts and garrisons also dictated the diversity, alteration, and multiplicity of administrative centers in Iran. Therefore, the fundamental and undeniable principle is this historical necessity—arising from the vastness of the country and political considerations combined with the suitability of each season in different regions—while the tradition of seasonal migration was a secondary matter (Bakhturtash, 1972).

With all this in mind, the selection of Persepolis cannot be solely attributed to climatic, military, or geopolitical factors. Before its construction, cities such as Ecbatana and Susa already served as major Achaemenid centers. Ecbatana, formerly the capital of the Medes, retained administrative significance within the Achaemenid system, while Susa—an ancient Elamite city—was a thriving political hub. Both were widely known throughout the empire and beyond. As Ali Mousavi notes, ancient Greek historians were more familiar with cities like Susa and Ecbatana, while Persepolis remained largely absent from their accounts—an absence that underscores its unique role and later emergence as a ceremonial capital closely associated with Darius I (Mousavi, 2012: 51). The Achaemenid Empire, in its grandeur, required a capital that was truly its own—not inherited from previous dynasties but created anew. Thus, Darius initiated the construction of Persepolis as a space that reflected the ideological and imperial vision of his reign. Darius the Great built the royal city and its magnificent palace complex not on the flat plains but on an artificial terrace spanning 125,000 square meters. This unparalleled terrace, one of the architectural masterpieces of antiquity, has withstood the passage of over 25 centuries, standing firm and majestic near Mount Raḥmat as a testament to history (Briant, 2002: 168).

In the Elamite version of inscription (DPf), carved on the southern wall of Persepolis—which, during Darius's reign and before the construction of the Gate of All Nations by Xerxes, served as the entrance to the complex—Darius introduces himself as the founder of this ensemble:

> 1. I, Darius, Great King, king of kings, king of lands, king upon this earth, son of Hystaspes, an Achaemenid.
>
> 2. And Darius king says: As for the fact that upon this place this fortress was built, formerly here a fortress had not been built. By the grace of Ahūrā-Mazdā, I built this fortress. and Ahūrā-Mazdā was of such a mind, together with all the gods, that this fortress (should) be built. And (so) I built it. And I built it secure and beautiful and adequate, just as I was intending to.

> 3. And Darius king says: Me may Ahūrā-Mazdā, together with all the gods, protect, as well as this fortress. And, furthermore, whatever has been erected in this place, may it not be kindly (to) what any hostile man (ever) counts on doing (Schmidt, 1953: 63).

One of the most widely accepted interpretations regarding the construction of the Persepolis complex is that it served to showcase the grandeur and legitimacy of the Achaemenid Empire—particularly as a ceremonial space for receiving annual delegations from subject nations, most likely during Nuvrūz (the New Year festival). A cursory examination of the extant bas-reliefs at Persepolis suggests that the primary function of the site was closely tied to royal ceremonies and the formal reception of foreign envoys. The repeated scenes of the king enthroned and rows of tribute-bearers presenting gifts, combined with the recurring motif of the lion-and-bull combat—often interpreted as a symbolic representation of the transition from winter to spring—support the notion that the complex had a significant ritualistic and seasonal dimension, possibly associated with the celebration of Nuvrūz. As Ali Mousavi notes, various scholars—including Herzfeld, Godard, Pope, Ghirshman, and Fennelly—have proposed differing views on this function of Persepolis, each emphasizing different ceremonial or symbolic aspects of the site (Mousavi, 2012: 52).

Heidemarie Koch, based on her examination of the decorations of the Tachara Palace (known as Darius's private palace), the Apadana, and the carvings at Darius's tomb, concluded that Darius did not establish anything other than the center of the Persian royal bureaucracy on the large terrace of Persepolis. She believes that his and his family's private residence, as well as the courtiers' quarters, must have been located separately from the terrace, in an area of open land beneath it (Koch, 2010: 156-157). However, this view may only apply to Darius's reign, since later archaeological findings regarding palaces such as Hadīsh (Xerxes's private palace) and the Harem Palace suggest a more personal use of the complex.

In contrast, Shapur Shahbazi believes that "the purpose of Darius the Great in building this palace in the land of Persia was not to create an administrative and political capital, because this location was far from the center of the empire. Instead, he wanted to create a center for Iranian ceremonies" (Shahbazi, 2010: 25-26). This opinion can be questioned based on the evidence, some of which Shahbazi himself has pointed out, such as the clay tablets discovered at Persepolis by Schmidt. Shahbazi views the treasury of Persepolis solely as a storehouse for the treasures of the Achaemenid Empire and does not attribute any administrative function to it. Meanwhile, Koch describes the treasury building as the center of administrative and financial affairs, the beating heart of Darius's court (Koch, 2010: 173). In practice, it is hard to imagine that a place where kings resided and where such grand structures were erected, always hosting the most important representatives of subject nations, would have ignored the management of the kingdom and political decisions.

Persepolis was not completed during the reign of Darius the Great, and additional structures were built by subsequent kings, particularly Xerxes. Evidence from architectural remains—

including: an unfinished tomb; parts of the rosette decoration left unfinished in several instances; the Unfinished Gate located to the north of the Hall of a Hundred Columns (this monumental structure, considered a counterpart to the Gate of All Nations, was never completed, as clearly shown by unworked stone surfaces and exposed unfinished elements); unfinished blocks; and unfinished stairs at the northeast corner of Palace H (Schmidt, 1953: 55, 82, 130, 244, 280)—indicates that major construction work was still ongoing when the site was destroyed by Alexander.

Ultimately, it was Alexander who determined the tragic fate of the richest city under the sun. Various accounts have been recorded regarding this event and its motives, ranging from it being an accident to a deliberate act of vengeance for Xerxes' capture of Athens and the burning of the Acropolis in 480 BCE.[3] Based on archaeological findings and the reports of various historians, André Godard responded to these differing views. Referring to Radet, an Alexander historian, he mentions Alexander's celebratory feasts after the conquest of Persepolis and a particular incident at one of these gatherings. Thaïs, a woman from Alexander's entourage during his campaigns, allegedly exclaimed in her drunken fervor that if Alexander set fire to the Persian kings' palace, he would earn a great favor from the Greeks, as they always yearned for revenge against the "barbaric" Persians who had destroyed their cities. Following her outcry, a wave of madness swept through the gathering. Thaïs urged Alexander to act, and he complied, leading the crowd with her. Together, they took torches and set fire to the cedar-roofed palace, causing a massive blaze. Godard rejects Radet's account, which is based on Quintus Curtius and Plutarch, arguing that it has now been proven that before Persepolis burned, its palaces were systematically looted, with their contents and furnishings relocated. This indicates that the burning of Persepolis was not accidental, and the theory that it resulted from a momentary lack of judgment is incorrect (Godard, 1947).

Persepolis was destroyed, its treasures plundered, and the city abandoned. However, the ruins themselves retained an extraordinary majesty that captivated every viewer. This compelled later generations to craft their own legends about it, leaving its secrets untold for centuries. It was only through scientific excavations and the deciphering of ancient scripts that these secrets began to be unveiled.

The history of Persepolis did not end with its destruction by Alexander; rather, it embarked on a turbulent journey afterward. The grandeur of the Achaemenid Empire tempted subsequent Iranian dynasties to associate themselves with its legacy, either by claiming lineage to the Achaemenid kings or through other means. Even the Parthians, often overlooked in history for various reasons, linked their dynasty to the Achaemenids and specifically to Artaxerxes II. Gareth C. Sampson, quoting Syncellus in his *Chronography*, writes that two brothers, Arsaces and Tiridates, rebelled against Antiochus because they traced their ancestry to Artaxerxes, the Persian king (Sampson, 2008).

Perhaps the greatest influence of and attachment to the Achaemenids was manifested during the Sāsānīyān dynasty. The Sāsānīyāns arose from the same region as the Achaemenids—Persia (present-day Fars Province in Iran)—and positioned themselves as their heirs and rightful successors

(Ghirshman, 1993: 345). Thus, they were influenced by the Achaemenids in various aspects, such as governance, tax collection, military organization, religious beliefs, and the adoption of certain artistic approaches. They also assumed the responsibility of honoring, preserving, and safeguarding Achaemenid historical and sacred sites, such as Persepolis and Naqsh-i Rustam (Malekzadeh, 1975). Historians have even attributed the neglect of Parthian history to the Sāsānīyāns' deliberate efforts to erase their memory and directly associate themselves with the Achaemenids.

After the rise of Islam, various periods witnessed a desire to revive the grandeur of the Achaemenid past. The connection to that golden era was sought through attempts to emulate Achaemenid civilization in all fields, including art, road construction, and state administration. Among the most captivating aspects of Achaemenid civilization was their art, particularly the art showcased at Persepolis. From antiquity to the present day, the motifs of Achaemenid bas-reliefs have been reproduced in various ways, primarily for aesthetic purposes and to decorate buildings. In some cases, modern artists have achieved a level of artistic quality close to that of the Achaemenid era, while in many instances, the reproductions have been mere imitations lacking the sophistication of the originals—like those seen in Qajar reliefs.

Finally, during the Pahlavi era—in a combination of modernism and a return to the grandeur of the past—the focus in art shifted toward modern artistic approaches rather than directly replicating Achaemenid art. The attention to Achaemenid heritage took a new form, emphasizing excavations, restorations, and the preservation of historical monuments. These invaluable efforts revived the memory of these remarkable artifacts, ensuring their identification, recognition, and protection against the ravages of time, human activity, and nature.

After the Islamic Revolution, following a revolutionary hiatus and an initial rejection of remnants of the "despotic regime"—to the point of considering their destruction—public interest gradually turned back to their historical heritage after much disillusionment. Interest in Iran's ancient history and culture revived, and gradually, both public perception and, in some cases, officials' views toward elements of Iran's ancient civilization, including Achaemenid heritage, underwent a transformation, leading to the emergence of new approaches to the ancient history of Iran.

## 4. The Onomastic Evolution of Persepolis

### 4-1. Etymology and Linguistic Transformations

The people of Iran, throughout different historical periods, have known Persepolis by various names, other than the name originally used by its founders, the Achaemenids: *Pārsih*. Even today, more than twenty-five centuries later, one of these names—*Takht-i Jamshīd*—has been widely accepted and is commonly used among Iranians, both the general public and academics. Among non-Iranians, thanks to renowned Greek historians, the name *Persepolis* has remained consistently in use from antiquity to the present day.

The most significant reason for the changes in the names of Persepolis throughout history can perhaps be attributed to the evolution of the Persian language. These linguistic changes, along

with shifts in script, led to considerable linguistic transformation, which disrupted the awareness of various Iranian peoples about their history over different periods. This disruption persisted until the deciphering of ancient languages and scripts, which ultimately resolved many historical ambiguities through the successful reading of ancient inscriptions.

The Persian language, a language of Iranian origin and one of the branches of the Indo-European languages, has undergone several stages of transformation from before 1500 BCE to the present day to become the Persian language Iranians speak today. (for the evolution of Iranian language and the path it has traversed from its inception to the present, see: Benveniste, 2016: 539). It is evident that as a result of linguistic changes over more than 3,500 years, ancient words have undergone significant structural and phonetic transformations. Many words, amidst the historical disruptions in Iran and the accompanying linguistic evolution—especially due to changes in script—have experienced profound alterations and, in some cases, have been erased from historical memory. Naturally, Persepolis and its name(s) could not remain untouched by these natural historical developments. Dandamayev explains this issue effectively:

> During the rule and dominance of the Sāsānīyān Empire, the names of Cyrus, Cambyses, Xerxes, and other kings of the true and historical Achaemenid dynasty were consigned to oblivion, and a legendary dynasty known as the Kayānīyān dynasty replaced the Achaemenids... The accounts of the Sāsānīyān period about Iran are by no means historical but are instead based solely on legends and epics. Medieval Iranian historians documented the credible and authentic history of Iran starting only from the reign of the Sāsānīyān dynasty. In the works of Persian poets and writers such as Niẓāmī and in modern Persian literature, references to the Achaemenids exist, but these rely on Greek sources transmitted through Syriac traditions.
>
> ... As such, before the deciphering of ancient Iranian cuneiform texts, it was impossible to assess or complete information about ancient Iran or examine the content of the Torah. From the first day Europeans encountered cuneiform scripts to the day they were deciphered, over two centuries passed... The deciphering of these inscriptions was one of the great achievements of the 19th century. It allowed us to gain insight into the civilizations and cultures of many nations worldwide (Dandamayev, 1994: 16).

Thus, it is based on this premise that we must examine and trace the evolution of names for places like Persepolis and Pasargadae, or names of figures such as Xerxes, Artaxerxes, or Cyrus. In onomastic studies, it must be acknowledged that the unfamiliarity with Old Persian cuneiform script and the obsolescence of other cuneiform scripts, such as Babylonian and Aramaic—which were used in the Achaemenid administration—led to various naming conventions being applied to the ruins of Persepolis in later periods. Providing an accurate chronology of the historical names used for Persepolis is challenging, and in some cases, one has no choice but to resort to conjecture. Consequently, studying the names of Persepolis based on their chronological precedence is not

straightforward. For this reason, in the present study, the investigation of the names used for Persepolis will be linked to the context and themes under which these names appear, rather than their chronological order. In this regard, the origins of these names will also be analyzed. The names associated with Persepolis are rooted in mythology, legend, superstition, religion, and even architectural elements and structural remnants of the Persepolis complex, such as its columns. By the end of this section, we may be able to propose a reasonable and coherent historical sequence for the names attributed to Persepolis, drawing from the results of our thematic research.

### 4-2. Mythological Associations: Jamshīd and Beyond

One aspect of the naming of Persepolis is rooted in myths and legends. The widely accepted name used today to refer to this historical complex—*Takht-i Jamshīd* (Throne of Jamshīd)—has its origins in Iranian mythology. While *Takht-i Jamshīd* may not have been the last name chosen for *Pārsih* (Persepolis), it is a name that has gained widespread acceptance among the Iranian public, irrespective of their familiarity with history. John Hinnells, who argues that Iranian myths have suffered damage during their transmission and that reconstructing a complete picture of them is challenging, introduces Jam or Jamshīd—or originally *Yima*[4]—as a figure belonging to Indo-Iranian beliefs. His most prominent characteristic in the *Vedas* is that he was the first immortal to choose mortality. He is highly revered for his thousand-year reign on Earth, marked by peace and prosperity, during which demons and their evil deeds—dishonesty, hunger, sickness, and death—held no sway. He was the first king to rule in peace, expand the world, and avoid warfare. Jamshīd serves as the archetype of an ideal king, envied by all rulers (Hinnells, 1989: 54-57 & 161).[5] Thus, the name of this mythical figure, who was also considered the creator of Nuvrūz, was aptly chosen for a structure that historically belonged to the Achaemenids, where Nuvrūz celebrations were held. During these ceremonies, Achaemenid kings received gifts from the leaders of subordinate nations and offered them gifts in return.

Firduvsī (940-1020), in the early pages of the *Shāhnāmih*, dedicates an entire chapter to Jamshīd and, in part, refers to the construction of his throne:

*With the splendor of kingship, he fashioned a throne*
*Adorned it with many gems,*

*Whenever he wished, demons lifted it high*
*From earth to the heavens,*

*Like the radiant sun, suspended in air*
*Sat the sovereign king on it,*

*The world gathered round his throne*
*In awe of his fortune,*

*They showered Jamshīd with gems*
*Proclaiming that day a New Day,*

*On the first day of the new year*
*Body relieved from suffering, hearts free of hate,*

*The nobles rejoiced, adorned in cheer*
*Calling for wine, for goblet, for bard,*

*And so, from that day, this blessed festivity*
*Remains as a legacy, a kings' gift in history.* (Firduvsī, 2020: 22).

But from when was the title *Takht-i Jamshīd* used, and when did the name Jamshīd and the title *Takht-i Jamshīd* begin to be used to refer to the complex we know today?

According to John Hinnels, in relation to the reconstruction of history based on mythology, later Iranian texts and early Muslim historians placed the myths of Gayūmart, Jamshīd, and others as the foundation of Iran's legendary history from the creation of the world until the Islamic conquest, with the foundation of this history being almost entirely based on the *Shāhnāmih* (Hinnells, 1989: 170). Ebba Koch, a historian, also holds this view specifically regarding Persepolis, believing that "in Islamic Iran, Persepolis was not associated with its historical founders, the Achaemenids, but with the mythical rulers of Iran as they were popularized by Firduvsī's great epic of kings, the *Shāhnāmih* (written around 1000 CE), in particular with Jamshīd" (Koch, 1993). However, Firduvsī relied on a written source to compose the *Shāhnāmih*: the prose *Shāhnāmih* of Abū Mansūr Muḥammad ibn-i Abd al-Razzāq, known as the *Abū Mansūrī Shāhnāmih*. This work was commissioned by Abū Mansūr and written by several authors, but only its introduction has survived to this day. The authors of the *Abū Mansūrī Shāhnāmih* themselves drew from ancient books, records, and some oral traditions (Safa, 1987: 613–615). We cannot say with certainty whether Firduvsī's reference to *Takht-i Jamshīd* was his own invention or if he borrowed it from the *Abū Mansūrī Shāhnāmih* or perhaps from other written or oral sources. More importantly, we do not know if his reference actually denotes the Persepolis [*Takht-i Jamshīd* (Throne of Jamshīd)] we are familiar with today. Or could it be that by the term "Throne," he specifically meant a royal throne in its literal sense rather than, by metonymy, the entire complex of Persepolis. Firduvsī's poetry allows for both interpretations: the throne that Jamshīd built, sat upon, and which demons elevated to the heavens, gathering the world around him; or the grand palaces constructed at Jamshīd's command by demons, where the great figures of various nations assembled to serve the king.

In the *Shāhnāmih*, before recounting the story of Jamshīd, Firduvsī narrates the tale of Gayūmart at the beginning of the Pīshdādīyān dynasty[6]. At one point, he says:

*Gayūmart became the lord of the world*
*First he built a place on the mountain,*

*His throne and fortune arose from the mountain*
*With the group, he donned leopard skin.* (Firduvsī, 11).

What prevents us from naming the place we now know as *Takht-i Jamshīd* (Throne of Jamshīd) "*Takht-i Gayūmart* (Throne of Gayūmart)" considering the precedence of Gayūmart's throne and kingship in the *Shāhnāmih*? The answer to this question is not simple, and it cannot be definitively and directly inferred from Firduvsī's poetry. The question of whether this site was known as *Takht-i Jamshīd* in popular oral culture before Firduvsī, or whether the association emerged after his poetry, remains unresolved. Interestingly, a century after Firduvsī, Ibn-i Balkhī (a historian of the 5–6th century AH / 11–12th century CE), in his *Fārsnāmih*, describes Gayūmart as the builder of what we know as *Takht-i Jamshīd* while discussing Istakhr (ancient Sāsānīyān royal residence, lies five kilometers north of Persepolis) and Marvdasht:

> In the beginning, Gayūmart built something there, and every king who sat upon it added to it. Ṭahmūris in particular greatly expanded it. When Jamshīd ascended as the ruler of the world, he transformed it into a great city… He also constructed a palace there at the foot of a mountain that had no equal in the world... (Ibn-i Balkhī, 2006: 125–126).

By aligning the mythical and historical contents of the *Shāhnāmih*, one might equate Gayūmart with Cyrus. According to Hinnells, Gayūmart was the first king in the *Shāhnāmih* to rule the entire world, revered by all (Hinnells, 1989: 170). Although Cyrus founded the Achaemenid Empire, it was Darius who was its great organizer (Ibid: 15). Thus, through the integration of myth and history, Jamshīd could also be aligned with Darius, who initiated the construction of Persepolis and designated it as one of his capitals. This was where, at the beginning of spring and during the Nuvrūz celebrations, the kings of various nations would be received in that grand complex. However, it is crucial to reiterate John Hinnells's observation: "Iranian myths, for various reasons, have been damaged during their transmission, making the reconstruction of their complete image challenging," and thus the precise alignment of mythological elements with historical realities is nearly impossible (Ibid: 55). and that it is almost impossible to accurately match myth-related elements with historical facts.

Nonetheless, whether or not Firduvsī meant this very site by *Takht-i Jamshīd*, it is highly probable that later generations, based on the descriptions in the *Shāhnāmih* and their observations of the remains of Persepolis, identified it as the same *Takht-i Jamshīd* referenced by Firduvsī. This grand complex, with its towering columns, bas-reliefs of demons and mythical creatures (like the Lamassu), depictions of gift-bearers, the king seated on the throne receiving emissaries, and scenes of battles between the king and demons, all align with his descriptions.

### 4-3. Religious Influences

Religious beliefs have significantly influenced the naming of both historical and non-historical sites throughout Iranian history. Often shaped by historical misunderstandings or ignorance, these beliefs evolved into superstitions that became deeply ingrained in popular traditions and adopted symbolic functions. A prominent example is the association of Persepolis with the figure of Prophet Solomon, a trend that gained traction after the advent of Islam, particularly among ordinary people, and sometimes historians and geographers. The name *Takht-i Suliymān* (Throne of Solomon) used for Persepolis illustrates how ancient structures, which did not align with contemporary understandings, were attributed to mythical or religious figures. Solomon, renowned in popular culture for his supernatural abilities, was often identified as the figure behind these attributions. In addition to *Takht-i Suliymān*, the name of Solomon appeared in various forms, such as Solomon's Stadium or Solomon's Mosque, further cementing his association with the site.

In Iran, this practice was not limited to Persepolis but extended to other historical sites such as the *Takht-i Suliymān* (an alternative name for the Fire Temple of Āzargushasp in West Azerbaijan Province) and the *Zindān-i Suliymān* (Prison of Solomon) a nearby mountain.[7] Similarly, the city of *Masjid Suliymān* in Khuzestan Province was named after a structure believed to be a mosque built by Solomon, even though it was likely a fire temple from the Achaemenid period. Another example includes *Mashhad-i Mādar-i Suliymān* (Mother of Solomon's Mausoleum) referring to Pasargadae and the tomb of Cyrus the Great. Notably, in this case, an additional figure—the mother of Solomon—appears in popular belief, even though she remains nameless, being known simply as Mother of Solomon. Curiously, this raises the question of how a prophet of Jewish tradition became associated with a mosque. In this research, we encountered yet another mosque named after Solomon, this time in Kashan (see: Meshkati, 1967). Based on this trend, it can be estimated that there are dozens of other sites in Iran linked to Solomon.

Regarding the current discussion, al-Muqaddasī (945-991) refers to Persepolis as *Malʿab-i Suliymān* (Stadium of Solomon), comparing parts of it to the sports grounds of Levant (Al-Muqaddasī, 1983: 660-661), likely alluding to structures such as the Roman Colosseum or amphitheaters he might have seen in places like Palmyra. Similarly, Iṣtakhrī (10th century CE) describes Iṣtakhr as the oldest city in Persia and the seat of Persian kings. He explicitly mentions the Mosque of Solomon, son of David, and firmly attributes the site to the Prophet Solomon, dismissing as erroneous those who associate it with Jamshīd or equate Jamshīd with Solomon (Iṣtakhrī, 1961: 110). Iṣtakhrī could arguably be one of the first to refer to Persepolis as the Mosque of Solomon, a naming convention that became more established over time, as evidenced by its appearance in the later *Ḥudūd al-'Ālam* under the slightly different spelling of *Mazgit-i Suliymān* (*Ḥudūd al-'Ālam*, 1983: 131). Among all these references to Solomon, Zakarīya Qazvīnī offers an interesting and less commonly cited observation on the role of Persepolis as a fire temple. However, even he bases his account on its association with Solomon, presenting this view as the prevailing belief of his time:

> There is a grand fire temple of the Magi in Istakhr, said to have been the mosque of Solomon—peace be upon him. Masʿūdī states that this fire temple is located outside the city and features massive, extraordinary columns, atop which large, intricately carved stone statues stand. These statues, some claim, represent the prophets. The fire temple is near a mountain where the wind never ceases, night or day. It is said that Solomon—peace be upon him—confined the wind to this place (Qazvīnī, 1994: 203).

But who was Solomon, and what connection did he have with Iran, Jamshīd, or Persepolis? Historically, Solomon's lifetime is separated by at least 500 years from the Achaemenid era and the construction of Persepolis. If Persepolis were to be attributed to Solomon, the timeline of this site—and other places associated with him—would need to be pushed back by nearly half a millennium. Solomon, the son of David, was a king and prophet of the Israelites. While his exact birth date is unknown, it is generally placed around 1035 BCE (Farrar, 1890: 4). His character has been a subject of complexity and controversy in Jewish, Christian, and Islamic traditions, and he is mentioned numerous times in the Quran. "God granted Solomon great blessings and diverse gifts, including wisdom and knowledge, understanding the language of animals, control over the wind, an army composed of humans and jinn, and unparalleled sovereignty. Due to the vastness of his kingdom and extraordinary power, many tales about him have been narrated in commentaries and prophetic stories, some of which are clearly mythical in nature" (Pishvai, 2005).

Some Iranians have long equated Solomon with Jamshīd. This conflation becomes even more tangled in the *Fārsnāmih Nāṣirī*, where the confusion between the names of Jamshīd and Solomon over Iran's historical sites—especially Pasargadae—takes on a new dimension. Mīrzā Ḥasan-i Ḥusaynī Fasāī, the author of the *Fārsnāmih Nāṣirī*, claims that the current tomb in the Pasargadae complex is the Tomb of the Mother of Jamshīd:

> Since the tomb of the mother of Jamshīd is located in this region, and the ancient Persian belief considered Jamshīd to be a prophet, after the Arab conquest of Persia, this region was called *Mashhad-i Um al-Nabī* (Shrine of the Mother of the Prophet). And since the Persians equated Solomon and Jamshīd as one figure, they also called it the *Mashhad-i Mādar-i Suliymān* (Shrine of the Mother of Solomon), (Ḥusaynī Fasāī, 1999: 1558).

Thus, in part of the popular belief, Jamshīd was considered synonymous with Solomon. Here, mythology and religion intertwine, merging two mythical and religious figures into one, making it challenging even for historians to distinguish between the two. Interpretations varied based on personal beliefs and ideologies: those with stronger religious inclinations tended to attribute sites to Solomon (e.g., Istakhrī), while those drawn to mythological and literary traditions were more likely to associate them with figures like Jamshīd or Gayūmart (e.g., as seen in the works of poets like Firduvsī). In any case, from a religious perspective, the myth of Solomon and his supernatural traits—transmitted through Israelite traditions—has deeply influenced Iranian folklore, even permeating some pseudo-scientific narratives.

Along with its religious f *Ṣad Sutūn* unction, such naming conventions may also stem from the symbolic function of these structures. Laurie Adams, in her book *A History of Western Art*, suggests that stone Lamassus—creatures composed of human and animal features—symbolized royal power, and that these monumental divine jinns served as guardian figures at the palace entrances (Adams, 2011: 45). Even in the bas-reliefs of Persepolis, depictions of kings battling otherworldly creatures appear, possibly inspiring associations of the site with legendary kings and figures mentioned in literary and religious texts. These figures were celebrated for their superhuman traits and dominion over both humans and supernatural beings, such as jinn, as well as their battles with demons and dragons.

### 4-4. Architectural Influences

Another aspect of the naming of Persepolis is derived from the site itself and the ruins left behind. After the destruction of Persepolis by Alexander the Great, the columns were one of the elements that remained from the vast complex. These stone columns, primarily belonging to the Apadana Palace, became one of the reasons for the selection of some of the names associated with Persepolis. Names such as *Ṣad Sutūn* (Hundred Columns), *Chihil Sutūn* (Forty Columns), or even *Hizār Sutūn* (Thousand Columns). According to Shapur Shahbazi, "During the Sāsānīyān period, this site was called *Ṣad Sutūn*, although the name referred not only to the *Tālār-i Ṣad Sutūn* (Hundred-Column Palace) but to all the buildings on the terrace. In later periods, in the collective memory of the people of Fars, *Ṣad Sutūn* became the *Chihil Sutūn* and *Chihil Minār* (Forty Minarets)" (Shahbazi, 2010: 23). *Tālār-i Ṣad Sutūn* (Hundred-Column Palace) is the second-largest palace at Persepolis after Apadana, where a hundred columns are located, and the hundred soldiers depicted on the palace's main doorways reference the ten thousand soldiers of the Achaemenid Immortal Guard, with the king at its head. After the destruction of Persepolis, many of the columns of this palace were also damaged, and it is certain that the naming of Persepolis as *Ṣad Sutūn* (Hundred Columns) by the later people was not because of the hundred columns in this palace or even throughout the entire Persepolis complex.

Our knowledge of the use of the name *Ṣad Sutūn* to refer to Persepolis comes from two inscriptions attributed to Shāpūr II in the Tachara Palace at Persepolis. In part of the first inscription (ŠPs-I), it reads:

> In the month of Isfand, in the second year (of the reign) of the Mazdā-worshipping deity, Shāpūr, King of Kings of Īrān and Anīrān [non-Iran], who bears the lineage of the gods, at a time when Shāpūr Sakānshāh rules the regions of Sind, Sīstān, and Tūrān up to the shores of the sea, the son of the Mazdā-worshipping deity Hurmuz, King of Kings of Iran and *Anīrān*, who bears the lineage of the gods, offered prayer at the court of his majesty, and he made his way to this road between Istakhr and Sīstān, and for good deed he came here to *Ṣad Sutūn*... (Daryaee, 2001).

In the second inscription (SPs-II), it is stated:

> In the month of *Tīr* of the forty-eighth year, on the day of Ūrmazd (the first day of the month), we, Seleucus, son of the right Shāpūr, and Kavor, the judge, came to *Ṣad Sutūn*, and the text that had been previously written and ordered by Shāpūr Sakānshāh to be inscribed was instructed by us... (Sami, 1975).

Since many numbers have traditionally held symbolic value in folklore, particularly in Iranian culture, the choice of "hundred" or "forty" for Persepolis is not rooted in factual reality but rather in symbolic and social constructs. The number forty, for instance, is one of those numbers whose significance goes beyond mere quantitative representation. Historically, the number forty has symbolized perfection and completeness. In contrast to numbers considered inauspicious, forty is regarded with an aura of sanctity and blessing in most societies and cultures, holding a special significance. In many references involving the number forty, we can see that the number itself loses its quantitative nature and takes on meanings of perfection, completeness, and abundance. For example, we all know that the *Chihil Sutūn* (Forty Columns) Palace in Isfahan has only twenty columns, or that the Tomb of the *Chihil Tan* (Forty Saints) in Shiraz contains no more than sixteen graves (Hasanzadeh, 2007). Thus, the use of forty to refer to Persepolis can be justified on the same basis, and the selection of the number one hundred can also be explained similarly. Overall, in the existing structures of Persepolis, the symbolic value and sanctity of numbers are abundantly evident.[8]

Jalāl al-Dīn Muḥammad Davānī a scholar of the 9th century AH, in his treatise "Arż-i Sipāh-i Ūzūn Ḥasan (The Presentation of the Army Ūzūn Ḥasan)" notes that the people of his time—he was from Fārs—used the term *Chihil Sutūn* to refer to the complex associated with Jamshīd. He also mentions another name that was previously used for Persepolis:

> Description of the *Chihil Sutūn*
>
> In some historical records that have come to attention, it is written that this place was known as the *Hizār Sutūn* (Thousand Columns) during the time of the Persian kings, and during the time of Jamshīd, whom historians believe to be Solomon, the construction of this site took place, and it is also reported that after its completion, Jamshīd ordered all his subjects to gather at the foot of the mountain on the day of Nuvrūz (Davānī, 1956).

Here, we encounter another name for Persepolis: *Hizār Sutūn*. Although *Hizār Sutūn* was not a commonly used name for Persepolis, references to it can be found in older sources. For instance, in the *Mujmal al-Tawārīkh* (likely dating back to the 5th or 6th century AH), when describing the reign of Humāy-i Chihrāzad,[9] there is a mention of *Hizār Sutūn*:

> ... and Humāy set them to building. In Pārs, she constructed three structures: one in the direction of the *Hizār Sutūn*, which is Iṣtakhr; the second… (*Mujmal al-Tawārīkh wa al-Qiṣaṣ*, 1999: 45).

*Chihil Minār* (Forty Minarets) is another name historically associated with the architecture of Persepolis and, specifically, with the remaining columns of the site. This name was widely known among people in the past and was also mentioned by foreign travelers. Giosafat Barbaro (1413–

1494), a Venetian diplomat, merchant, and traveler, is one of the earliest individuals to refer to *Chihil Minār* in his travelogue. He writes, "…there is a plain above it, surrounded by nearly forty columns, which they call *Chihil Minār* [in the text: *Cilminar*], meaning 'Forty Columns' in their language" (Barbaro, 1985: 97).

Another figure, Pietro Della Valle, an Italian traveler from the 11th century AH and 17th century CE who traveled to Iran during the Safavid period, also mentions in his work that the people of that time called Persepolis *Chihil Minār*:

> ...an enormous ancient structure known in Iran as *Chihil Minār*, located a bit further from Shiraz in the ancient city of Persepolis, which I believe to be the burial place of the ancient kings of Iran or a palace from the time of the Cyrus and Darius (Della Valle, 1991: 330).

Robert Stodart, an Englishman who was sent to the court of Shāh ʿAbbās Safavid with a delegation between 1627 and 1629 CE, left a travelogue in which he recounts his visit to Persepolis:

> On the twenty-third day, I went to *Chihil Minār*. It's a historical site with ancient relics. It was here that the great monarchs of the East, such as Cyrus and Cambyses, who laid the foundations of this renowned structure and many other buildings, resided. This Cambyses is the same figure whom Iranians refer to as Jamshīd.
>
> After visiting *Chihil Minār* and the tomb of Rustam, which is a farsang [league] away from *Chihil Minār*, we observed the carvings there, took horses and reached Zarqān, a poor village beside a hill, one English mile from "Rustam's House," which has now been converted into a mosque and restored (Stodart, 1960).[10]

Another person who mentioned *Chihil Minār* was the French merchant and traveler, Tavernier (11th century AH/17th century CE), who traveled to Iran during the Safavid era (Tavernier, 2020, 325). From examining the travelogues written during this period, we conclude that *Chihil Minār* was the term used to refer to Persepolis during the Safavid era.

### 4-5. Underused Names

In addition to these names, there might have been other names referring to Persepolis, some of which did not gain popularity and have faded from historical memory. Besides figures like Jamshīd and Solomon, one of the individuals to whom Persepolis was attributed was Humāy—which was also mentioned earlier. One of the earliest references to this attribution can be found in *Tārikh-i Ṭabarī* (History of Ṭabarī), in a historically complex and somewhat chaotic narrative that intertwines legendary figures with historical ones from the Achaemenid and Sāsānīyān periods, alongside references to Roman (but not ancient Greek) eras, as well as prophets from the Israelite tradition. Ṭabarī speaks of Gushtāsp, Ardishīr (Artaxerxes), Bahman, Rustam, Dastān, Dar (Darius), Sāsān, Isfandīyār, Humāy, and others, even drawing inspiration from the story of Moses. He recounts that after Bahman's death, Humāy placed Dara in a chest and cast him into the

Kur River so she could become the sole king. She was also the one who repeatedly sent armies to fight Rome and had the buildings of Istakhr (possibly Persepolis) constructed by Roman captives in the Roman style, and so forth (Tabari, 2011: 483-486). Apparently, this narrative became the dominant one for some time after Ṭabarī, with Humāy being regarded as the founder of Persepolis and Istakhr identified as Persepolis.[11] For example, this same narrative appears almost verbatim in *Akhbār al-Ṭiwāl* by Dīnwarī (815-895), (Dīnwarī, 1985: 51-52) and *Tārikh-i Payāmbarān va Shāhān* (History of the Prophets and Kings) by Ḥamza ibn al-Ḥasan Iṣfahānī (893-961), (Ḥamza ibn al-Ḥasan Iṣfahānī, 1967: 38), both of whom lived not long after Ṭabarī's time. In later periods, the name Istakhr frequently appeared in significant historical and geographical works, such as Istakhrī's *Masālik al-Mamālik* (The Routes of the Kingdoms) and the well-known *Ḥudūd al-'Ālam*.

Another name with low frequency in historical texts, which some authors believed referred to Persepolis, was mentioned by Odoric of Pordenone, an Italian religious missionary from the 14th and 15th centuries CE. Some historians consider the city he described as *Comerum* to be Persepolis. After passing through Yazd, he reports:

> Then passing many days' journey on forward, I came to a certain city called *Comerum*, which was a huge and mighty city in old time, containing well-nigh fifty miles of walls, and in times past did great damage to the Romans. In it there are stately palaces altogether destitute of inhabitants, notwithstanding it abounds with great store of provisions (Komroff, 1928: 215-216).

Ali Mousavi, citing Shapur Shahbazi, considers this word to be a corruption of *Kumihr*, derived from *Kūh-i Mihr* (the Mountain of Mehr) or *Kūh-i Raḥmat* (the Mountain of Mercy), (Shahbazi, 1977, as in: Mousavi, 2012: 95), near which Persepolis was constructed. It is possible that Odoric, due to language barriers and communication difficulties, misunderstood and interpreted *Kūh-i Mihr* as *Kumir*, or as he says *Comerum*. There is also the possibility of confusion with other place names, leading him to mistakenly associate this name with Persepolis, especially since a location with this name exists in the same region, which Muḥammad Nāṣir ibn-i Jaʿfar Furṣat Shīrāzī (1271–1339 AH), a poet, writer, painter, and statesman of the Qajar era, mentioned this place in *Āsār-i Ajam* while discussing Shiykh Quṭb al-Dīn, stating, "His tomb is in *Kumehr*, meaning in *Kamīn*..." (Furṣat Shīrāzī, 1998: 405).[12] Interestingly, Furṣat Shīrāzī himself, on page 377, dedicates a section to introducing *Kamīn*, but, there, he makes no mention of either Persepolis or *Kumihr*. Based on this, we may conclude that Odoric's report of *Comerum* and his association of it with Persepolis is a confused account, and it is even unlikely that the local people used this term to refer to Persepolis.

## 5. Tracing the Original Name

Today, after centuries have passed, we know that the true and original name of Persepolis was *Pārsih*, "a title derived from the name of the Persian people, who called their own province by the same name, Pārs, which we today call Fārs. This name, *Pārsih*, is inscribed as the city's

name in Xerxes' inscription on the wall of the 'Gate of All Nations' and also appears on the Elamite tablets unearthed from the treasury and fortifications of Persepolis" (Shahbazi, 2010: 22). This discovery—the recognition of the name used by the builders of this complex, the Achaemenids—has only been made possible through the efforts of dozens of archaeologists, historians, and travelers who deciphered cuneiform and read the ancient inscriptions of Persepolis. Each contributed, through transcription and comparison of various cuneiform inscriptions, to the unraveling of the cuneiform alphabet, ultimately enabling historians and archaeologists to read these ancient texts with precision. This undertaking spanned three centuries—from the 17th to the 19th century—before reaching fruition. The initiative can be traced back to 1622, when Pietro della Valle brought a copy of the cuneiform inscriptions of Persepolis to Italy during his journey to Iran. Then, in 1674, Jean Chardin first used the term "cuneiform". Later, more seriously and separately, individuals like Engelbert Kaempfer (1651-1716), Carsten Niebuhr (1733-1815), and eventually Friedrich Grotefend (1775-1853) and Henry Rawlinson (1810-1895) succeeded in completely and accurately reading the Achaemenid inscriptions at Persepolis and other sites, like Bīsutūn.[13] After centuries of using various names, the trilingual inscription of Xerxes on the wall of the Gate of All Nations at Persepolis clarified that *Pārsih* was the original name of Persepolis a name hidden from our knowledge for a span of twenty-three centuries.

The translation of Xerxes' inscription (XPa), written in cuneiform four times in three languages —Old Persian, Elamite, and Babylonian—on the walls of the Gate of All Nations at Persepolis reads as follows:

> **- Paragraph 1:** A great is who created this earth, who created that heaven, who created man, who created the joy of man, who made Xerxes king, one king among many, one governor among many.
>
> **- Paragraph 2:** I am Xerxes, the great king, the king of kings, the king of countries with all kinds of people, the king of this vast, far-reaching land, son of Darius the king, an Achaemenid.
>
> **- Paragraph 3:** Xerxes the king says: By the will of Ahūrā-Mazdā, I built this Gate of All Nations. Many other beautiful works in this *Pārsih* were done by me and my father. Everything that is beautiful to the eye, we did by the will of Ahūrā-Mazdā.
>
> **- Paragraph 4:** Xerxes the king says: May Ahūrā-Mazdā protect me and my kingdom, and what has been done by me and what has been done by my father—may Ahūrā-Mazdā preserve it! (Sharp[14], 1967: 109).

Despite this significant historical discovery and the understanding that *Pārsih* was the name chosen and used by the builders of this complex, ultimately, *Takht-i Jamshīd* (Throne of Jamshīd) became the established name, which remains widely accepted among Iranians today. Furṣat Shīrāzī's repeated and consistent use of the title *Takht-i Jamshīd* in *Āsār-i Ajam* indicates that this name became established and was in use during the Qajar period. Furṣat Shīrāzī, who was commissioned to map and document Iran's ancient sites at the end of Nāṣir al-Dīn Shāh's reign, write:

> Some historians have written that the city of Istakhr was initially built by Gayūmart; others state that it was founded by his son, whose name was Istakhr; following that, Hūshang added to its construction; and then Jamshīd completed it. It is recorded that Jamshīd's enthronement was 2,419 years after Adam's fall, and *Takht-i Jamshīd* is called "Persepolis" in English. From its remnants, ruins, buildings, and columns, it is evident that few constructions in the inhabited world were built with such solidity; minds are astonished upon seeing it. The Eternal God is witness to the fact that words fail to capture its description; one cannot truly understand what has been achieved and what structures were left behind until they have seen it. This humble one stayed there for seven days and nights. To the best of my ability, I drew a few sketches of those buildings and recorded some details about the site... (Furṣat Shīrāzī, 1998: 218).

He then goes on to describe the different parts of *Takht-i Jamshīd* in detail and consistently uses this name. Thus, this name has become widely used among both the general public and the scholarly community. Ordinary people commonly refer to this complex as *Takht-i Jamshīd*, and even the most renowned historians and archaeologists, despite their familiarity and knowledge of the original name of the site, *Pārsih*, use the popular term accepted by the public. For example, one of the most distinguished researchers on Persepolis, whose work has become a source for many international articles and historical books on this subject, is Professor Shapour Shahbazi. He has conducted some of the most important published studies on Persepolis, and while referring to its original name, he did not choose or use any name other than *Takht-i Jamshīd* in Persian; a choice that was both deliberate and wise. For the name *Takht-i Jamshīd* itself has become a part of Iran's cultural heritage, and changing it would mean tampering with the collective memory of Iranians; an act that would undoubtedly be met with resistance and possibly collective opposition.

In all the periods in which various names were used in Iran to refer to this site, simultaneously and among non-Iranian historians, a single name, Persepolis, was used to refer to that. This uniform use of the name Persepolis and the reason for the lack of significant variation or change in its name in non-Iranian societies are due to surviving texts, especially from ancient Greek historians. The name used by Greek historians from the outset to refer to Persepolis has continued with minor modifications to the present day. However, the research of Professor Shapour Shahbazi, based on various sources, provides an interesting etymology of this name's choice, which is worth quoting in detail:

> The famous Western name for this place, *Persepolis*, has a peculiar origin. In Greek, *Persepolis*, or its poetic form *Perseptolis*, is an epithet for Athena, the goddess of wisdom, craftsmanship, and war, meaning 'destroyer of cities.' This epithet was used by Aeschylus, the 5th-century BCE Greek poet, in *The Persians*, to refer to 'the city of the Persians' as a pun and play on words. This deliberately incorrect translation, in its simpler form, *Persepolis*, became

popular in Western texts and was later adopted by modern people (Shahbazi, 2010: 22).

It is clear that the Greeks and Greek historians were familiar from the beginning with the use of *Pārsih* by Iranians to refer to Persepolis; Ktesias, in referring to Persepolis and Pasargadae, used *Pārsih* (Ktesias, 1888: 136). however, they seem to have preferred the use of Persepolis, and this name was accepted and established among them and almost the entire Western world, except in cases where foreign travelers and historians referenced the names used by locals and Iranians to refer to Persepolis, some of which we have previously mentioned.

## 6. Conclusion

This study has traced the evolution of Persepolis's names, revealing a complex interplay of historical, cultural, linguistic, and mythological factors that have shaped perceptions of this monumental site. This study explored how the name *Pārsih* (its authentic Achaemenid name) was obscured over millennia, replaced by a series of designations reflecting Iran's shifting cultural and historical landscapes. Specifically, our awareness of the name *Pārsih* has been established through the deciphering of cuneiform texts, marking a new understanding that was not previously available. These names offer a unique lens into the transformations of Iranian society, from the grandeur of the Achaemenid Empire to post-Islamic reinterpretations and modern nationalist revivalism.

Concerning the names of Persepolis, aside from *Pārsih* (which we know with certainty was used by the Achaemenids themselves) the exact timing of other names is unknown. Based on various historical sources and their references to the name used for Persepolis, we likely can say in which historical period each name was utilized. Thus, following the title *Pārsih*, which was used from the time of the construction of Persepolis, during the Seleucid rule and considering their direct connection to Alexander and Greek historians, it can be said that the widely known title *Persepolis*, coined by Greek historians, was in use. However, concerning the Parthian Empire, which rose to power after the Seleucids and ruled Iran for nearly five hundred years, we lack as much information as we have for the Achaemenid or Sāsānīyān eras. Some historians attribute this lack to the destruction of Parthian cultural artifacts and heritages by the Sāsānīyāns, who sought to present themselves as the direct heirs of the Achaemenids. As discussed earlier in this study, the Parthians traced their lineage back to the Achaemenids and specifically to Artaxerxes II. Syncellus, in *Chronography*, mentions that the two brothers, Arsaces and Tiridates, rebelled against the Seleucid rule during Antiochus' reign due to their claimed lineage from Artaxerxes, king of the Persians. Thus, given the historical closeness of the Parthians to the Achaemenids, it can be inferred that they, too, likely referred to Persepolis as *Pārsih*.

In the Sāsānīyān era, and based on an inscription by Shapur II in the Tachara palace at Persepolis, we know that Persepolis was called *Ṣad Sutūn* (Hundred Columns). However, after Islam, various names arose for different reasons. The primary influence stemmed from the mythological perspective on history, based on oral epic traditions and, above all, Firduvsī's *Shāhnāmih*. Thus,

the title we use today, widely recognized among all Iranians, took shape and eventually became established after centuries: *Takht-i Jamshīd* (Throne of Jamshīd). In the Islamic period, along with *Takht-i Jamshīd*, various other names were used, such as *Takht-i Suliymān* (Throne of Solomon), *Malʿab-i Suliymān* (Solomon's Stadium), *Masjid-i Suliymān* (Mosque of Solomon), *Chihil Sutūn* (Forty Columns), *Chihil Minār* (Forty Minarets), *Hizār Sutūn* (Thousand Columns), and several other less common names. Among non-Iranians, the title *Persepolis*, established by Greek historians, was recognized from the beginning, and in the post-Islamic era, travelers and writers often referred to the local names used for this site alongside Persepolis.

These onomastic transformations highlight how collective memory and cultural identity have shaped and been shaped by Persepolis's legacy. The use of *Takht-i Jamshīd*, widely recognized among Iranians today, underscores the enduring influence of Firduvsī's *Shāhnāmih* in intertwining myth and history. Simultaneously, the continued use of *Persepolis* in Western traditions underscores the global resonance of this site, albeit through external interpretations shaped by Greek historiography.

This study has examined the evolution of Persepolis's names to explore how language and culture have intersected in preserving, interpreting, or distorting historical narratives. Persepolis, as both an architectural marvel and a linguistic palimpsest, has reflected the layers of Iranian identity and history. Its names, from the Achaemenid *Pārsih* to later titles, have highlighted shifts in political power, cultural memory, and national identity. This analysis has underscored the importance of protecting cultural heritage from modern challenges, such as ideological distortion and geopolitical conflict. Future researches could investigate the sociopolitical implications of onomastic changes, revealing how the renaming of cultural sites has shaped collective memory and national identity. By understanding Persepolis's names, we have gained insight into the broader role of onomastics in preserving and interpreting heritage, emphasizing the ongoing relevance of names in shaping cultural continuity and transformation amid political change.

## Endnotes

1. Darius, in the Bīsutūn inscription (DB), lists 23 subordinate countries: 1. Persia, 2. Khūzistān (Īlām), 3. Babylon, 4. Assyria, 5. Arabia, 6. Egypt, 7. Greeks living by the sea (Cilicia and Cyprus), 8. Sardis (Lydia), 9. Ionia (Greeks living on the coast of Asia Minor), 10. Media, 11. Armenia, 12. Cappadocia, 13. Parsava (Khurāsān), 14. Sīstān (Zarang), 15. Hirāt, 16. Khārazm, 17. Balkh (Bactria), 18. Sogdia 19. Gandhara, 20. Saka, 21. Satagavsh (part of present-day Afghanistan), 22. Harauvatish (Arachosia), and 23. Makran (Sotoudeh, 1971). In his later inscriptions, such as those at Persepolis, Susa, the Suez Canal in Egypt, and Naqsh-i Rustam, Darius mentions additional lands and tribes beyond the 23 regions conquered during the reigns of Cyrus and Cambyses. These include Asagarta (around the region of Kurdistān), India, Skudra (parts of modern Macedonia), Libya, Ethiopia, Karkā (possibly Georgia), and other groups of Scythians and Ionians (Greeks). In some cases, the number of satrapies increases to 30, as indicated in Darius's inscription at Naqsh-i Rustam. Xerxes, in his inscription at Persepolis, adds two more groups: the Dahaeans (a Scythian group) and the Ākufchīyā (likely in Kerman and Makrān), bringing the total number to 31 satrapies (Jamali, 2013).

2. For instance, the Tachara Palace, which was Darius's private residence, is famously known as the "Hall of Mirrors" among the people. This is because the stones used in its construction are highly polished and smooth, and in several doorways, they have remarkably retained their clarity and gloss, reflecting faces like a mirror. Additionally, due to the well-preserved condition of the stones and the minimal damage caused by fire, from the Sāsānīyān period to the post-Islamic era, kings, princes, military commanders, and

calligraphers visiting Persepolis have engraved inscriptions and memoirs on its walls, columns, and doorways. Today, many of these inscriptions hold significant historical interest and value (Sami, 1975).

3. Different narratives have been recorded regarding these events, ranging from the capture and destruction of Athens to the burning of the Acropolis, with the latter theory finding broader acceptance among historians. Tom Holland provides a comprehensive account of this event in his book *Persian Fire: The First World Empire and the Battle for the West*, detailing the evacuation of Athens by the Greeks, its transformation into a ghost town, and the subsequent arrival of Xerxes' army (for further reading, refer to: Holland, 2005). In general, some historians attribute Xerxes's campaign to a desire for revenge over the defeat of the Persians at the Battle of Marathon (Barringer & Hurwit, 2005: 91). While others see it as a response to the burning of the city of Sardis, one of the Achaemenid satrapies, by the Greeks. The abstract of the historians' accounts in this context can be summarized in Abdulazim Rezaei's statement that "The Iranian army deviously went toward Athens, conquered the said city, burned down the temple of Athena, and in this way the revenge of the Greeks for the burning of Sardis was avenged" (Rezaei, 1985: 221).

4. Even here, the linguistic evolution of the name, which we now write and pronounce as Jamshīd, is noteworthy.

5. Hinnells' reference to Jamshīd's thousand-year reign is likely based on a source other than the *Shāhnāmih*, as the *Shāhnāmih* states: *Seven hundred years passed him by*; *He created all that was good and ill* (Firduvsī, 2020: 28).

6. A legendary lineage of primordial kings central to Zoroastrian belief and Persian mythology. Initially depicted as rulers of the entire world, their dominion was eventually confined to Īrānshahr in the legends.

7. Based on excavations by the German Archaeological Institute in Iran, beginning in 1960, the structure known as the Zindān-i Suliymān has been identified as a fortress from the 8–7$^{th}$ centuries BCE, later acquiring a religious function alongside the Āzargushasp Fire Temple, where sacrifices were performed atop its summit. (see: Kleiss, "Takht-i Suliymān and Zindān-i Suliymān"). Once again, these two sites were attributed to Solomon not based on historical reality but due to popular myths and superstitions.

8. For more detailed information regarding the symbolic value of numbers in Persepolis, see Appendix Two in the *Authoritative Guide to Persepolis*, titled "Scales and Numbers in Persepolis."

9. This refers to the female Iranian ruler, the seventh king of the Kayānīyān dynasty.

10. Here, we witness Stodart's historical error in attributing the construction of Persepolis to Cyrus and Cambyses, identifying Cambyses rather than Darius as equivalent to Jamshīd. Another issue is his perception of the Naqsh-i Rustam complex and the tombs of the Achaemenid kings as the tomb of the legendary Rustam from the *Shāhnāmih*, based on the beliefs of the people of that time.

11. As previously mentioned, Istakhr is a city from the Sāsānīyān era, located near Persepolis.

12. The editor explains in a footnote that *Kumihr* is said to have originally been *Kūh-i Mihr*, which, in any case, is the old name for *Kamīn*.

13. For a complete study of the process of cuneiform discovery, refer to the article by Dr. Lutz Glelhammer, German Ambassador to Iran: "The Discovery of Cuneiform."

14. The Reverend Ralph Norman Sharp was an Anglican missionary and later university assistant professor of Old Persians in Pahlavi university, Shiraz.

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# نام‌شناسی تخت‌جمشید در اسناد و متون تاریخی: از آغاز تا دورهٔ قاجار


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**چکیده**

این پژوهش به بررسی سیر تاریخی نام‌هایی می‌پردازد که در طول زمان به تخت‌جمشید، یکی از برجسته‌ترین محوطه‌های باستانی ایران، اطلاق شده است. مسئلهٔ اصلی پژوهش، این پرسش است که، چگونه تغییرات در نام‌گذاری یادمان‌های باستانی بازتابی از دگرگونی‌های گسترده‌تر در حافظهٔ جمعی، ایدئولوژی و هویت فرهنگی هستند. هدف اصلی مطالعه، دنبال کردن فرآیندهایی است که طی آن‌ها نام‌هایی چون «پارسه» در سنگ‌نوشته‌های هخامنشی تا «تخت‌جمشید» در دوره‌های متأخرتر، در بستری از گفتمان‌های تاریخی، دینی و فرهنگی شکل گرفته‌اند. این پژوهش با بهره‌گیری از رویکردی میان‌رشته‌ای که تحلیل زبان‌شناختی، تاریخی و باستان‌شناختی را با یک‌دیگر تلفیق می‌کند، به بررسی منابع متنوعی ازجمله کتیبه‌های سلطنتی، متون تاریخی کلاسیک و اسلامی، سفرنامه‌ها و ادبیات اسطوره‌ای می‌پردازد و به نقطهٔ عطفی در دوران مدرن اشاره می‌کند که پیشرفت‌های علمی در حوزهٔ باستان‌شناسی، به‌ویژه رمزگشایی خطوط میخی، موجب رفع برداشت‌های نادرست تاریخی شد و نام اصیل «پارسه» که در روزگار هخامنشیان به‌کار می‌رفت، بار دیگر به هویت این مجموعه بازگردانده شد. یافته‌های پژوهش نشان می‌دهد که تاریخ نام‌گذاری تخت‌جمشید صرفاً موضوعی واژگانی نیست، بلکه دریچه‌ای مهم برای درک چگونگی به یاد آوردن، بازتفسیر و بازسازی گذشته است. با قرار دادن این تاریخ نام‌شناختی در دل مباحث کلان‌تری چون: باستان‌شناسی، میراث‌فرهنگی، حافظهٔ تاریخی و تاریخ‌نگاری، این پژوهش سهمی در فهم ژرف‌تر فرآیندهای فرهنگی‌ای دارد که هویت تاریخی را شکل می‌دهند و بازتعریف می‌کنند.



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## The Sheikh-Makan Monument in Ilam Province, Western Iran: Fire Temple or Water Mill?

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**Abstract**

The Sheikh Makan structure in Ilam Province represents one of the most debated architectural remains from the Sasanian period, consistently drawing scholarly attention and controversy. This study employs a systematic methodology to analyze the site's architectural features, construction techniques, and archaeological context in order to determine its primary function. The rectangular complex comprises a central domed chamber, a vaulted iwan, and integrated hydraulic channels elements characteristic of industrial architecture, particularly watermill infrastructure. Notably, the structure lacks key markers typically associated with Sasanian religious architecture, such as circumambulatory corridors, fire temple, and the canonical north-south sacred orientation. In contrast, the building displays unmistakable industrial features, including flour production mechanisms and milling apparatus. A comparative analysis with established Sasanian religious complexes most notably the Negar Fire Temple and the Espakho Temple reveals significant divergences in spatial organization and intended use. Archaeological evidence, supplemented by ethnoarchaeological data, supports the hypothesis of its prolonged use as a hydraulic mill, indicating the functional adaptation of a Sasanian-era construction during later periods. The site's strategic location adjacent to defensive structures and historical trade routes further underscores its economic rather than religious significance. Although some scholars, have proposed a sacred function for the site (suggesting it may have served as a fire temple), the present study definitively identifies the structure's primary role as an industrial facility. It thus offers a paradigmatic example of Sasanian architectural repurposing in the Islamic era. These findings underscore the need for targeted archaeological excavations to resolve existing chronological ambiguities and to trace the developmental trajectory of the building within the broader framework of Iranian architectural history. Ultimately, this research makes a significant contribution to understanding the functional transformation of built environments and the complex interplay between sacred and utilitarian spaces in post-Sasanian Iran.

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## 1. Introduction

The study of Sasanian architecture presents ongoing interpretive challenges, especially regarding the functional classification of surviving structures. These persistent uncertainties stem from three key issues: (1) inadequate archaeological investigations, (2) discrepancies between traditional typologies and material evidence, and (3) the complex architectural adaptations during the Islamic transition (Tahmasbi, 2012: 1). The Sheikh-Makan monument in Ilam Province exemplifies these scholarly debates, embodying the dynamic relationship between sacred and practical spaces in late antique Iran.

Understanding such transitional structures requires examining the profound spatial changes following the Arab conquests. As Rossi (2023:17-33) demonstrates, the early Islamic period saw significant shifts in settlement patterns, particularly the abandonment of rural religious sites in favor of urban centers. This trend is especially evident in western Iran, where Sasanian rulers had strategically developed Zoroastrian religious infrastructure during their westward expansion (Chen, 2020: 5). Located near the historic city of Seymareh (Darreh Shahr) along important trade routes, the Sheikh-Makan monument offers a valuable case study for analyzing these historical transformations. This study employs a multidisciplinary approach to address the longstanding debate about the monument's original purpose. Through systematic examination of:

- Its rectangular layout with an east-west orientation
- Hydraulic systems including water channels and milling components
- Strategic positioning near Sasanian fortifications
- Architectural similarities to confirmed religious and industrial structures

We aim to develop a more sophisticated understanding of its functional development. The research specifically fills gaps in current scholarship about western Iranian Sasanian architecture and its adaptation during the Islamic period (Hojabri & Karimiān, 2022: 279).

## 2. Geographical and Historical Contexts of the Sheikh-Makan Structures

Ilam Province is situated in the western part of Iran (Salavarzi and Amouzadeh, 2023: 25), (Fig. 1). The Sheikh-Makan features are located 8 km east of Darreh Shahr (the historical city of Seymareh) within the Sheikh-Makan Gorge (Sheikh-Makho). The Sheikh-Makan Gorge (coordinates: E:47°24'01", N:33°05'51") was formed as a result of a landslide approximately 10,000 years ago (Watson & Wright, 1969). This gorge is near the town of Seymareh (now Darreh Shahr).

However, none of the researchers have mentioned the Sheikh-Makan Gorge and its features. The name of Sheikh-Makan Gorge is derived from the name of the village located 500 meters from the gorge, a shortened form of Sheikh Mohammad Khan in the Lori language (Fig. 2). Within the village, the major monument is the Sheikh-makho Castle, built in 1916 by Mir Seyed Mohammad Khan Ashraf al-Ashayer (Fig. 3).

During Reza Shah Pahlavi's reign (1925-1941 CE), the village was referred to as Sheikh-Makan in administrative documents. The ruins in the Sheikh-Makan Gorge are unique. Approximately 2

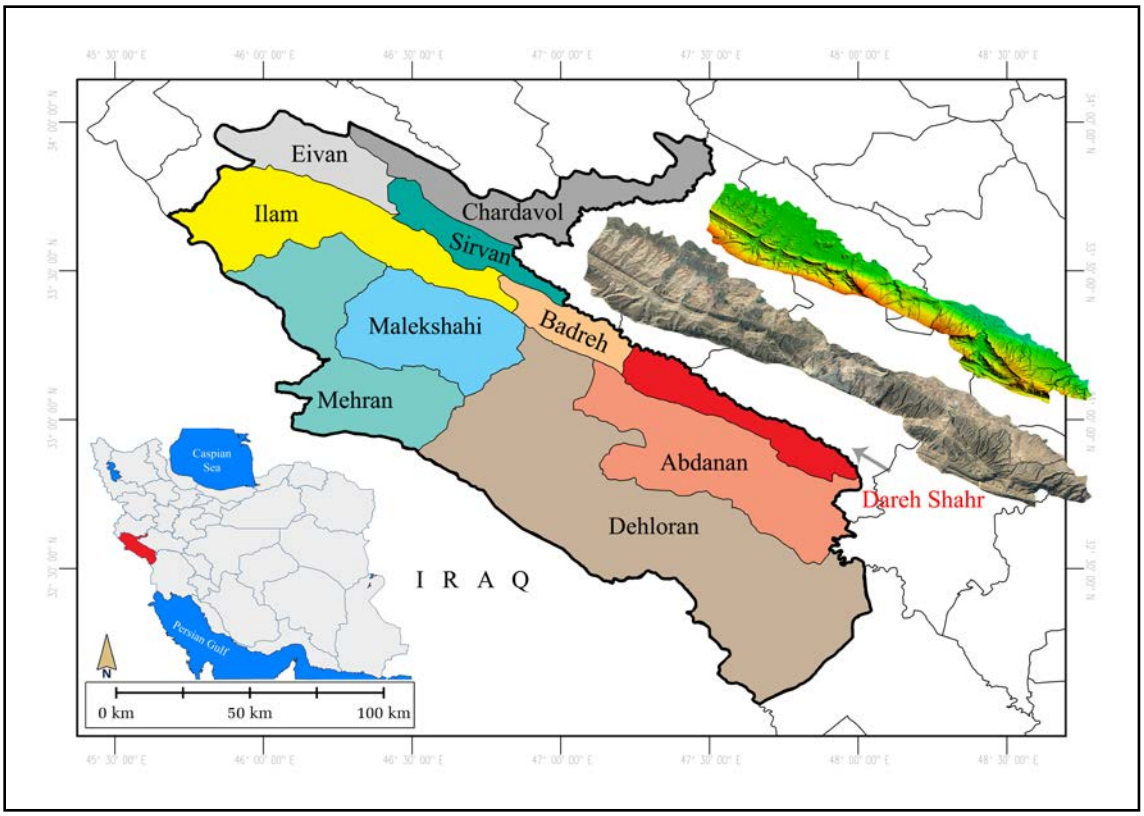


**Fig. 1: The Geographical Location of Darreh Shahr County (M. Rokni).**

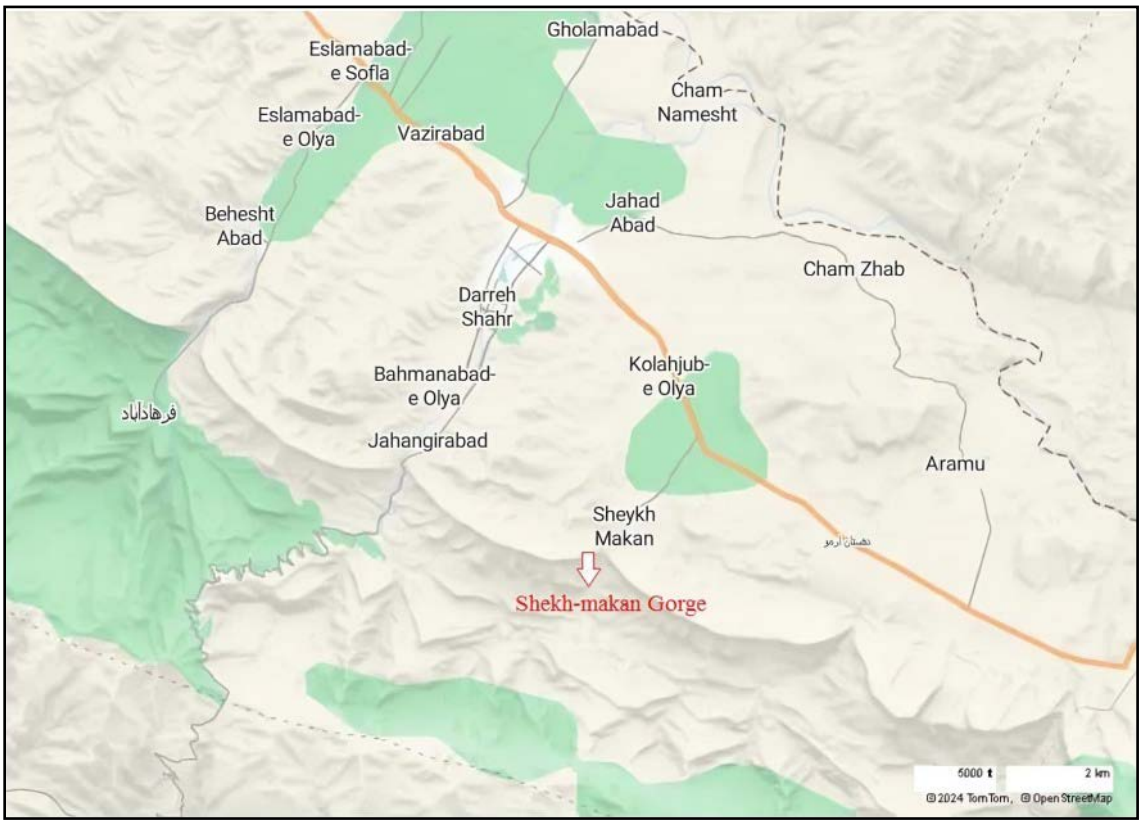


**Fig. 2: The Geographical Location of Sheikh Makan (source: Bing Maps, 2024).**

**Fig. 3: A View of Sheikh Makan Castle in Sheikh Makan Village (https://www.chtn.ir/photo/1402082701496/)**

kilometers from the Sheikh-Makan Gorge lies the narrow Bahram Chubin Gorge, located at the foothills of Kabir Kouh. Local legends attribute the ruins found there to Bahram Chubin, a Sasanian general famous for his rebellion against King Khosrow Parviz (Izadpanah, 1977: 421), although some believe the gorge was also a hunting ground. Two historical regions, Mehrjan Qazq (centered in Seymareh) and Masbazan (centered in Sirvan), were situated in the south of Ilam. Iranian and Arab authors such as Ibn Khordadbeh, Ya'qubi, Yaqut al-Hamawi, Mas'udi, Istakhri, Ibn Hawqal, Muqaddasi, Ibn Athir, and Mostowfi indicate that the term "Jebal," meaning "mountainous region," became commonly used to refer to this area and its surroundings after it came under Muslim control. Some sources also refer to it as part of Koust Khurbaran (Marquart, 1994: 37). Blazari attributes its conquest by the Arabs to the year 21 AH, prior to the conquest of Nahavand (Balazari, 1967). Based on these reports, it is clear that the city of Seymareh existed during the Sasanian and subsequent periods.

Rawlinson described Seymareh as a Sasanian city (Rawlinson, 1839), while Morgan identified Darreh Shahrs "Madaktu," the capital of ancient Elam (de Morgan, 1960). Stein suggested the existence of monumental structures from the Parthian and Sasanian periods at the site (Stein, 1940). The oldest aerial photograph of Seymareh, taken in 1935, revealed an area of over 500 hectares (Schmidt, 1940). Izadpanah also examined monumental structures in the region (Izadpanah, 1997). Archaeological surveys began in 1983, with Mo'tamedi initiating excavations in 1995, which continued for nine seasons under Lakpoor's supervision (Lakpoor, 2010). Mazaheri documented water structures, including mills, during his surveys in Darreh Shahr (Mazaheri, 2006), and Sharifinia has recently researched the water mills of modern Seymareh (Sharifinia, 2020).

## 3. The Sheikh-Makan Gorge Structures

### 3-1.The Fortress

A Sasanian fortress is constructed on the mountainside, utilizing the mountain wall as its western boundary (Izadpanah, 1977: 420). The fortress overlooks one of the ancient routes leading to Susa. The significance of this fortress lies in its strategic control over the path passing through the gorge (Kambakhsh Fard, 1989; Izadpanah, 1997). The eastern wall, made of rubble stone and partially baked gypsum, reaches a maximum height of 14.5 meters above the fortress roof. The wall is 1.35 cm thick. The exterior surface is finished with plaster. Seventeen steps carved into the mountain lead from the fortress to a roof leading to a circular observation point equipped with battlements, arrow slits, and surveillance openings. Its walls include projections and a lookout fort for effective protection of the gorge. With four rooms and a single entrance on the north side providing a clear view of the passage, the structure is primarily made of rubble and plaster. The nearly impregnable southern remnants of the wall and guard room highlight the fortress's military purpose. The strong enclosure and uniform architectural style indicate that the valley was strategically controlled from both the northern and southern gates (Fig. 4).

**Fig. 4: The Sheikh Makan Fortress (Photo by: Ruhollah Gilani).**

### 3-2. The Sheikh-Makan Monument

The Sheikh-Makan monument, located adjacent to the fortress within the gorge, is known today as the water mill by local residents. However, Izadpanah believes that this monument was originally

a fire temple that the local people converted into a mill, making it an important historical structure in the region. The building, made of rubble and plaster, has a simple plan featuring a domed chamber and an eyvan (portico), connected by an entrance. The combination of a dome chamber and eyvan is a common feature in Iranian architecture, utilized in a distinctive manner, with the eastern entrance leading to the eyvan (Shah Mohammad Pour, 2021: 287).

The initial step in understanding the Sheikh-Makan mill involved creating precise documentation to reveal its original geometry. The structure has remnants of a dome in the northern half and has a rectangular plan made of stone and plaster. Identifying its function is challenging, prompting further investigation into its architectural components and spatial elements to clarify uncertainties. To achieve a more accurate understanding than previous studies, modern methods and meticulous analysis are essential. This includes precise documentation of the current architectural state and comparative analyses with water mills and fire temples. However, definitive conclusions can only be reached through scientific excavation. The architectural structure and plan of this mill are quite different from those of other mills in Darreh Shahr County as well as in the rest of Ilam Province (Fig. 5, 6, 7, 8). The building is rectangular, measuring 8.60×4.68 m, and is oriented at an angle along the east-west axis, with the eyvan and main entrance facing east. The structure has not been excavated, so there is no information about the floor. This building includes sections such as the entrance, the miller's room, the furnace, and the water channel, with the area of each part measurable and evaluable separately.

**Fig. 5: Sheikh Makan Building, View from the East (Photo by: Ruhollah Gilani).**

**The building's architectural structure includes the following elements:**

**- Water Channel:** This channel is 11 m long, 2.45 cm wide, and about 1.15 cm thick. As it approaches the furnace opening, its width decreases from 1 m to about 50 cm, apparently to increase the intensity and flow of the water.

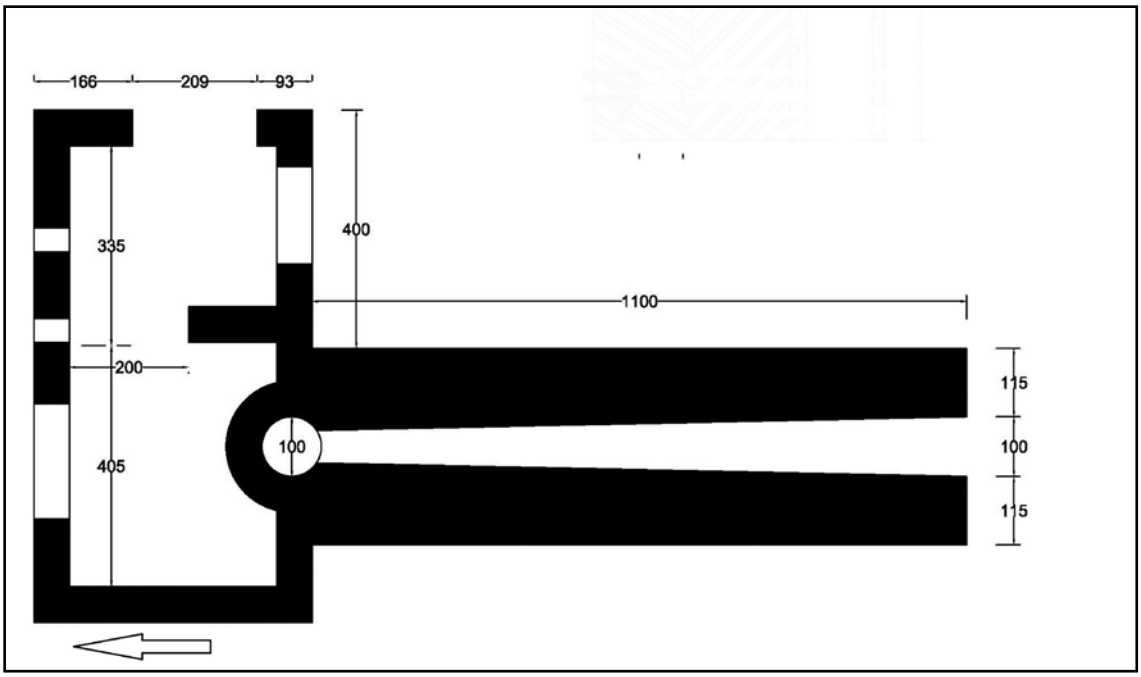


**Fig. 6: Plan of Sheikh Makan Building (Author, 2024).**

**Fig. 7: Sheikh Makan Building, View from Above (Photo by: Ruhollah Gilani).**


**Fig. 8: A View of the Sheikh Makan Building and Fortress (Photo by: Ruhollah Gilani).**

**- Furnace:** The diameter of its opening is 110 cm, with wall thickness measuring 57 cm.

**- Entrance Portal:** The entrance portal was intact during Izadpanah's visit and opened to the east. Its dimensions are 2.20×1.10 m.

**- Entrance Eyvan (Miller's Room):** This space is square-shaped, with an internal area measuring 3.30×3.30 m. In this area, there are two niches with camber arches, measuring 60×80 cm and 47×54 cm. Additionally, on the southern side, there are remnants of a rectangular niche measuring 80 cm in width, with an unspecified height.

**- Central Space:** This may have been the location of the millstone and features an opening with a pointed arch measuring 2×1.60 m. The internal dimensions of this space are 4.60×3 m. On the northern side, there is a niche measuring 80×90 cm, and on the western side, another niche measuring 80×80 cm. The niches have both arch and flat designs, but there is no complete symmetry among them. The reason for the distribution and duality of the niches in terms of form is unclear.

**This structure exhibits three distinguishable architectural phases:**

**- First Phase:** This corresponds to the construction of the western side within the gorge, where remnants of a destroyed furnace can be found at the southeastern end of the water channel.

**- Second Phase:** The previous furnace was left unused, and a new furnace was constructed to the north, which remained in use until the late Qajar period.

**- Third Phase:** This may coincide with the restoration and revival of the Pourashraf Castle during the Qajar era, as this mill continued to be utilized until the early Pahlavi period (Mazaheri, 2006: 794).

## 4. The Sheikh Makan Building as a Fire Temple

Izadpanah (1997) believed that the building was originally a Sasanian fire temple that was converted into an industrial structure after Islam was adopted. He thought that the diversion of water from the river in the gorge toward the structure caused irreparable damage to the original building. The foundation of fire temples during the Sasanian period began with the square structure known as the Sun Temple, featuring a circumambulation corridor in Hatra and the four-arched circumambulation of Kohe Khajeh (Mehrafarin & Ahmadihidayati, 2011: 78). Huff categorizes fire temples with a dome supported by four arches into three groups. The first group consists of a simple dome over a square formed by four arches, having straight, thin walls with three or four entrances. The second group includes four arches with corner columns and arches, with examples featuring a central domed room surrounded by a narrow corridor. The third group, which is less common, is similar to the second group, but instead of a circumambulation, it features an eyvan (Huff, 1987: 245).

One of the most important aspects is the spatial relationship pattern between the eyvan and the dome chamber, which has been widely utilized in the architecture of palaces, tombs, and especially in Iranian mosques. The primary spatial relationship between the dome chamber and the portico has been modified in mosques, transforming this space into a niche. However, the understanding and function of four-arched structures have always faced challenges and ambiguities, with researchers expressing various viewpoints ranging from guiding pathways to ceremonial spaces. In Ilam Province, numerous fire temples and four-arched structures have been

identified, and some have been introduced. However, considering the unique position of this region, which includes the closest routes to Mesopotamia and Ctesiphon, the Sasanian capital, serious studies have not been conducted.

The absence of fire temples along the north-south axis may be attributed to the belief that evil spirits enter from the northern direction, which led to Zoroastrian religious buildings always being oriented away from the north. The most prominent features identifying a building as a Sasanian fire temple, four arches supporting a dome, include a square altar, four internal columns, a covered corridor surrounding the building, and the connection of the fire temple to public ritual sites (Huff & O'Kane, 1990: 634-642). Some pre-Islamic structures were repurposed during the Islamic period into mosques with modifications to their architecture. For instance, the portico of Ctesiphon became one of their first prayer halls (Pope, 2003).

One way to preserve Iranian worship places before Islam was to repurpose them as Islamic places of worship, maintaining their sanctity and allowing these structures to continue serving a new function. This shift primarily involved transforming religious buildings into Islamic sanctuaries, while changes from religious to non-religious functions occurred less frequently. Notably, some transformations were initiated by the Iranians themselves, particularly in the case of sanctuaries like the Imamzadehs, where fire altars from the Sasanian period have been discovered. This topic can be explored alongside other arts and the continuation of Sasanian culture during the Islamic period. Consequently, with the arrival of the Arabs in Iran, the four-arched structure remained the main framework for many mosques and Imamzadehs (Ettinghausen, 2002: 200).

## 5. The Sheikh Makan Building as a Water Mill

The architecture and components of water mills vary according to climatic conditions, water resource management, and dimensions. The components are generally divided into two categories based on function:

-Technical Spaces: This category includes essential elements for milling operations, such as the "tanooreh" (vertical shaft), "charkhāb" (water wheel), and inlet and outlet channels. All mills, regardless of size, require these components for operation.

-Ancillary Elements: This includes spaces like restrooms, storage areas, bakehouses, and stables. While these do not directly participate in milling, they support milling activities. The mill operates using energy generated by water pressure, which accumulates in the "tanooreh". Water is directed into the tanooreh, exiting with pressure at the bottom, striking the mill's blades to cause rotation. The construction materials include local resources like stone and gypsum mortar.

Water entered the windmill's chamber through a channel from the river within the gorge. This chamber, built with stone and semi-baked crushed gypsum mortar, is durable and resistant to cold, heat, and moisture. The chamber has an external cylindrical shape, with inner walls tapering like a funnel. Water poured from the top into the chamber strikes the wooden turbine, causing the grinding stone to rotate and grind the grains. In the milling system, the speed of the water in the chamber increased due to the reduction in cross-sectional area (Raznik *et al.,* 2003: 82). Currently,

there are no remnants of the grinding stones or the waterwheel (wooden turbine) of this mill.

The entrances to this mill are simple and lack decoration. These entrances were, in fact, the connection points between the various spaces of the mill and the outside world. The presence of multiple niches was a measure to enhance the utility of these spaces and accommodate their various functions. These niches were used for placing tools and household items, as well as reducing the load pressure of the ceiling on the structure, indicating that the primary use was residential. In the past, architects were able to lighten the walls to the desired extent by creating niches at the bottom of the wall, approximately half a meter above the ground, and constructing shelves above them (Pirnia, 1994).

Despite the numerous mills in the region, unfortunately, no intact mill has been identified so far, making it difficult to compare them in terms of layout, components, and architectural structure. However, based on ethnographic studies in the area, the dimensions of the mills were generally around 30 square meters, which somewhat aligns with the dimensions of the Sheikh's building. The city of Darreh Shahr (Seymareh) is called the land of water mills. Wherever there is water in this region, a water mill has been constructed. The grinding stones scattered throughout the ancient city of Seymareh testify to the long history of water mills in this area. The numerous remnants of these mills also indicate the importance of agricultural processing in the region (Sharifinia, 2020). The water mills in Darreh Shahr are of the funnel type, and their distribution pattern, like in other parts of Iran, is directly dependent on the paths of the rivers originating from Kabir Kouh. Most horizontal mills in Iran are fed by rivers flowing down from the mountains (Harverson, 2003: 155).

The structures of mills in the region are generally similar, differing mainly in the materials used. Mills owned by wealthy individuals and local chieftains are constructed with sturdy materials like rubble stone and gypsum mortar, while those belonging to ordinary members of society are made from less durable materials, such as reeds, which have since deteriorated. The funnel section is often the only architectural element remaining from most surviving mills. Management and oversight of these mills were the responsibility of the villagers, with their wages derived from the products processed in the mills; these structures reflect the existing social hierarchy. Unfortunately, many of them have suffered erosion and destruction due to both human and environmental factors (Sharifinia, 2020: 99).

## 6. Analytical Comparison, Chronology, and Suggested Building Function

In analyzing the architectural patterns used in ancient fire temples, the Sheikh Makan building can be compared to the third type of fire temples, which feature a portico in front of a domed room. It is also comparable to the four-portico structures of Negar in Kerman, Darabagh, Bar Cheshmeh in Farashband, and the Spakho building in North Khorasan, with the distinction that Negar has a narrow corridor surrounding its central domed space (Soleymani, 2015: Fig. 9).

Undoubtedly, similar walls can be found surrounding many of the seemingly isolated four-portico structures and fire temples today. The Spakho prayer building exhibits architectural

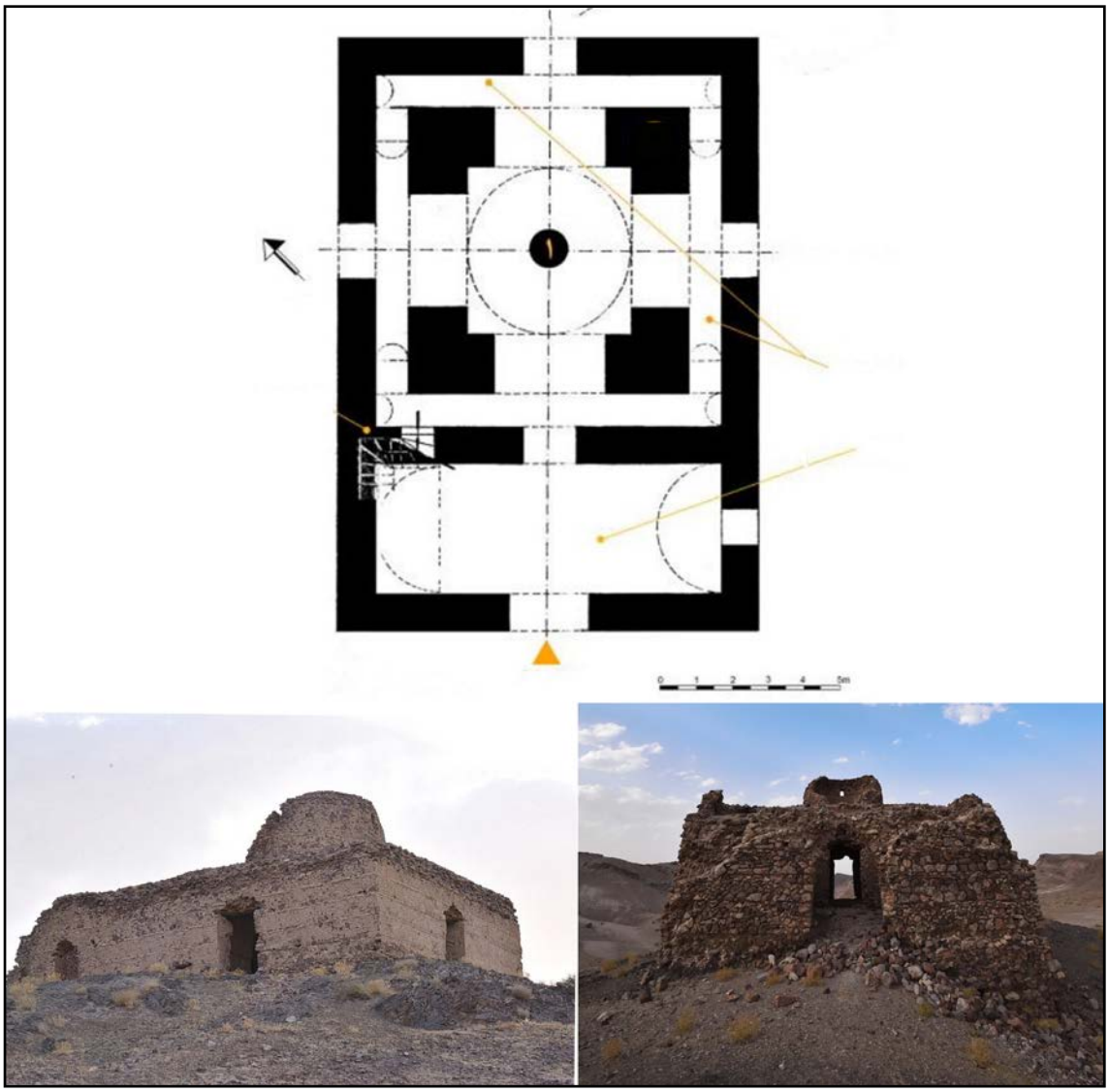

**Fig. 9: Negar Fire Temple in Kerman (Soleymani, 2015 & https://iranmonument.com/آتشکدهنگار/).**

characteristics of the Sasanian period (Fig. 10), including the main portico of the structure and extensive use of the pointed arch, and its appearance bears a close resemblance to the Sheikh Makan building. By analytically examining all structures known as four-portico buildings and fire temples attributed to the Sasanian-Islamic period, we will conduct a comparative analysis of the Sheikh Makan building alongside the two structures of Negar and Spakho, as presented in the table at the end.

The Sheikh Makan consists of two cubic-shaped rooms, with the front room serving as a porch and built on a natural rocky base. Its plan resembles the third type of fire temples, particularly those with porches. Among various four-arched buildings and fire temples from the Sasanian-Islamic era, it shares similarities with the Negar building in Kerman province and the Spakho building in North Khorasan, though notable differences exist in architectural details. While the exact functions of these buildings remain uncertain, the Negar building appears to possess all the features of a fire temple. In contrast, the Spakho building, with its differing elevations and mihrab-

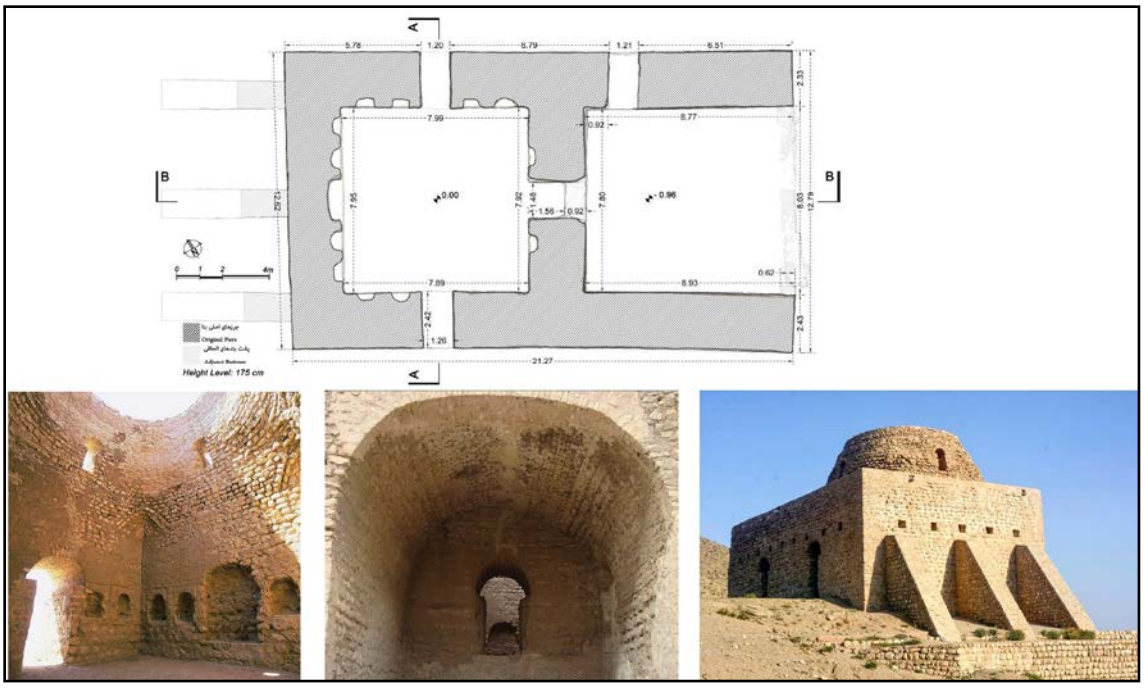

**Fig. 10: Spakho Shrine in the Northeast of Iran (Shah Mohammad Pour, 2021).**

**Table 1: A Comparative Analysis of the Sheikh Makān Structure, Spakho, and the Negār Fire Temple (Author, 2024).**

| Architectural Elements | Negar | Spakho | Sheikh Makan |
|---|---|---|---|
| Plan | Rectangular | Rectangular | Rectangular |
| Portico (Eyvan) | ✓ | ✓ | ✓ |
| Circumambulatory Corridor | ✓ | - | - |
| Fire Altar | - | - | - |
| Platform | - | ✓ | - |
| Materials | Rubble stone & semi-baked gypsum mortar | Rubble stone & semi-baked gypsum mortar | Rubble stone & semi-baked gypsum mortar |
| Building Dimensions (m) | 14.16×11.53 | 21.27×12.79 | 8.60×4.68 |
| Main Axis of the Building | North-South | East-West | East-West |
| Entrance Direction | South | East | East |
| Entrance Arch Covering | camber arch | camber arch | camber arch |
| Middle Arch Covering | camber arch | Keyhole | Ogee arch |
| Symmetry | ✓ | - | - |
| Niche | - | ✓ | ✓ |
| Dome | Barrel Vault | Barrel Vault | Barrel Vault |
| Surrounding Elements | - | Cemetery | Military fortress ancient road |

shaped recess, suggests it may have served as a place of worship and possibly a burial site (Shah Mohammad Pour, 2021).

## 7. Comparative Analysis

• **Plan:** The architecture of Negar, like that of other fire temples, is centered around a central point of symmetry determined by the fire altar. In contrast, Spakho and Sheikh Makan emphasize a linear axis that starts from the porch, passes through the middle entrance, and extends to the end wall of the dome room.

• **Circumambulatory Corridor:** All fire temples have a circumambulatory corridor around the dome room, which is visible in the Negar temple. However, there is no such corridor in the Spakho and Sheikh Makan buildings, making it one of the most important architectural elements of fire temples.

• **Fire Altar Base:** In none of the structures has the base of the fire altar been identified.

• **Platform Element:** The platform element is only present at the entrance of the porch in the Spakho building.

• **Construction Materials:** In terms of materials, all three buildings are constructed from local materials in the region, using rubble stone and semi-baked, semi-crushed gypsum mortar.

• **Size Comparison:** The Sheikh Makan building is smaller than the others in terms of dimensions.

• **Arch Design:** The arch covering the entrance in all three buildings is a camber arch; however, the middle entrance in Negar is a camber arch, in Spakho it is keyhole-shaped, and in Sheikh Makan, it is an ogee arch.

• **Symmetry vs. Asymmetry:** The Negar fire temple exhibits symmetry, while the Spakho and Sheikh Makan buildings show asymmetry.

• **Niche Elements:** The niche element is only found in the Spakho and Sheikh Makan buildings, while the Negar fire temple lacks niches.

• **Dome Covering:** The dome covering in all three buildings is a barrel vault.

• **Architectural Decorations:** Architectural decorations are only observed inside the niches of the Spakho building, while the two fire temples, Negar and Sheikh Makan, lack architectural decorations.

By examining the similarities and differences among these three structures, it can be concluded that they share commonalities in their overall plan and elements, including the porch, dome room, materials, camber arch entrance, elevation, and location along routes. However, the Sheikh Makan building lacks the most important architectural element of fire temples: the circumambulatory corridor. Additionally, it is smaller in dimensions compared to the identified fire temples and does not follow the symmetry typically found in fire temple plans. Despite these observations, the Sheikh Makan building, contrary to the proposed hypotheses, resembles the Spakho building more in terms of details, even though it shares a similar plan shape with the rare fire temples that have porches.

The Sheikh Makan building has an east-west orientation, with the entrance of the porch facing east. In contrast, the axis of fire temples is primarily oriented north-south, with notable deviations from the north observed in other fire temples of this period, especially those from the late Sasanian era. Many of the identified four-portico structures by Vanden Bergh also reflect this orientation in Fars, Kerman, and Lorestan, which are oriented according to specific angles, with their entrances facing south. This is also true for the four-portico structures B and X at Takht-e Soleyman (Boucharlat & Lecomte, 1987: 55).

However, some archaeologists believe that the main entrances of certain fire temples, such as the Bandiyan worship building in Darghaz, Shiyan, Mil Milgeh, and Palangerd (Rahbar, 1998:11; Rezvani, 2005; Moradi, 2009; Khosravi *et al.,* 2018: 283), could have faced east. The deviation from north is observed in most fire temples and four-portico structures dating from the early, middle, and late Sasanian periods. After the arrival of Islam, many places of worship from the previous era, such as churches (Creswell, 1969: 157), were also affected. However, in all the cases examined, no structure was found that had a religious or ritual function and was repurposed for non-religious and service-related uses after the advent of Islam. Regarding the Sheikh Makan building, it is noteworthy to consider how a religious structure could have been transformed into a non-religious function. The existence of a mill next to the fortress in the gorge throughout different periods seems logical for facilitating access, supply, and preparation of food for the inhabitants of the fortress.

The Sheikh Makan building in Ilam likely dates from the late Sasanian to early Islamic period, based on its materials, architectural style, and the context of nearby Sasanian structures. Despite the presence of pointed arches suggesting Islamic construction, these arches originated in the late Sasanian era, indicating a gradual transition rather than an abrupt shift in culture. Evidence supports the hypothesis that the Sheikh Makan building functioned as a water mill rather than a fire temple, as it features a rectangular plan, dome chamber, portico, irrigation channels, and flue elements indicative of industrial use. The absence of key fire temple features, such as a circumambulatory corridor and fire altar base, further supports this conclusion. Its preservation is vital, serving as a symbol of traditional knowledge and a potential cultural tourism attraction. Further archaeological research could clarify its history and role in regional social and economic changes, showcasing sustainable resource use.

## 8. Conclusion

This investigation of the Sheikh-Makan Monument in Ilam Province has provided significant insights into its architectural and functional identity, challenging traditional classifications as either a Sasanian fire temple or a water mill. Through meticulous analysis of its structural characteristics and historical context, this study concludes that the Sheikh-Makan building primarily functioned as a water mill, despite its architectural features suggesting a connection to Sasanian religious practices. Key findings indicate that while the monument exhibits a rectangular plan typical of Sasanian architecture, the absence of essential elements characteristic of fire temples such as a circumambulatory corridor and a fire altar reinforces its identification as a water mill. The architectural layout, including the presence of a water channel and furnace, aligns with known configurations of milling structures in the region, highlighting its practical utility in agricultural processing. Moreover, the historical context of the Sheikh-Makan site emphasizes the adaptive reuse of structures in post-Islamic Iran, reflecting broader socio-economic transformations. This research underscores the importance of further archaeological exploration to uncover additional layers of history and clarify the monument's role within the local community. In summary,

the Sheikh-Makan Monument serves as a vital case study in understanding the complexities of architectural evolution and function in ancient Iran, illustrating how structures can embody multiple identities over time. Future research should focus on systematic excavations and comparative analyses with other regional sites to enhance our comprehension of the interplay between architecture, culture, and economy in historical contexts.

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**Authors' Contribution Statement**

I am the sole author of this article and was responsible for all aspects of the research and writing process, including: Conceptualization and design of the study, Data collection and analysis, Original draft preparation, Critical revision and editing, Final approval of the manuscript.

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# مـطالعات باسـتان‌شـنـاسی

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# بنای شیخ مکان در استان ایلام، غرب ایران: آتشکده یا آسیاب آبی؟


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**چکیده**

بنای شیخ مکان در استان ایلام، به‌عنوان یکی از آثار بحث‌برانگیز معماری دورهٔ ساسانی، همواره محل اختلاف‌نظر پژوهشگران بوده است. این پژوهش به روشی نظام‌مند به بررسی ویژگی‌های معماری، شیوهٔ ساخت و یافته‌های باستان‌شناختی می‌پردازد تا کارکرد اولیهٔ بنا را روشن سازد. ساختار مستطیل‌شکل بنا شامل: تالار گنبدی مرکزی، ایوان طاق‌دار و کانال‌های آبی یکپارچه است که همگی از شاخصه‌های معماری مرتبط با سازه‌های صنعتی، به‌ویژه آسیاب‌های آبی محسوب می‌شوند. نکتهٔ قابل‌تأمل، فقدان عناصر تشخیصی معماری مذهبی ساسانی مانند: راهروی طواف، آتشدان و محور مقدس شمال-جنوب در این بناست. در مقابل، مؤلفه‌های صنعتی مشخصی ازجمله مکانیسم تولید آرد و اجزای آسیاب در آن شناسایی شده است. تحلیل تطبیقی با نمونه‌های شناخته‌شدهٔ معماری مذهبی ساسانی، مانند: آتشکدهٔ نگار و معبد اسپاخو (به‌عنوان یکی از معابد شاخص این دوره) تفاوت‌های بنیادین را در هر دو سطح کالبدی و عملکردی آشکار می‌سازد. شواهد باستان‌شناختی و داده‌های قوم‌باستان‌شناسی حاکی از استفاده طولانی‌مدت از این بنا به‌عنوان آسیاب آبی است که احتمالاً نشانگر بازکاربری عملکردی یک سازهٔ ساسانی در دوره‌های پسین است. موقعیت راهبردی بنا در مجاورت دژ و مسیرهای تجاری نیز بیشتر بر نقش اقتصادی آن تأکید دارد تا کارکرد مذهبی. اگرچه فرضیهٔ کارکرد مذهبی (آتشکده) توسط برخی پژوهشگران مطرح شده، اما این پژوهش با استناد به مدارک موجود، کارکرد اصلی بنا را به‌عنوان یک سازهٔ صنعتی تأیید می‌کند که نمونه‌ای ارزشمند از بازکاربری معماری ساسانی در دوران اسلامی محسوب می‌شود. یافته‌ها بر ضرورت انجام کاوش‌های هدفمند برای روشن‌سازی زوایای تاریک گاهنگاری مطلق و سیر تحول این اثر در تاریخ معماری ایران تأکید می‌ورزد. این پژوهش سهمی مهم در درک فرآیندهای تحول عملکردی فضاهای تاریخی و رابطهٔ پیچیده بین سبک معماری مذهبی و صنعتی در ایران پس از ساسانی دارد.



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## New Researchs on the Discovery of Sogdian Graves in China

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**Abstract**

Sogdiana was one of the oldest city-states in Eastern Iran, and it was located along the ancient Silk Road. According to historical records and archaeological materials, numerous Sogdian tombs have been discovered in Western China. It appears that these tombs were constructed by Sogdians living in the area. The examination of these artefacts indicates the use of Iranian-Chinese architectural styles. Historical documents and Chinese texts suggest that Sogdians entered China as government officials, merchants, and others, establishing family-run businesses in this region. These enterprises played a significant role in trade, culture, history, religion, and more. Archaeological discoveries in the central plains of China have notably reinforced the strategic importance and role played by the Sogdians and Sogdian cities in these exchanges. Given the significance of this topic and the rich information available in the Chinese literature, this article compiles the excavated Chinese tombs and analyzes these data. This section explores how the Sogdians became one of the most influential ethnic groups in the political, economic, social, religious, linguistic, and cultural changes of Chinese dynasties over time, alongside other cities in Western China.

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## 1. Introduction

The Sogdians played a crucial role in cultural exchange between ancient China and Iran, and they were strategically located along the transportation routes of ancient Central Asian countries. Since the excavation of Yu Hong's tomb in Taiyuan, the excavation of Anjia's tomb in Xi'an, the excavation of Shijun's tomb, and the excavation of Kangye's tomb, Miho Art Museum, Guyuan, Tianshan, Luoyang and other. The most important Sogdian tombs discovered in China. These tombs are not only the earliest discovered Sogdian tombs with precise dating, but also the statues on the stone coffins have obvious Sogdian artistic features, and their religious connotations have attracted considerable attention from scholars. They not only promote practical exchanges through trade and economic interactions but also facilitate the integration of culture, art, religion, and other aspects. Over the past century, the long-term integration of Sogdian culture with Chinese society, along with the subsequent process of "Sinicization," has further strengthened exchanges between China and Iran.

As key figures in cultural exchange between Central Asia, scholars have conducted extensive research on the migration and cultural dissemination of the Sogdians from Chinese historical records, Dunhuang Turpan documents, stone carvings, and other sources. In addition, the discovery of the graves of Sogdian leaders who settled in China reveals the fusion of local beliefs and Chinese funeral customs. This article will summarise the Sogdian tombs excavated from different dynasties by combining Chinese historical materials and archaeological excavations to clarify the Hu cultural identity of the Sogdians in China.

### 2. 1. The tomb of Anpu and his wife from the Tang Dynasty in Luoyang

An Pu (Chinese: 安菩) is a General Tang Dingyuan (Fig. 1 & Fig. 2), and his wife He Shi. Anpu, with the surname An, given name Pu, is a descendant of the great leader of the nine surnames An in the Western Regions (roughly located in present-day Bukhara, Uzbekistan). Anpu was born around 600 AD and surrendered to the Tang Dynasty with his father in 630 AD. Due to his bravery and ability to defend the Tang Dynasty's borders, he was appointed a fifth-rank official in the capital and a general in Dingyuan. The historical books describe Anpu as "using one as a thousand to sweep away the swarm of bees flying alone." As a Sogdian, Anpu was born in the Western Regions, died in Chang'an, and was buried in Luoyang. His life was quite legendary.

In April 1981, an archaeological excavation team from Luoyang Municipal Institute of Cultural Relics and Archaeology discovered the Anpu joint burial tomb at the northern foothills of Longmen Dongshan (Longmen East Hill). The site is geographically situated approximately 13 km south of modern Luoyang's urban center, positioned 1 km west of the Yishui River's western bank, and located approximately 8 km north of the documented position of the southern city wall of the Sui-Tang period (581-907 CE) Luoyang capital. This strategic location places the burial complex within the historical hydrological system and urban configuration of the medieval Chinese capital.

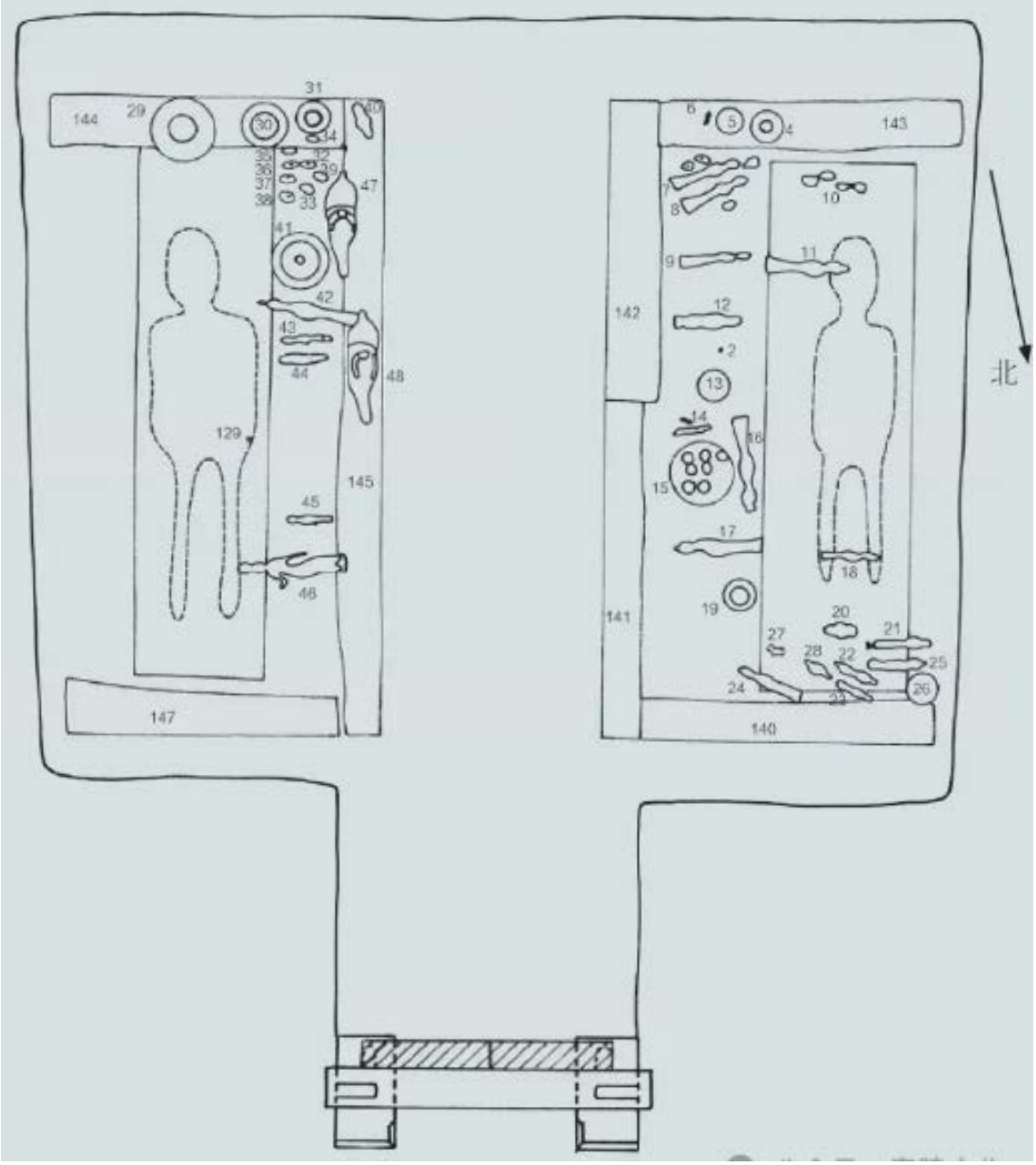


**Fig. 1: Luoyang Institute of Archaeological Research.(1981). An Pu tomb plan .The tomb of An Pu has a spade-shaped (or "shovel-shaped") floor plan, situated with its back against the Eastern Hills and oriented south-to-north (https://q6.itc.cn/q_70/images03/20240424/d69e30ad732747aaa20c71ce328d1a10.png).**

The Anpu Tomb is shaped like a shove, with its back facing Dongshan and facing south to north. It consists of four parts from north to south: the tomb passage, tomb door, corridor, and tomb chamber, with a direction of 168°. The tomb passage was damaged before cleaning, and on-site signs indicate that it may be a sloping tomb passage of unknown length.

The Anpu Tomb features a tripartite architectural configuration comprising a sloped passageway, sealed entrance portal, and rectangular burial chamber. No extant surface-level architectural features remain due to extensive temporal degradation. In 1987, as part of an urban heritage preservation initiative, the Luoyang Municipal Government commenced development of China's

**Fig. 2: Luoyang Municipal Institute of Archaeology. (1981). Portrait of tomb owner An Pu facing right (https://q8.itc.cn/q_70/images03/20240424/67151314f89847bf-9798385f644a5129.png).**

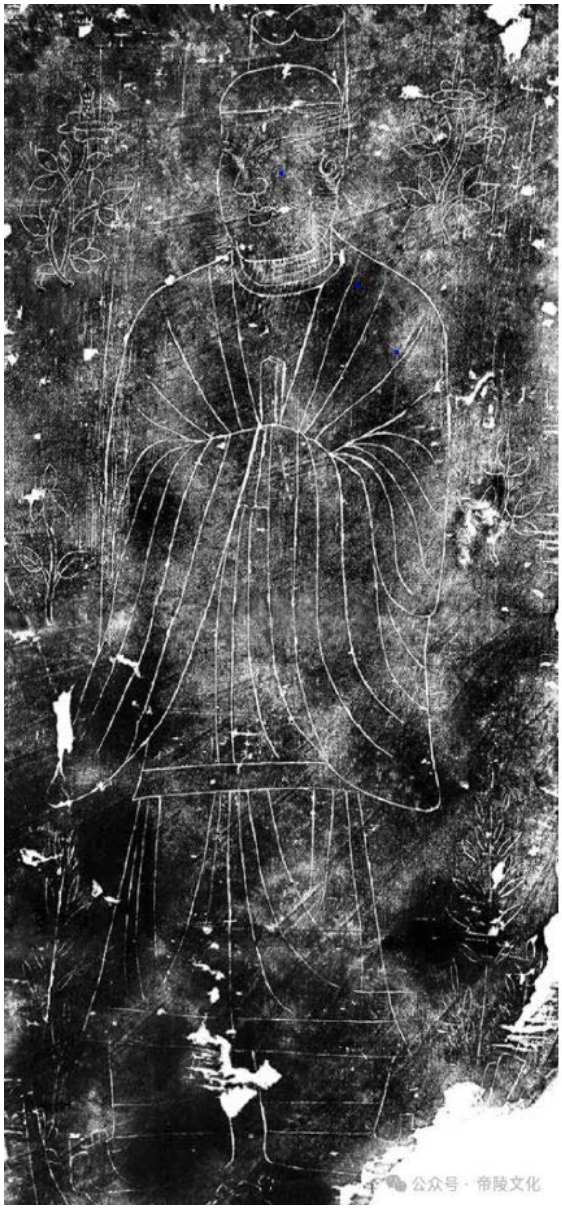

**Fig. 3: Luoyang Municipal Institute of Archaeology. (1981). Portrait of tomb owner An Pu facingleft .. (https://q8.itc.cn/q_70/images03/20240424/67151314f89847bf-9798385f644a5129.png).**

inaugural Museum of Ancient Tomb Architecture. Through engineered conservation protocols, the Anpu couple's tomb complex and 23 additional mortuary structures were scientifically relocated in toto to the Mangshan necropolis (34°43'N, 112°28'E) within Luoyang's northern suburban periphery, preserving original spatial relationships and stratigraphic integrity.

The stone carvings excavated from the tomb, comprising the tomb door components, coffin bed edges, and epitaph, are all crafted from limestone. These artifacts feature intricate patterns created using line-drawn intaglio and reduced horizontal carving techniques. Since the establishment of the People's Republic of China, hundreds of Tang Dynasty tombs have been unearthed in Luoyang, among which the tomb of Shi Jun stands out as one of the larger-scale discoveries.

While many tombs excavated in the early stages had been previously looted, the intact tomb of the Anpu couple, containing a wealth of precious cultural relics, represents a significant first for Luoyang. This discovery marks a pivotal achievement in the archaeological study of cultural heritage within Luoyang city, providing invaluable insights into the Tang Dynasty's material culture and burial practices.

### 2. 2. Yu Hong's tomb is located in Shānxi Province

YuHong （Chinese: 虞弘） Northern Dynasty diplomat (533–592 CE), was a Jihu ethnic leader from Yu City-state in the Western Regions (present-day Yiwu County, Xinjiang Province). He served as a prominent official and distinguished diplomat during the Northern Wei to Sui dynasties period in Chinese history.

Historical records indicate that although Yuhong's ethnic origin might not have been Sogdian (RongXin jiang, 2001), his administrative role as Inspector of Sabao Province (a Tang Dynasty institution governing Sogdian settlements) strongly suggests cultural affiliation with Sogdian traditions. This positionality implies probable acculturation to Sogdian religious practices, particularly given the sarcophagus' material evidence. The artifact's iconography, notably its prominent canine depictions, provides archaeo-religious evidence supporting its interpretation within Zoroastrian mortuary contexts. These representations likely reflect characteristic Sogdian funerary practices involving ritual canine companions and sky burial customs (exposure of corpses to scavenging animals), consistent with Zoroastrian purity doctrines (Boyce, 2001; Compareti, 2009) .


**Fig. 4: Shanxi Museum. (1999). Yun Hong's stone coiffing [Photograph]. Baidu Images (https://img1.baidu.com/it/u=1443729236,1283329415&fm=253&fmt=auto&app=120&f=JPEG?w=1200&h=800).**

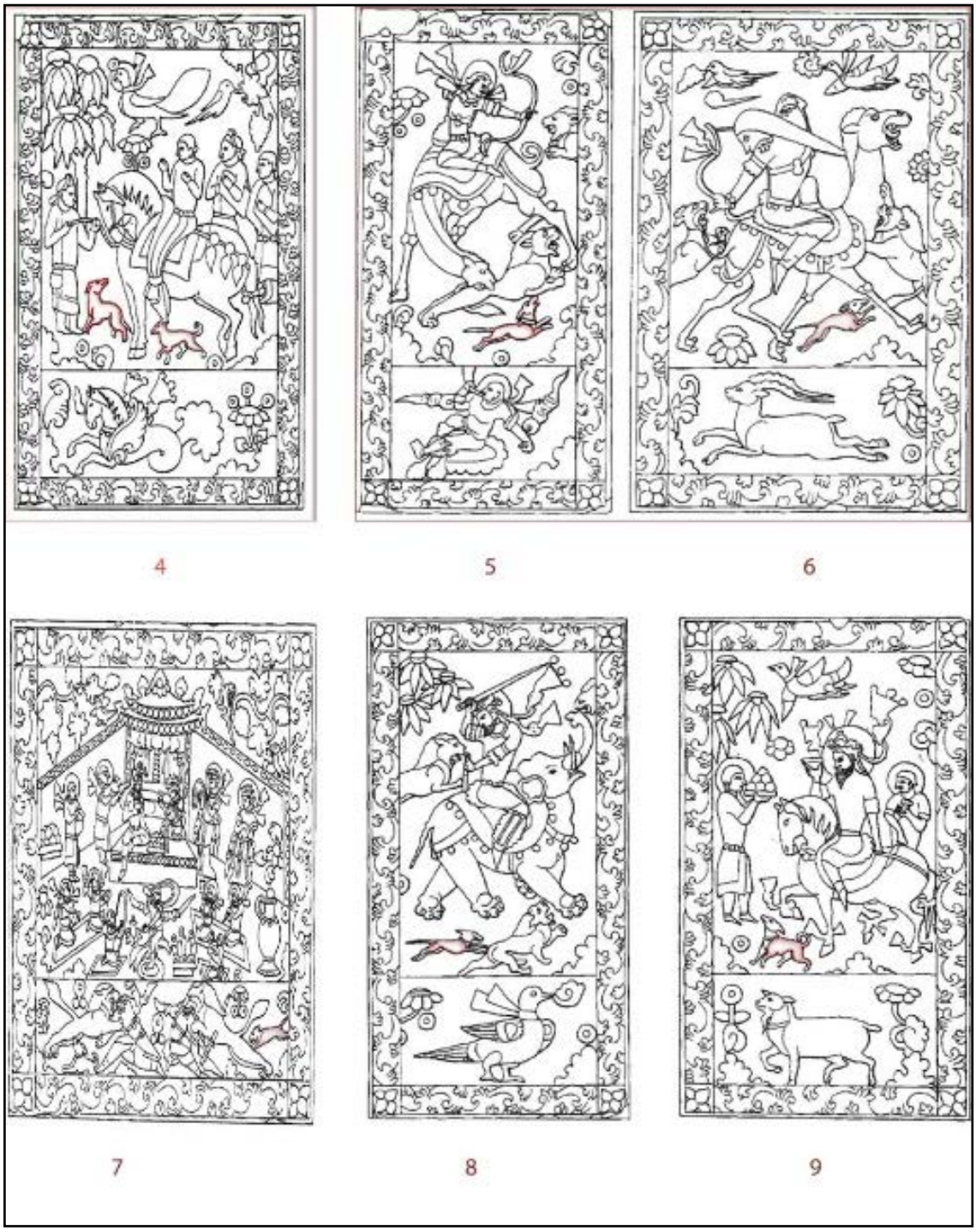


**Fig. 5: Shanxi Museum. (1991). Pictures on the stone coiffing in Yuhong's Tomb [Photograph]. (Baidu Images. https://img2.baidu.com/it/u=4115801371,1668534488&fm=253&fmt=auto?w=1080&h=405).**

In July 1999, a significant archaeological discovery was made in Wang guo Village (Chinese: 王郭村 Wang guo cun), Jinyuan (Chinese: 晋源) District, Taiyuan (Chinese: 太原) City, Shānxi Province. A white marble sarcophagus featuring a gilded and polychromatic relief portrait was unearthed from the tomb of Yu Hong, dating back to the 12th founding year of the Sui Dynasty (592 CE).

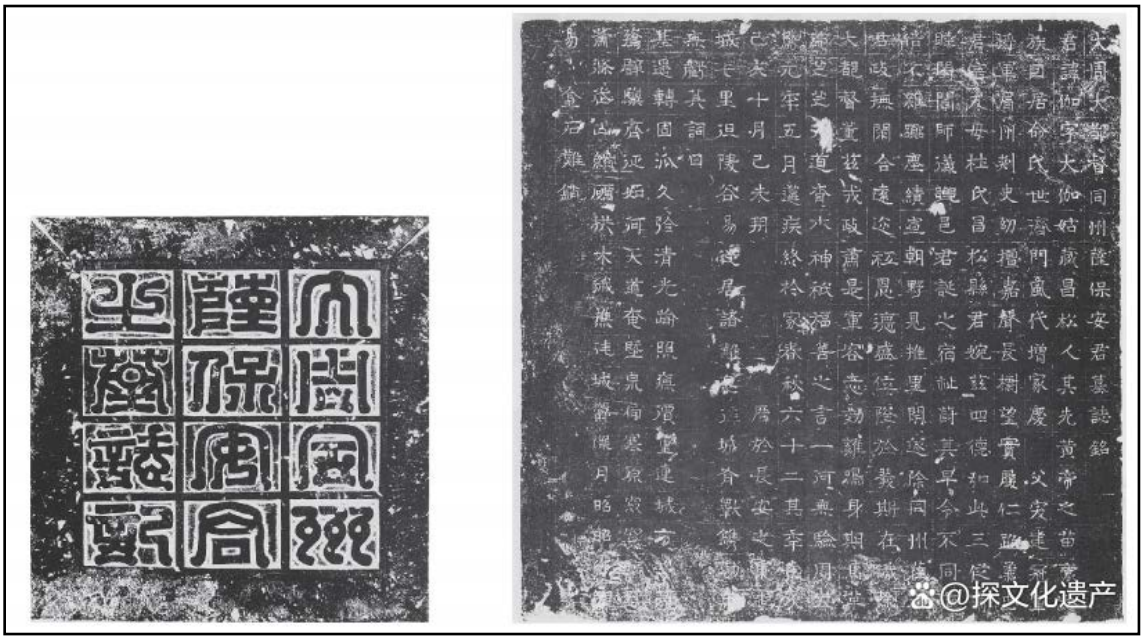


**Fig. 6: Shaanxi Institute of Archaeology. (2003), (The epitaph commemorates An Jia [Photograph]. Baidu Images.https://pic.rmb.bdstatic.com/bjh/240330/dump/e70e803cae360cd69d5c3bc8271dfcee.png).**

The Sogdians, renowned as skilled merchants, were primarily adherents of Zoroastrianism. Following the Southern and Northern Dynasties period, substantial migrations of Sogdians occurred into Xinjiang and mainland China. During the Northern Dynasties through the Sui and Tang Dynasties, an official position known as Sabao (also referred to as Sabao or Sabo) was established specifically for the administration of Zoroastrian and Sogdian affairs.

Regarding ethnic classification in Chinese history, particularly during the Wei and Jin dynasties, Chen Yinge (Chen Yin ge's, 1987), (Chinese: 陈寅恪) observed that ethnic distinctions were predominantly culturally determined. Notably, he emphasized that when Han Chinese individuals adopted the cultural practices of ethnic minority groups and assimilated with them, they were consequently classified as members of those minority groups.

Notably, the sarcophagus' artistic program demonstrates syncretic adaptation of Zoroastrian motifs within Chinese burial conventions, exemplifying cross-cultural transmission along Silk Road networks. This cultural hybridity manifests through the combination of Sogdian symbolic elements (e.g., fire altars, divine fravashis) with Han-style architectural features, suggesting localized reinterpretation of foreign religious iconography (Grenet, 1984; Wu, 2004).

This group of images deeply reflects the Zoroastrians' belief in the two main stages of the resurrection of the dead and their entry into heaven. "Last Judgement" and "Final Resurrection". It is shown in (Fig. 20), holding a white horse is held to sacrifice the god Mithras. The subject of this painting is a funeral. The subject of the funeral. The Zoroastrian god Zurvan's journey is related to animals (Figs. 9-20). In the picture, there is a dog chasing a horse, which shows that this painting is the subject of a funeral and after passing the final judgement and sacrifice to the garden of paradise.

### 2. 3. A stone bed and its image and the fusion of Zoroastrianism in Sogd

The epitaph commemorates AnJia, a scion of an illustrious family with a distinguished lineage spanning generations. His father, Tu Jian （Chinese: 突建）, served as a general and governor of Meizhou （Chinese: 梅州）, while his mother, Du Shi （Chinese: 杜氏）, held the noble title of ruler of Changsong County, both celebrated for their unwavering moral integrity. From a tender age, AnJia displayed exceptional intelligence and virtue, achieving remarkable success. He ascended to the esteemed positions of governor of Tongzhou（Chinese: 通州）and commander-in-chief, where he governed with benevolence and managed the military with remarkable efficacy. Tragically, he succumbed to illness at the age of sixty-two and was laid to rest in the eastern precincts of Chang'an（Chinese: 长安）city. The epitaph extols his virtues and accomplishments, expressing the fervent hope that this inscription will endure through the ages, serving as an eternal testament to his legacy for generations to come.

In May 2000, the tomb of Saba Anjia from Tongzhou, who died in 579 during the Northern Zhou Dynasty, was discovered in Xi'an, Shănxi Province. The Shănxi Provincial Institute of Archaeology notes the description of an excavation from the Northern Zhou Dynasty in the outskirts of Xi'an (西安Xi'an Privence of Shănxi): Anjia Tomb is located in the city of Xi'an; It is 35 metres long and consists of a sloping tomb passage, 5 passage holes, 5 patios and two pits consisting of a heavy brick sealed door, a stone door, a brick archway, and a square brick domed tomb. An essentially complete but scattered petroglyph and skeleton of the tomb owner are placed in the middle of the corridor, and a stone couch with images is placed in the tomb. A total of 60 characters (Fig. 4) are carved on the stone gate and surrounding stone couches. The main lines

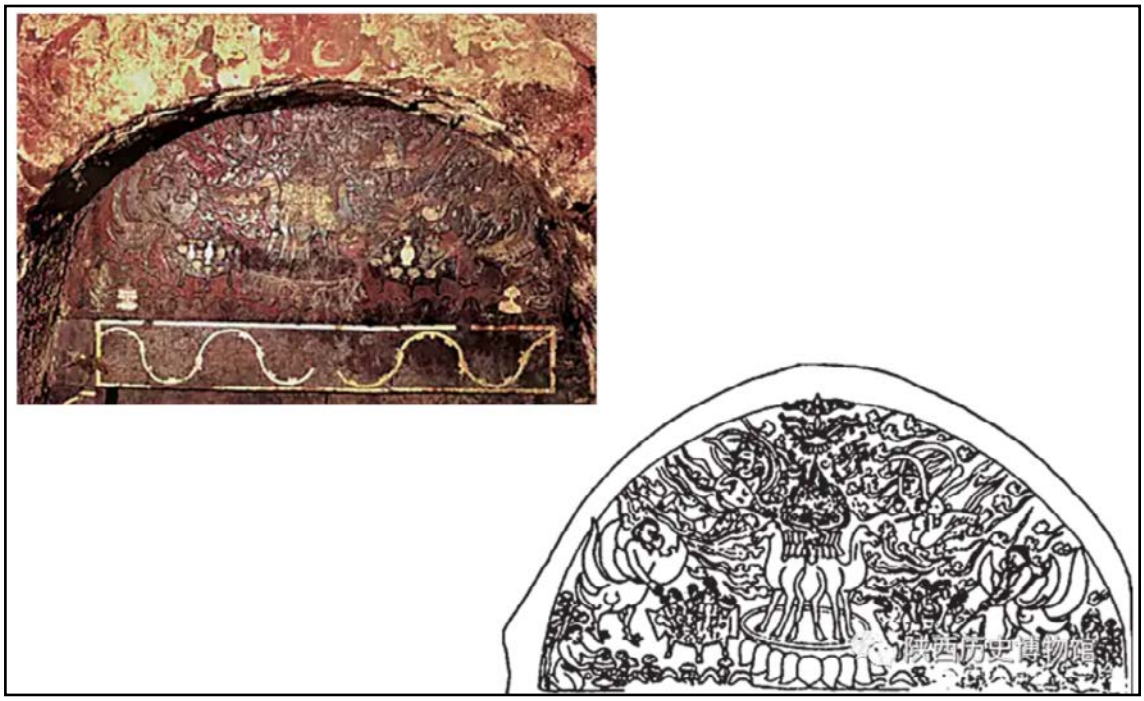

**Fig. 7: Shaanxi Institute of Archaeology. (2003). (The stone gate front of Anjia tomb [Photograph]. China News Service Images. https://p7.itc.cn/q_70/images03/20220408/a24f6008292d482b9d0e397d2b5cd2d7.png).**

**Fig. 8: Shaanxi Institute of Archaeology. (2003). Religious element from Anjia tomb [Photograph]. Quanjing Photo. (https://mulu.oss-cn-beijing.aliyuncs.com/00109111549124.png).**

**Fig. 9: Shaanxi Institute of Archaeology. (2003). Stone couch from Anjia's tomb [Photograph]. Sohu News. (https://5b0988e595225.cdn.sohucs.com/c_zoom,h_231/images/20190904/e23015a0172c460fb3c96b427a33d1dc.jpeg).**

**Fig. 10: Xi'an Cultural Relics Protection and Archaeology Institute. (2004). Shijun's stone coffin [Photograph]. Shaanxi Daily (https://xzzsx.sxdaily.com.cn/app_if/getImage?path=%E5%9B%BE%E7%89%87%E5%AD%98%E5%82%A8;xy/202407/03/66185caf-9555-49ed-9bc7-690f7f1da9edcopy.jpg).**

of the sash are carved with a pomegranate motif on a semi-circular forehead depicting a scene of Zoroastrian sacrifices, with a gilded relief in the centre of the front with three camels (one of which has its head straight ahead). is forward, the other two heads look to either side), with the feet on the base of the lotus and a small petal behind, the brazier is placed on the base of the lotus petal. The plant is placed on a lotus base with firewood.

This group of motifs is arranged in the middle of the lintel, indicating that the owner of the tomb was a Zoroastrian believer. It is used to determine the nature and religious affiliation of all patterns. He also noted: On both sides of the flame music is being played, the left hand is a pipa (a musical instrument), and the right hand is a Congo (a musical instrument) with red pants, bare feet and colourful clothes surrounded by clouds. The collar and bracelet of a man with a pipe are made of gold leaf. On both sides of the camel, human figures with eagle feet (Gods of Ahura Mazda) can be seen (Fig. 11).

Judging from AnJia's tombs, it was seen that the Sogdians used stone beds as a burial tool in China. Some images of Sogdians may have been depicted around a stone couch. The content of wall paintings mostly reflects the life of the Sogdian people. The ages of these tombs are mostly in the late Northern Dynasties. At that time, the Sogdians, who had entered China, had already been living in mainland China for a long time and slowly adopted the burial style of earthen cave

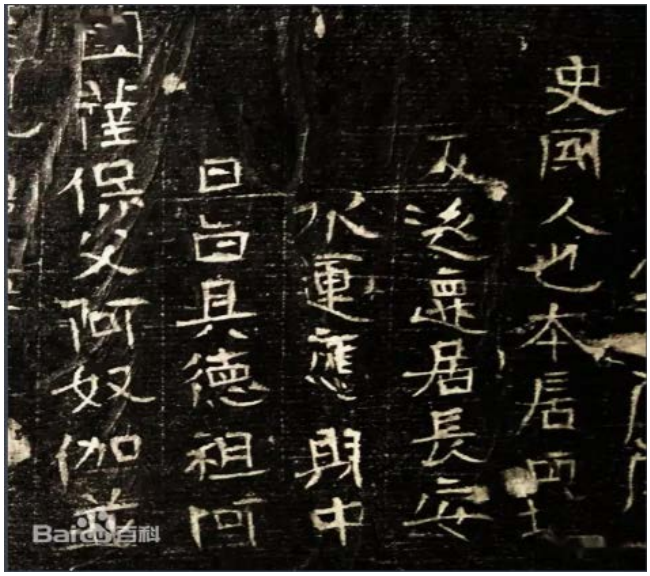

**Fig. 11: Xi'an Cultural Relics Protection and Archaeology Institute. (2004). Stone coffin with faint inscription [Photograph]. Bing Images (https://ts4.tc.mm.bing.net/th/id/OIP-C.0Yni6ZtNrMMCAcXsUZQIeQHaID).**

tombs in the central plains. However, these Sogdian tombs are different from the tombs in the central plains of China. That is, there is no Ossuary in the Sogdian tomb. In the tomb, only a stone bed was present, which was seen more than the base of a stone bed and some images around it from the tombs. Among them, the body of the owner of AnJia' is placed in the tomb corridor. The middle of the corridor is the fire temple. This shaped tomb is not a traditional Chinese tomb. Also is not of the burial tradition of the Sogdian indigenous people. Rather, the results must have been Sogdian entering China and combining the earthen tomb structure of the Central Plain of China, Northern Han-style Ossuary's, and Sogdian relief Ossuary's. This type of stone bed is much larger than an ossuary. In total, there are 12 images around the stone bed base, three sides, and seven bed bases (Fig. 5).

### 2. 4. ShiJun (Chinese: 史君) tomb

Shi Jun, whose surname was Shi, held the position of Sabah in Liangzhou, a region corresponding to modern-day Wuwei in Gansu (Chinese: 甘肃) Province. The role of Sabao, which he occupied, was pivotal as it encompassed both religious and administrative duties. As the leader of Zoroastrianism, the Sabao was responsible for overseeing sacrificial rites and managing the affairs of Hu merchants residing in China. This dual role highlights the integration of religious and commercial governance in the context of ancient Chinese society.

In June 2003, ShiJun Tomb1 (Xi'an Cultural Relics Protection and Archaeology Institute，2004) an excavation uncovered the tomb of a Sogdian nobleman from the Northern Zhou Dynasty located in the northern suburbs of Xi'an. Now collected in the Xi'an Museum. The tomb contained a meticulously crafted stone coffin (Fig. 7) measuring 2.46 metres in length, 1.55 metres in width, and 1.58 metres in height. The stone coffin of the Shijun Tomb is a first-class cultural relic from the Northern Zhou Dynasty (557-581 AD).

The tomb of Shi Jun, containing a joint burial of a couple, is situated in Jingshang Village, Daming Palace Township, Weiyang District, Xi'an City. The stone coffin unearthed from the tomb features intricate carvings with rich iconographic content, reflecting a blend of Han cultural elements and Zoroastrian motifs. These artifacts serve as significant textual and material evidence, offering invaluable insights into the historical interactions along the Silk Road and the cultural exchanges between China and the West during that period. The findings not only enhance our understanding of the socio-religious dynamics of the time but also underscore the tomb's importance as a key archaeological resource for interdisciplinary research.

Designed in a hipped-roof palace style, the stone coffin featured intricate details such as a base, central wall panels, eaves, and ridges. Elements such as the rafter head, tiles, wooden arches, columns, and other components were adorned with gold. An inscription above the lintel of the outer stone coffin vaguely engraved the words "Shi countrymen also" (Fig. 5), suggesting that the tomb owner was a descendant of the ancient Western Regions and was known as Shi Jun. Shi Jun and his wife Kang, both of Sogdian descent, were originally from the Western Regions and later settled in Chang'an. Shi Jun was granted the title of Sabao in Liangzhou, as indicated by historical inscriptions.

The four sides of the stone coffin wall panel are embossed with patterns of four armed guardian gods, Zoroastrian gods, sacrifices, ascension to heaven, banquets, travel, and hunting. Painting or gilding on characters' faces, clothing, and animals. The carving content and style show obvious external characteristics. On the outside of the stone coffin, craftsmen used gilded, painted shallow reliefs to record the rich and legendary life of Shi Jun. In these reliefs are scenes of him and his friends gathering in Chang'an, toasting and enjoying drinks, as well as his posture of horseback hunting in Chinese-style bird cloud mountain trees and water wave decorations, reflecting the exchange and integration of Central and Central Asian cultures.

### 2. 5. The KangYe 's (Chinese: 康业) tomb

Kang Ye According to the epitaph, the tomb owner was a descendant of the Kangju King, who held various prestigious positions, including Grand Deity of Wei, Grand Commandant of Luozhou (Chinese: 罗州), Grand General of Chariots and Cavalry, and Hule of Yongzhou (Chinese: 雍州). He passed away in the sixth year of Tianhe during the Great Zhou Dynasty (571 AD) and was posthumously appointed as the Governor of Ganzhou (Chinese: 甘州). The discovery of the Kangye Tomb provides valuable insights into the social life, funeral customs, and cultural exchanges of the Sogdians in China during the Northern Zhou Dynasty.

On November 2004 (Reporter Lei Kai), the Xi'an Institute of Cultural Relics Protection and Archaeology recently conducted a cleanup of a North Zhou Sogdian tomb in the northern suburbs of Xi'an, which dates back more than 1400 years: the Kangye Tomb of the Northern Zhou Dynasty. A complete screen stone collapse was unearthed, with ten exquisitely carved paintings on the inside of the screen. The only well-preserved North Zhou Sogdian skeleton in China found on the stone collapse. This archaeological discovery provides extremely valuable information for

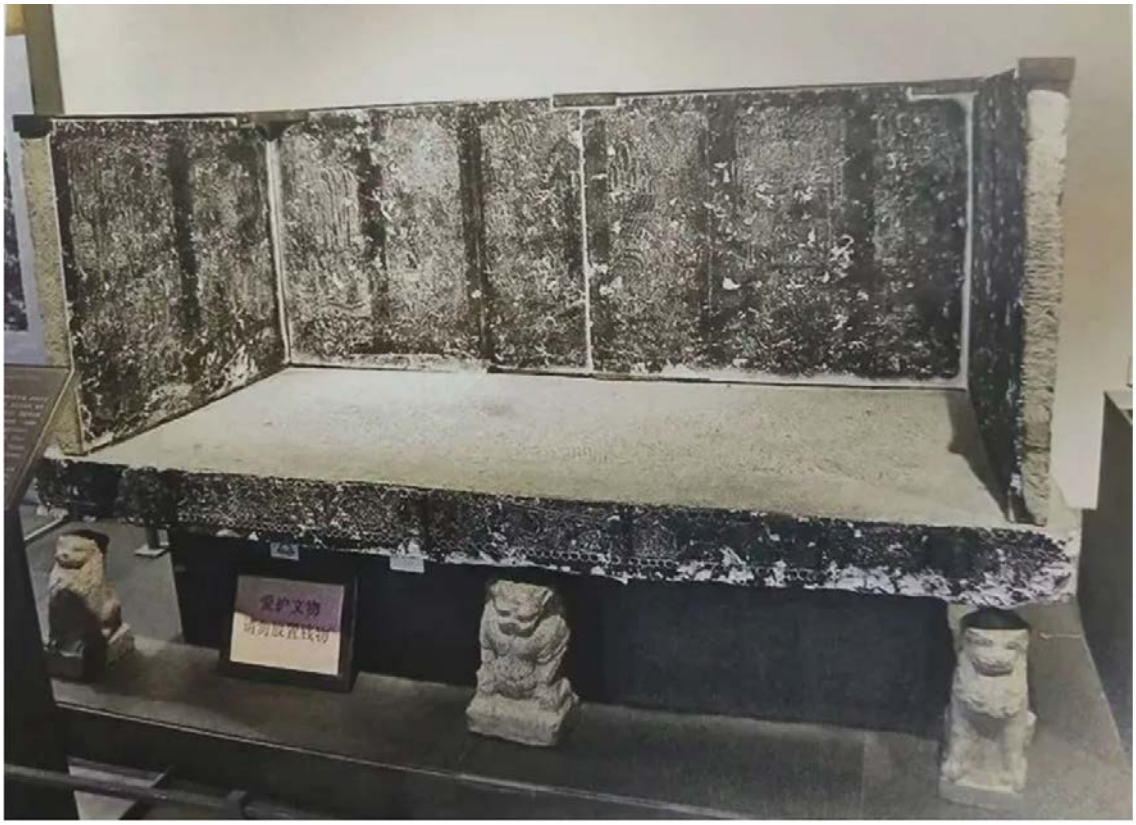

**Fig. 12: Xi'an Cultural Relics Protection and Archaeology Institute. (2008). Stone bed with Kangye motifs [Photograph]. Baidu Baike (https://bkimg.cdn.bcebos.com/pic/b219ebc4b74543a98226db6bcf5c9d82b9014a90be4b).**

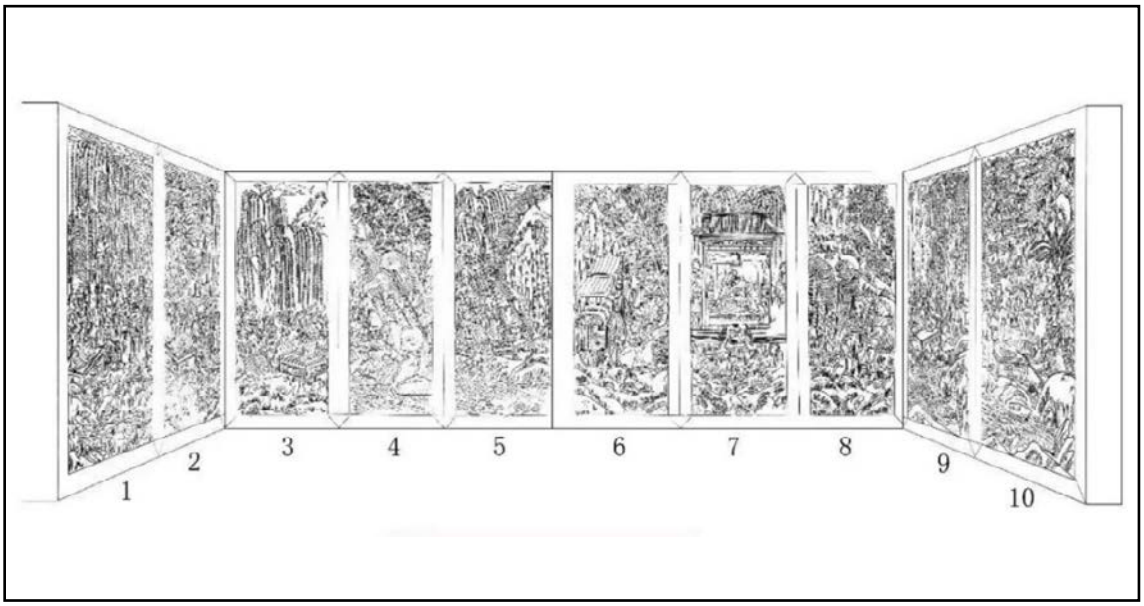


**Fig. 13: Xi'an Cultural Relics Protection and Archaeology Institute. (2008). Stone bed with Kangye motifs [Photograph]. WeChat Public Platform (https://mmbiz.qpic.cn/sz_mmbiz_jpg/GkLFebheyicTkAzfr1K4wibzCKXHGAvoyhgOw4GmsiceRSu69WnVanREUMPiaUZ9rTO08yIpot5E7LpqSe25YZfYMQ/640).**

studying the social life, funeral customs, and cultural exchanges of Sogdians in China during the Northern Dynasties. With the deepening of archaeological discoveries, the presence of a merchant caravan mainly composed of Sogdians active on the ancient Silk Road in China has gradually become clear (Shănxi Institute of Archaeology, 2003).

It was located north of Xi'an. To its north is the Anjia Tomb of the Northern Zhou Dynasty, and to its west is the tomb of the Shijun of the Northern Zhou Dynasty, further confirming that the northern suburbs of Xi'an are the location of the Sogdian tomb group. The tomb structure of the Kangye Tomb in the Northern Zhou Dynasty is the same as that of the Anjia Tomb in Xi'an, Shijun Tomb, and YuHong Tomb in Taiyuan, Shānxi. They all have a sloping tomb passage with a dome roof, a single tomb chamber, a corridor, and decorative murals on the inner wall. Except for collapsed screen stones and unearthed epitaphs, very few burial items were found. The unearthed epitaph shows that the tomb owner was named Ye, with a character base, and he was a descendant of the Kangju King. He died in the sixth year of Tianhe's reign in the Great Zhou of (571 AD) and was posthumously appointed governor of Ganzhou. The burial tool unearthed from the Kangye Tomb of the Northern Zhou Dynasty is a complete collapsed screen stone, which is the seventh Sogdian tomb discovered in China with a collapsed screen stone or stone coffin. According to experts, the use of Han Chinese seating arrangements and collapsed stone screens as burial objects was a unique burial custom of the Sogdians who lived in China during the Northern Dynasties. It was a result of the integration of Chinese and Western cultures, and no such burial system existed among the Sogdians themselves. On the unearthed collapsed fence stone, archaeologists discovered a well-preserved skeleton of a Sogdian. Due to the Sogdian belief in Zoroastrianism, their bodies are often disposed of by burning, resulting in relatively few complete Sogdian skeletons being preserved. This discovery is currently the only well-preserved skeleton of a Sogdian from the Northern Zhou Dynasty in China (Xi'an Cultural Relics Protection and rchaeology Institute, 2004) .

### 2. 6. Sogdian stone image from Miho Art Museum

The Miho Museum, in Shiga Prefecture, Japan, has a screened stone couch consisting of 11 rock images and double slabs. According to research by scientists, China should be the country. Sogdian burial objects during the northern dynasties, including the third stone couch numbered from right to left, is a famous burial chart of social etiquette (A. L. Juliano and J. A. Lerner, 2001).

Consists of the upper and lower fields and the face composition. Top centre, standing a man wearing a long white robe, a coloured mask (padam) of Zurvan, a priest of the Sayyad, facing the altar of the sacred fire. A dedication ceremony takes place in the open air. A puppy is on his right. Looking at the altar of fire and sacrifices, this means that what is found must be a Zoroastrian burial. There is an image of "cutting the face" at the top (Fig. 14) of the Miho stone image screen. According to historical records, during the medieval period of China, most nomadic peoples, such as the Huns and Turks, had the custom of "cutting their faces" during funerals. When the Huns heard that someone had died, the whole of the country wailed, and some people cut their faces and

**Fig. 14: Xi'an Cultural Relics Protection and Archaeology Institute. (2008). Panoramic view of Kangye's tomb [Photograph]. Shaanxi Library Digital Collection (https://www.sxlib.org.cn/dfzy/sczl/wwgjp/wwgjtk/yz/201808/W020180807421459986017.jpg).**

bled. When a person (Turkish) dies, they park the body in the tent; most of the family members and relatives slaughter cows and horses for the sacrifice, cut their faces loudly around the tent, and shed blood and tears together. This behaviour should be performed seven times before stopping. In Suishu, "History of the Western Regions" in the State of Kang (Book of Sui, 1849).The reports that the system of marriage and funeral is similar to that of the Turks. This shows that the Turks invaded Sogd in the sixth century after occupying AD. Sogdiana was influenced by the Turks' wedding and funeral customs. When discussing the customs of the nine surnames of Zhaowu, Mr. Cai Hong sheng (Cai Hongsheng, 1998) .pointed out that the customs of cutting the face have long been common among the Northern and Western Hu people and have become one of the main features of the ancient funeral culture of Inner Asia. This view is supported by evidence from local archaeological sites in Sogd. Images of male and female faces in a mourning ceremony with cut ears and faces are carved on the surface of an Ossuary vessel discovered in the Tok Kala region of Khwarezm (not the last name of Huo Xun（Chnese: 火寻）. Sogdian people practice the custom of cutting noodles not only during funerals but also during ancestor worship. According to 11th-century external writing: It is written that the Sogdians held a ceremony of worshipping ancestors at the end of December of the Sogdian year and mourned, cried, scratched their faces, and fed the dead. Even in China, the Sogdians still follow the traditional funeral ceremony of "cut face". For example: In May 649, when Emperor Taizong of the Tang Dynasty died, he wrote in Zizhi Tongjian（Chnese: 资治通鉴）, Hundreds of foreigners from all over the states who

had come to China to serve as officials and pay tribute wept with great grief. I heard the funeral sound, and blood was splattering all over the ground. This way of expressing condolences through self-mutilation is very different from the Chinese tradition of mourning and the cultural concept of filial piety. After the Sogdians arrived in China, they began to cut their faces at funerals. For example, when the people of An Xingwei died, his son An Yueshu left his job for his father. He was so sad that he cried and bled. His children are Shishinfu, his son was so sad that he cried and cut his face, and his daughter did not eat during her mourning days. The relatives are very sad and mournful. Since Yanmian cremation is mostly performed during funeral ceremonies, we have no way of knowing. It is the real situation at that time, and we can only rely on documents and pictures to describe it.

The image of the Sogdian-Turkish union (Fig. 15), length 62.3 cm, width 35.2 cm, thickness 6.2 cm is an image of the Sogdian union, on which a strong man is sitting, on the left and right of three people, Two people are sitting, and one is standing. With the person standing in a servant position. The two people below are sitting around a plate of food, and each person has a servant, and another person is standing behind the plate. Juliano and Lerner and Lu Zhongdi mainly believed (Juliano & Lerner, 1997) that it was a banquet image, based on the above image. Jiang Bo in believed that the plan was a Sogdian alliance (Jiang Boqin;2000), and the person standing in the middle was the person who confirmed the alliance. Marshak believed (Marshak, 2001) that this image represented a banquet during an inheritance ceremony, with the heir sitting in the middle and a sad expression on his face. This image is almost identical to the image on the right

**Fig. 15: Xi'an Cultural Relics Protection and Archaeology Institute. (2008). Panoramic view of Kangye's tomb [Photograph]. (Zhihu. https://pic2.zhimg.com/v2-beaab3af3d420d2138b28d81fb3b093d_b.jpg).**

of the centre of their sarcophagus. It seems that the two sides who read Sogd here in Miho were the Sogdians on the left and the Turks on the right, and the person in the middle may have read Sogd, according to Mr. Jiang Boqin, not the son of the tomb.

The picture of a Sabao couple (Fig. 16) having a feast, the stone bed (length 61.6 cm, thickness 34.6 cm) depicts a banquet with the host and hostess seated on top of the dome, dancing together in front, with bands on either side. Juliano (Juliano and Lerner, 1997), Lerner, and Lu Zhongdi believe that the scene is a wedding banquet, where the man is a Central Asian and the woman is possibly Chinese. Marshak believed that this scene was a feast for the owner of the tomb and his wife in real life or in heaven. The owners of the Sogdi tomb and his wife are Han and Jianbei. In the reconstructed form now seen, the image of this stone tablet is the second from the left on the reverse, offset from the centre of the reverse. According to the official archaeological excavation of the Yuhong Tomb Stone Ossuary, the middle Ossuary was the site of a couple feasting.

**Fig. 16: Rong, X. (2002). MIHO Museum Sogdian stone sarcophagus panels .Funeral procession for a deceased Sogdian Sabao (http://5b0988e595225.cdn.sohucs.com/images/20190831/f96af5836ff94ea1b20396290574794c.jpeg).**

This image (Fig. 17) L 60.8 cm, W 53.4 cm, D 4.7 cm, this is a square stone couch carved with two images separated by designs that show originally two. The images were independent (I used J-1 and J-. respectively) 2 marks, probably because the stone was extracted from a larger piece, the two images were carved on the same stone couch.

Three people also ride on horseback. See the opposite of the three horses below, a woman with long buns and a servant behind. This image of a horseman is opposite to the third image of a funeral. Marshak's tool diagram suggests that the hero on horseback may be the Sogdian king, but the image that appears in China must be Sabao, the leader of the Sogdian settlement in China

This image (Fig. 18) can be divided into two parts. Above it is a four-armed goddess seated on a panel decorated with lion heads peering out from either end, which Li Giuliano, Lerner, and Zhongdi named after the goddess holding the sun and moon. The goddess Anahita is gone. Below are two female musicians standing on a lotus flower and playing pipes and harps. Below is a picture of music and dance in the centre of which is a woman dancing with bands sitting on the floor on either side. Juliano, Lerner, and Zhongdi believed that the upper part represents heaven and the lower part represents the human world. Mr. Jiang Boqin also held the same view. Marshak confirmed (Marshak: 234) the above decision based on the Sogdian wall materials, but he considered this image the temple of the goddess Anahita. The statue of Anahita is only half-height, with a stone platform underneath it. The two deities responsible for performing music and dance may have originally been on the left and right sides of the statue, as the slab was made in a long strip, and they were carved on the bottom. The dancers below are much smaller and must represent dancing and worship in front of a shrine or temple.

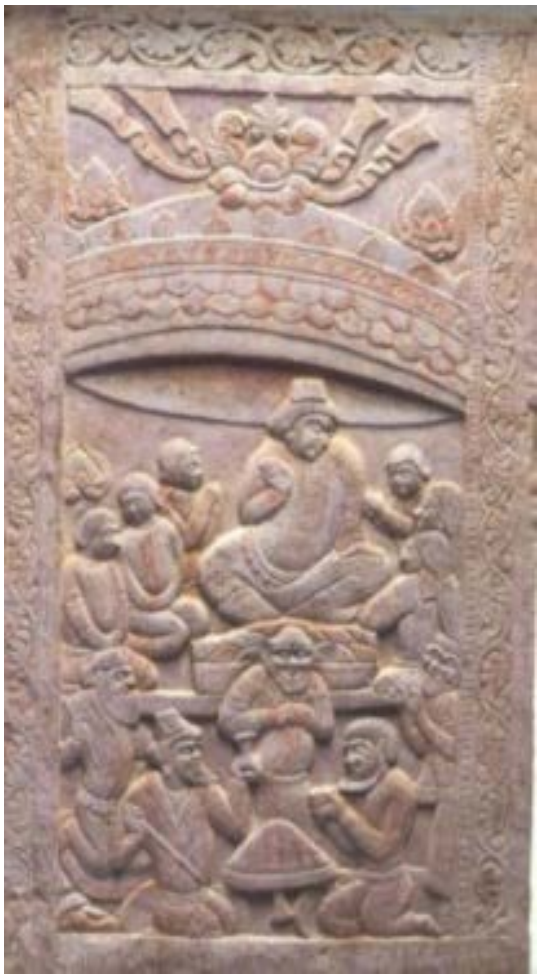

**Fig. 17: Rong, X. (2002). MIHO Museum Sogdian stone sarcophagus panels .Depiction of Sogdian-Turkic alliance ceremony [Digital image]. (http://5b0988e595225.cdn.sohucs.com/images/20190831/640cb421a73c47c69faec03d50e9e60a.jpeg).**

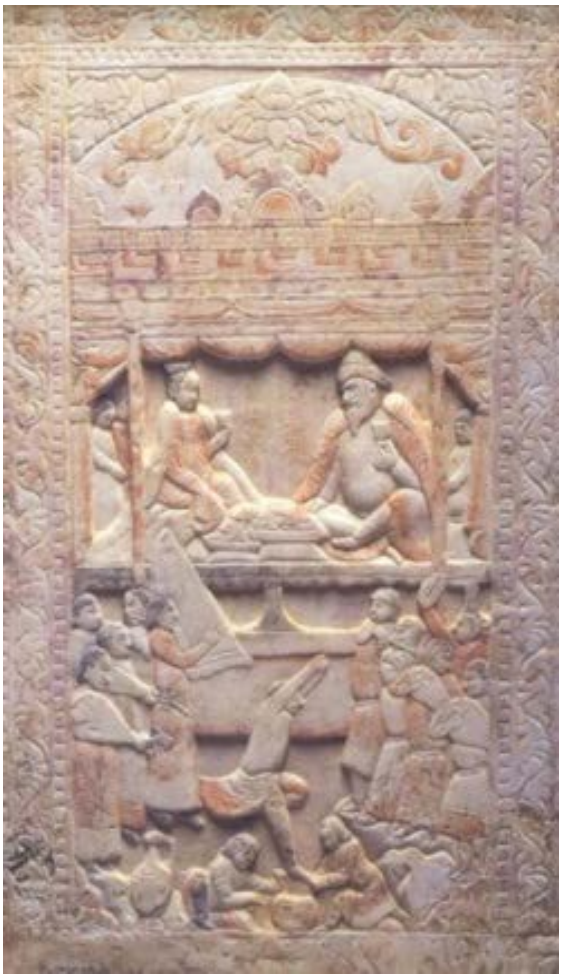

**Fig. 18: Rong, X. (2002). MIHO Museum Sogdian stone sarcophagus panels .Banquet scene of Sogdian Sabao and his wife [Digital image] (http://5b0988e595225.cdn.sohucs.com/images/20190831/986185cb09cb407092ae61e0b5ecd3db.jpeg).**

### 2. 7. Shi Jun（Chnese: 史君）Tomb Group, Ning Xia（Chinese: 宁夏）

Tomb epitaphs were unearthed from six tombs. The tomb owners were ShiShewu （Chinese: 史射勿）, the commander of the Northern Zhou Dynasty and the general of the Sui Dynasty's cavalry, and his descendants, as well as Shi Suoyan's （Chinese: 史索言） uncle and nephew. It was revealed that this location was the burial site of the Shi family, a member of the "nine surnames of Zhaowu （Chinese: 昭武）" who originally lived in Central Asia.

The Shi Jun Tomb Group includes the tombs of the descendants of the Sogdian people during the Sui and Tang dynasties. National key cultural relics protection unit. Located in Kaicheng Town, Yuanzhou District, Guyuan, Ningxia. Eight tombs were excavated from 1982 to 1987. The tombs are arranged in an east-west manner, facing north and south, with long tomb passages and multiple brick chambers in the courtyards. The tomb owner was an official of the Northern Dynasties and the Sui and Tang Dynasties, and the tomb was large to scale. The tombs were often painted with murals and had a rich collection of burial objects. The sealed soil of the tomb of Shi Shewu is about 4.7 metres high and has a circumference of about 78 metres. Thirteen murals depicting warriors, attendants, and horse-drawn horses were unearthed in the tomb passage and chamber walls.

Eight relics were found: white porcelain plates, vases, ink stones, celadon jars, glass bowls, painted warrior figurines, sapphire seals, gold coverings, crescent-shaped gold ornaments, Eastern Roman gold coins, Sassanian gold coins, Persian silver coins, and more. Among them, the sapphire seal is engraved with a medieval Persian Pali inscription, and the gold overlay and crescent shaped gold jewellery have Zoroastrian colours. This cemetery has a high value for studying the exchange and integration of Chinese and Western cultures. The theme of the murals in the tombs of the Sogdian people surnamed Shi in Guyuan follows the old system of the Northern Wei Dynasty. Present the identity, status and life of the deceased before their death, in the hope of remaining like in the underworld. Enjoy a life of glory and wealth, just as before death. Smooth and rough drawing techniques: Crazy and lifelike, reflecting the funeral culture of the northwest region during the Sui and Tang dynasties. The state of social development. However, there is no mention of Sogdians in the mural content about local religious and cultural customs. Burial customs are the most distinctive feature of a nation-social phenomenon, compared with burial customs in the Sogdian region during the same period, as can be seen from the occupancy. The Sogdians named Shi from Guyuan (Ma Caihong, 2014)were deeply influenced by Middle Eastern culture and have reached a high level of influence Sanitisation.

### 2. 8. Shi Ma ping（Chinese: 石马坪）Tomb

The stone coffin tomb in Shrimping, Tianshui is on the top of Wenshan Mountain, Shimaping, Qinzhou District(Gansu Provincial Cultural Relics Bureau). In June 1982, during the construction of the Shangshui Engineering Command Centre in Tianshui City, it was discovered that after cleaning and organising by the Tianshui Cultural Centre, an excavation report was published in 1992. The epitaph is made of cinnabar, but due to the inability to distinguish the tomb owner and

age, and considering various factors such as the stone bed screen painting, the excavators believed that the tomb owner's identity belongs to the aristocratic class, and the tomb age is approximately between the Sui Dynasty and the early Tang Dynasty. With successive excavations of the tombs of Sogdian aristocrats such as Yu Hong, An Jia, Shi Jun, and Kang Ye, it was found that the problems with the Shimaping Stone Coffin Tomb were similar. Therefore, the problems with the Shimaping Stone Coffin Tomb were re analysed based on the above tombs, mainly focusing on the stone coffin screen and Zoroastrian faith, as well as specific tomb dates and tomb owner identities.

The tomb is a single-chamber brick tomb with a vertical shaft and a tomb passage. The tomb door stands at 1.58 metres high, and the upper part of the tomb passage features an arched top. The tomb chamber is square in plan, and the stone bed is positioned in the centre-south of the chamber. The stone bed is composed of sandstone and shale, which are relatively soft. It has a height of 1.23

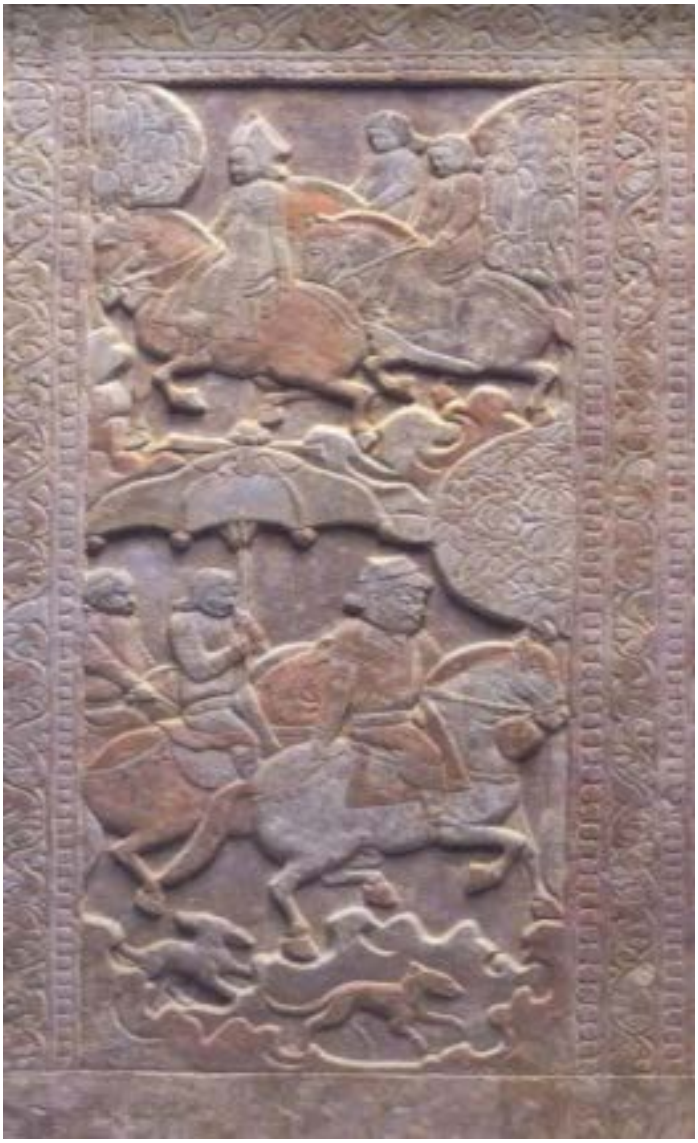

**Fig. 19: Rong, X. (2002). MIHO Museum Sogdian stone sarcophagus panels .New sarcophagus burial scene. (http://5b0988e595225.cdn.sohucs.com/images/20190831/688a5bcfe25546ec826ec2b0ae3f60c1.jpeg).**

metres, a width of 1.15 metres, and length of 2.18 metres. The bed seat, bedboard, and screen were composed of 26 portrait stones and plain stone strips. Among them are 17 portrait stones. The left and right sides of the stone bed, as well as the back seat, are composed of plain 9-square stone strips. The front of the bed seat comprises two portrait stones with two sets of concave carved pot doors corresponding to the upper and lower layers. The upper pot door is carved with six round bottomed lotus petal-shaped male musicians, while the lower pot door is carved with six identical divine beasts. The bedboard comprises four equally sized stone slabs, with child and mother buttons connected. The front edge of the bed is engraved with a continuous honeysuckle pattern and decorated with gold. The screen is composed of 11 painted stone reliefs with a height of 87 cm and a width of 30-46 centimetres. The front face is 5 squares, with 3 squares on each side. The bottom is embedded in the groove on the edge of the bedboard. Although screen paintings have

**Fig. 20: Rong, X. (2002). MIHO Museum Sogdian stone sarcophagus panels (https://img1.baidu.com/it/u=4099256364,3974186654&fm=253&fmt=auto&app=138&f=JPEG).**

**Fig. 21: Xi'an Cultural Relics Protection and Archaeology Institute., (2004) Panoramic view of Shi Jun's sarcophagus tomb [Archaeological photograph] (http://dingyue.ws.126.net/2021/1126/8d357238j00r35ms2004bd000h000o6p.jpg).**

gone through thousands of years and most of the golden colours have peeled off, it is not difficult to see the magnificent scene of flowing light and golden splendour from the remaining colours in the picture at that time. On the front of the bed, there are two stone beast divine dogs at each foot, squatting with their heads held high and their backs supported under the two feet of the bed board. The stone beasts are all painted in gold and bear the bedboard. On the right side of the two beasts, one appears to be a large and powerful male dog; The animal on the left is slightly smaller and gentle in size, and is a female dog. On the left and right sides of the front of the bed, there are 5 seated musicians with a height of 32-33 centimetres. They wear a flat-topped cross-cornered headscarf, a round necked tight-sleeved left lapel robe, and a waistband; High nose, deep eyes, and thick eyebrows, resembling the image of a Hu person. Among them, there are three musicians on the right side of the bed, one playing the horizontal flute, the other holding the Beili, and the other playing the panpipes; On the left, there are two musicians, one holding the sheng and the other playing the pipa. This uniquely shaped screen stone bed was the first unearthed stone in Tianshui. At that time, due to limited resources for reference and analogy, as well as limited conditions, the inscriptions on the tomb epitaphs fell off and could not be recognised. The excavators only preliminarily determined the tombs from the Sui Dynasty to the early Tang Dynasty based on content, style, architectural art, character modelling, and portraits. The excavation report was not made public until 10 years after the tomb excavation. The Tianshui screen stone coffin bed did not receive enough attention at that time. It was not until 20 years after the discovery of the stone bed that this "national treasure level" discovery began to attract people's attention. Around 2000, a batch of stone coffin beds and similar portrait materials were unearthed in Taiyuan, Shānxi, the

**Fig. 22: Ma, C.,(2014).Mural depicting sword-wielding warriors on the eastern wall of the tomb passageway (https://q0.itc.cn/q_70/images03/20250708/4657d4c0851e4e73956ad2279cedbe13.jpeg).**

**Fig. 23: Ma, C., (2014). Mural depicting attendants holding hu tablets on the eastern wall of the tomb passageway [Archaeological photograph]. (https://q8.itc.cn/q_70/images03/20250708/00340c68291544cfbc55e0505aff3f44.jpeg).**

**Fig. 24: Ma, C., (2014). Mural depicting female attendants on the western wall of the burial chamber [Archaeological photograph] (https://q6.itc.cn/q_70/images03/20250708/5b58ea726b5244caaeaeb62398482edf.jpeg).**

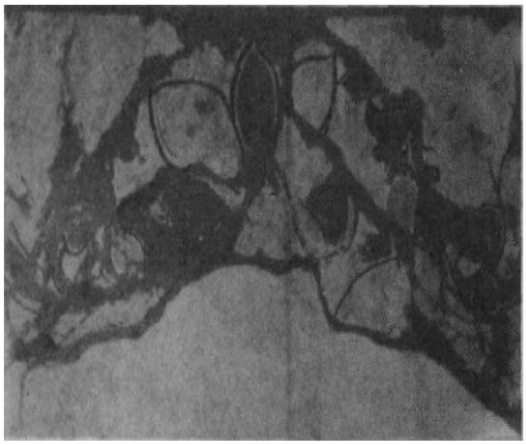

**Fig. 25: Ma, C.,(2014).Floral motif mural in the second corridor passage of the tomb [Archaeological photograph] (https://q7.itc.cn/q_70/images03/20250708/5182f98416024916aa8661951f9202bc.jpeg).**

tomb of Yu Hong from the Sui Dynasty, the tomb of An Jia from the Northern Zhou Dynasty, the tomb of Shi Jun, and the tomb of Kang Ye from Xi'an, Shǎnxi. Especially after the epitaph clearly recorded that they were all Sogdian tombs, this astonishing discovery began to attract people's attention. Therefore, the Tianshui Pingfeng Stone Bed was identified as a noble tomb of the Sogdian people from the late Northern Zhou Dynasty to the Sui Dynasty; Its cultural value and

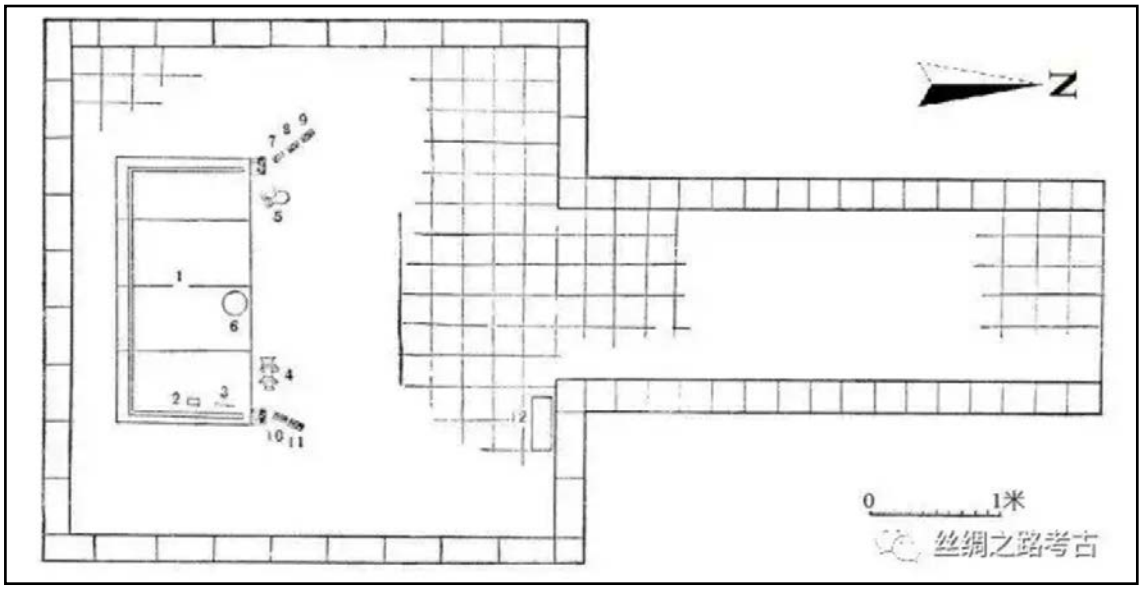


**Fig. 26: Ningxia Institute of Cultural Relics and Archaeology. (2020). Plan of the stone funerary bed tomb at Tianshui Shipaping [Archaeological drawing] (http://www.nxkg.org.cn/uploadfile/2020/0507/20200507110616923.jpg).**

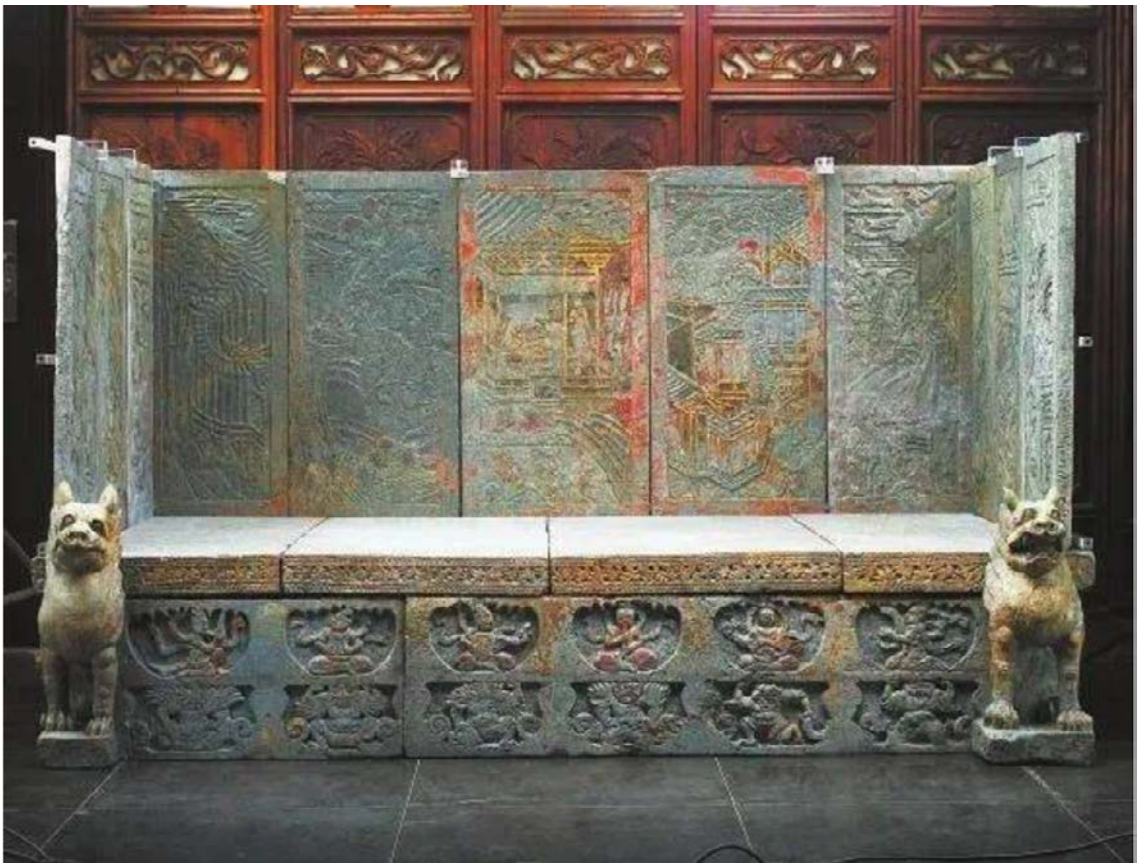

**Fig. 27: Xi'an Museum. (2022). Frontal view of a shaped stone bed from the Northern Zhou dynasty (https://p9.itc.cn/q_70/images03/20220224/3ca80af63b154d10b69e7d8e3d585700.jpeg).**

unique significance in various aspects, such as culture, religion, art, ethnicity, and communication, have gradually been recognised by people. With the completion of the protection and restoration of the stone coffin bed by the Tianshui Museum in 2010 and further confirmation of its painted content, the hidden screen stone coffin bed in the deep chamber finally revealed its true face 30 years after its excavation.

## 3. Conclusion

**1. Artistic Techniques and Tomb Imagery:** The Sogdian people, regardless of the dynasty, depicted the tomb owner as both a performer and an audience. However, the application of artistic techniques in these depictions did not surpass the boundaries of traditional Sogdian painting. Sogdians who migrated to China partially adopted Chinese burial techniques, particularly in tomb painting, design, drawing, and carving. According to tomb stone bed maps, the tomb owners, who had lived in foreign lands for extended periods, often displayed scenes of their anticipated afterlife and their longing for their homeland. This is evident in the tombs of Anjia, Kangye, Shijun, Yuhong, and the Shi family in Ningxia, where the content primarily focuses on their careers, lifestyles, and aspirations for the afterlife. These depictions are mostly rendered in simple forms of painting and carving, emphasizing their yearning for the external world.

In contrast to Han tombs, which typically portray the living conditions of the deceased, Sogdian tombs reflect the status and identity of the tomb owners. While Sogdian tombs, like those of the Han Chinese, often depict various scenes of daily life, the awareness of intentions towards the afterlife has become less pronounced. This distinction highlights the differing cultural priorities: Han tomb imagery emphasizes the continuity of life and social roles, while Sogdian tomb imagery focuses on the individual's identity and their connection to their cultural roots. Additionally, the artistic techniques used in Sogdian tombs, such as the use of vibrant colors and intricate carvings, demonstrate a blend of Sogdian and Chinese artistic traditions, reflecting the cultural syncretism that occurred during their settlement in China.

**2. Function of Tomb Imagery: Faith, Worship, and Identity:** The imagery in Sogdian tombs serves to express the relationship between faith, religious worship, and the interaction between humans and deities. Zheng Yan posits that the images of tomb owners during the Han Dynasty and earlier were transient, often revolving around one or two central figures. These images typically highlight specific aspects or details of the tomb owner's life, serving as a standard representation and a lasting memory. For the deceased, these images function as both a memory and a regret. For their descendants, they provide a means of commemoration and a connection to family traditions.

The differing emphasis on the main imagery functions in Sogdian and Chinese tombs reflects the distinct attitudes of the Hu (Sogdians) and the Han Chinese towards the relationship between humans, deities (or spirits), and tombs. In Sogdian art, the depiction of deities is often positive, influenced by Zoroastrian and Buddhist traditions, while the image of the donor is more commonly seen in secondary roles. This contrasts with Han tomb imagery, which often emphasizes the social hierarchy and the deceased's role within the family and community. The Sogdian tombs' focus on

individual identity and religious symbolism underscores their unique cultural perspective, which prioritizes personal faith and the connection to the divine over communal or familial obligations.

**3. Cultural Traditions and National Mentality: Integration and Adaptation:** The differences in tomb imagery between Sogdian and Chinese traditions can be attributed to various factors, including environmental and regional influences, cultural traditions, historical conditions, lifestyle, ideology, and ethnicity. Historically, the Sogdians entered the Central Plains as immigrants and were often marginalized within the social structure. The cultural traditions and lifestyles they brought to China were markedly different from the Confucian customs that dominated Han culture. Through the excavation of Sogdian tombs across different dynasties and regions in China, it is evident that each tomb has unique characteristics, reflecting diverse attitudes towards life and religious worship.

This reveals that the Sogdians, after a prolonged and stable presence in China, gradually absorbed and integrated local cultural elements. Thus, Sogdian tombs provide valuable insights into how the Sogdians preserved Iranian cultural heritage, disseminated their own culture, and assimilated into the local culture, forming a unique cultural identity as Sogdian immigrants in China. The cultural style of the Sogdians was inherently open, contrasting with the more restrained Han culture. The process of cultural integration for the Sogdians in China was lengthy and complex. Despite this, their core beliefs and thoughts remained rooted in Sogdian cultural traditions.

The function of tomb imagery is reflected in two primary aspects: as idols and as monuments, with the latter primarily serving as an idol. Notably, most Sogdian funeral imagery does not adhere strictly to a chronological narrative, further distinguishing it from Chinese tomb art. This non-linear approach to tomb imagery reflects the Sogdians' emphasis on symbolic representation rather than historical accuracy. Additionally, the inclusion of Zoroastrian and Buddhist motifs in Sogdian tombs highlights their religious syncretism and adaptability, as they navigated the complexities of living in a predominantly Han Chinese society.

In conclusion, the study of Sogdian tombs not only sheds light on their artistic and cultural practices but also provides a deeper understanding of the processes of cultural exchange and integration in ancient China. The unique characteristics of Sogdian tomb imagery, from its artistic techniques to its symbolic functions, underscore the Sogdians' ability to maintain their cultural identity while adapting to their new environment. This dual focus on preservation and adaptation makes Sogdian tombs a fascinating subject for exploring the dynamics of cultural interaction in early medieval China.

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## Conflict of Interest

Author declared no conflict of interest.

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# تحقیقات جدید دربارهٔ کشف قبرهای سغدی در چین


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**چکیده**

سُغدیانا یکی از قدیمی‌ترین دولت‌شهرهای شرقی در ایران باستان است که در جادهٔ ابریشم باستانی واقع شده بود. براساس مدارک تاریخی و مواد باستان‌شناسی، مقبره‌های سُغدی زیادی در نقاط مختلفی از چین غربی کشف شده‌اند و گویا این مقبره‌ها توسط سغدیان مقیم این منطقه ساخته شده‌اند. بررسی این آثار نشان از آن دارد معماری ایرانی-چینی در این سازه‌ها به‌کار رفته است. مطابق اسناد تاریخی و متون چینی گویا این حقیقت است که سُغدیان به‌عنوان مقامات دولتی، بازرگانان و... وارد چین شدند و در این بخش از سرزمین‌های چین کسب‌وکارهای خانوادگی-تجاری برای خود ایجاد کرده و از این‌طریق در فرآیندهای تجارت، فرهنگ، تاریخ، دین و غیره، نقش مهمی ایفا نمودند. کشفیات باستان‌شناسی در منطقهٔ دشت‌های مرکزی چین به‌طور قابل‌توجهی جایگاه استراتژیک و نقش سُغدیان و شهرهای سُغدی را در این تبادلات تقویت کرده است. با توجه به اهمیت این موضوع و اطلاعات غنی موجود در ادبیات چینی، این پژوهش به جمع‌آوری مقبره‌های کاوش‌شدهٔ چینی پرداخته و قصد دارد، این داده‌ها را تحلیل کند؛ این‌که چگونه سُغدیان توانستند در گذر زمان در جوار سایر شهرهای چین غربی به یکی از تأثیرگذارترین گروه‌های قومی در تغییرات سیاسی، اقتصادی، اجتماعی، مذهبی، زبانی و فرهنگی سلسله‌های چینی تبدیل شدند.



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## Documentation and 3D Modeling of Mountain Castles Using Drone Photogrammetry at the Historic Forg Castle

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**Abstract**

Forg Castle is a mountain fortress dating back to the Late Islamic period (from the Afsharid to the Qajar era). Due to its strategic location and unique architecture, the castle has always attracted attention and necessitates precise documentation using modern methods. Drone photogrammetry is one of the modern technologies that, with the advancement of technology in recent decades, has become increasingly used in this type of study. Whether used alone or in combination with other techniques, it has been widely employed in the 3D modeling of immovable cultural heritage and archaeological sites. This technology creates accurate and photorealistic 3D models of historical structures and sites using 2D images. Such documentation is valuable for conservation efforts and sustainable development. The present applied research was conducted with the aim of assessing the capabilities of drone photogrammetry in a mountainous castle with significant elevation differences. The study focused on modeling Forg Castle for documentation and the creation of a 3D map. It was carried out in three stages: fieldwork, software processing, and archival research, using an analytical approach. As a result, a 3D model of the mountainous Forg Castle was produced with true texture and a Ground Sample Distance (GSD) of 0.97 centimeters per pixel. The accuracy of the results was evaluated using four ground control points (GCPs) and three check points, indicating the high performance of drone photogrammetry as a fast and effective method for the documentation and 3D modeling of mountainous castles and their architectural features despite elevation differences with a ground accuracy of 6.2 centimeters.

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## 1. Introduction

Forg Castle is one of the most important and beautiful historical castles in South Khorasan Province and is registered as a national heritage site of Iran. It is located in the village of Forg, a part of Darmian County, approximately 90 kilometers east of Birjand. Due to its strategic location and unique architecture, the castle holds special significance. The construction of Forg Castle began in the early year 1160 AH (during the reign of Nader Shah Afshar) by Mirza Baghakhan, the then governor of the region, and was completed by his son, Mirza Rafi‘ Khan, after whom the castle is also named (Darmiani, 1986). Forg Castle, due to its strategic location overseeing the entire village, surrounding farms, and communication routes in the eastern region, held great military and defensive importance and served as a strong fortress resisting enemy attacks. The castle was registered as a national heritage site of Iran under number 3450 in the year 2000 CE and also holds the potential to be listed as a UNESCO World Heritage site. This castle is classified among mountainous castles, which are recognized as significant cultural heritage monuments, but due to their rugged terrain and complex structures, accessing and documenting them is challenging.

Traditional surveying methods are often time-consuming, costly, and sometimes unsafe. In recent years, UAV photogrammetry (using drones) has emerged as a powerful tool for documenting, preserving, and monitoring such sites. Recent advancements in data acquisition techniques leveraging Unmanned Aerial Vehicles (UAVs), or drones, coupled with cost-effective aerial imaging sensors, have greatly accelerated 3D mapping across diverse applications, including civil engineering, agriculture, military operations, and archaeology. 3D photogrammetry is a scientific discipline that utilizes 2D images to generate precise and realistic 3D models of objects and environments. This technology employs specialized software and complex algorithms to create point clouds from digital camera images, offering an accurate representation of the object’s or environment’s shape, size, and structure. These point clouds are then converted into editable 3D models. This technique holds significant potential for cultural heritage, contributing to the creation of 3D models of archaeological sites (Kanun *et al.,* 2021) and the extraction of building geometries (Eisenbeiss *et al.,* 2005). New 3D digital tools offer unique advantages for informing, educating, and preserving artifacts and sites. These tools not only enhance public access for museums and historical locations but also extend reach to researchers who might otherwise be unable to access these materials and sites (Zarnowski *et al.,* 2015). However, the use of UAVs for documenting mountainous sites, including castles, comes with certain limitations and challenges. For instance, steep slopes, dense vegetation, and complex structures can create shadowed areas that reduce the quality of the captured images (Chiabrando *et al.,* 2017). Additionally, wind, rainfall, and sudden changes in weather conditions in mountainous regions significantly affect UAV flight safety and the quality of the collected data (Nex & Remondino, 2014). Local regulations regarding UAV flights in protected areas may restrict full operational permissions (Colomina & Molina, 2014). Finally, the captured images generate large volumes of data that require powerful hardware and software for processing (Eltner *et al.,* 2016). This study focuses on the precise documentation and 3D modeling of the mountainous Forg Castle, characterized by significant elevation differences,

using drone technology. It also aims to measure the margin of error and ground sample distance (GSD), taking into account the elevation variation and the number of ground control points. However, the castle is currently in a partially abandoned state and, despite severe damage, still retains significant architectural and structural value. This study aims to provide a precise and quantitative approach to lay the groundwork for its future interpretation, as well as for potential conservation and restoration efforts.

## 2. Research Background

The 3D modeling of the Stenico Castle in Trentino, Italy marked one of the first significant applications of UAV photogrammetry in the field, utilizing both aerial and terrestrial images (Gonzo *et al.,* 2004). This foundational study paved the way for subsequent research and the broader adoption of the technology. In the years that followed, the scope of this research expanded. For example, Lerma & Colleagues (2010) investigated the use of UAVs for documenting historical castles in Spain and proposed methods to improve the 3D modeling process. Over time, more comprehensive approaches for using UAVs in cultural heritage documentation emerged (Remondino and Barazzetti, 2011). extensively explored the application of UAVs for documenting sites with limited access, such as mountain castles. These studies highlighted the importance of using UAVs in challenging environments. A significant advancement in this area was the integration of UAV imagery with Geographic Information Systems (GIS), (Verhoeven, 2011). This demonstrated how such integration could lead to a better understanding of the spatial context of hill-top castles and their historical defensive advantages, providing new insights into spatial analysis. In recent years, numerous studies have presented the practical application of UAV photogrammetry in conservation and restoration programs. For instance, Koutsoudis & Colleagues (2017) highlighted the potential of this method for cultural heritage preservation and digital archiving using UAV photogrammetry for the Kastania Castle in Greece created accurate 3D models for structural assessment and restoration planning by mapping the Byzantine Platamon Castle in Greece (Hatziyazaro *et al.,* 2018). Additionally, in a comprehensive study on the medieval Mundojar Castle, Orihuela and Molina utilized UAV photogrammetry to support conservation efforts and sustainable development (2021). The most recent research on Noe-Wildon Castle in England has also emphasized the benefits of UAV-based documentation and 3D data acquisition (Bauer *et al.,* 2025).

## 3. Geographic Setting

Forg village is located 107 kilometers southeast of Birjand in South Khorasan Province. It has a population of 690 people in 204 households and is situated in Darmian Rural District, within the Central District of Darmian County. The village lies entirely on the slopes of Momenabad Mountain and has a cold, mountainous climate. It is considered one of the summer highland areas (yeylaq) of South Khorasan (Choubdari *et al.,* 2021). This region is entirely mountainous and lies along the southern highlands of Khorasan, which significantly influences its climate and

vegetation. The dominant climate of the rural district is arid and desert-like; however, due to its higher elevation, the northern and more elevated areas enjoy a milder climate compared to the surrounding plains (Fig. 1).

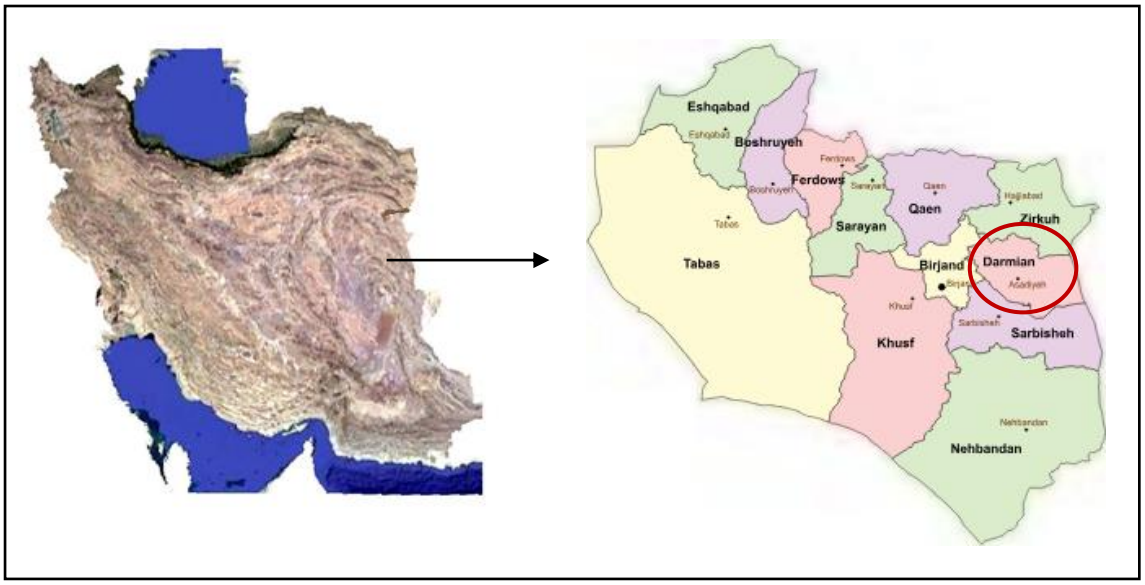


**Fig. 1: The location of Darmian county (Authors, 2024).**

## 4. Introducing Forg Castle

Many travelers have explored the Forg region. For instance, Colonel C.M. MacGregor, in his travelogue "A Journey Through the Province of Khorasan", wrote: Forg is built on a hill 2,000-2,500 feet high, making it vulnerable to artillery fire from the northern and western heights. To its south, and on its other two sides, lies a mountain, with its peak 1,200 yards from the castle walls. MacGregor further noted that "within the castle, three large cisterns are built, said to hold enough water to supply a large garrison for a year and a half." (MacGregor, 1987: 98). In 1933 (1312 in the Persian calendar), the author of "Ein al-Vaqayeh" visited the Darmian region and Forg Castle, describing it as: Forg Castle is situated on a mountain, its walls and towers strongly constructed from baked bricks, with a stone foundation. It was surrounded by two 'Haji Lions' (likely referring to stone lion sculptures) and two earthworks, each five zars thick [approximately 5 meters]" (Riazi Heravi, 1993: 110).

Given the castle's location on uneven terrain with significant elevation changes, its designer opted to follow the existing natural topography rather than using predefined plans and altering the mountain's structure. Consequently, the castle's layout lacks the typical regularity often seen in desert castles. The castle covers an area of approximately 9,200 square meters, with its extent stretching from east to west. The main entrance is located on its eastern wall, which is also the lowest point of the castle. The castle is divided into three sections: eastern, central, and western. In the eastern section, the entrance corridors, watchtowers, and a water reservoir are visible. The central section is situated at a higher elevation, but due to significant destruction, its original purpose cannot be determined. The western section, which is the most important and highest part

of the castle, is separated and guarded by two towers, indicating its strategic significance. This section includes spaces such as vestibules, connecting corridors, stables, a food storage area, watchtowers, and an underground passage. It consists of two floors, with the upper floor having been destroyed (Fig. 8).

## 5. Materials and method

This research is an applied study conducted using both field and documentary methods. In the field phase of this research, specialized drone-based photogrammetry software, such as Agisoft Metashape version 2.2.1, was evaluated on various data from the Forg castle. The main stages of this study included: flight plan design in PIX4D PRO software, identification of control points on the site using multi-frequency GPS, data acquisition using a Mavic 2 Pro drone, transferring the acquired images to Metashape software, generating a point cloud, and designing a model using the point cloud. Subsequently, in addition to three-dimensional cartography, the spatial structure and physical distribution of the city were studied using documentary information, including historical texts. In this research, a Mavic 2 Pro multi-rotor drone with a 20-megapixel Hasselblad camera and high-definition (HD) images, along with 8 kilometers of obstacle detection sensors in four main flight directions, was used to acquire aerial images. A Raymand multi-frequency GPS model was also utilized to identify control points. A preliminary design sketch was prepared in advance for data acquisition from the historical Forg castle for its three-dimensional modeling. Field operations were conducted at the Forg castle, in the castle area, for 2 hours (Table 1) The workflow stages of the photogrammetry project using a drone consisted of: photogrammetry process parameters, flight process, flight quality, image processing by photogrammetry software or other specialized software, Ortho photo generation, and the application of the obtained data (Suziedelyte Visockiene *et al.,* 2016).

**Table 1: Drone and camera specifications in the research (Authors, 2024).**

| **Gauge Specifications** | | **UAV specifications** | |
|---|---|---|---|
| Type of Gauge | Hasselblad camera with a 1-inch CMOS sensor attached to the drone. | Type of drone | Multi-Rotor (DJI Company) |
| ISO and shutter speed. | Automatic | GPS | Yes |
| | | Weight | 907 g |
| | | Flight Speed | Km per hour68 |
| The number of pixels | MP 20 | Continuity of flight | 30min |
| | | Wake up mode | Automatic |
| | | Sitting mode | Automatic - Semi Automatic |

## 5.1. Aerial survey network design

PIX4D software was used for designing, guiding, and controlling the flight in this research. To design the flight in the aforementioned software, after selecting the drone type, the flight area was determined as the first step. Considering the drone type, which was a multi-rotor with a flight speed of 10.5 meters per second and equipped with a Global Positioning System (GPS), the flight settings and camera angle with respect to the horizon were entered into the software. Thus, based on the actions taken, the longitudinal and lateral overlap values of the acquired images were determined to be 80% and 85% respectively (Fig. 2). According to the Ground Sample Distance GSD 0/97, the flight altitude was set at 40 meters and the flight starting point was defined at the center of the castle.

Considering the area of the designated zone within the Forg castle, the flight was designed in double grid, and then the flight plan was saved onto the drone's memory by the software (Fig. 3). The drone's flight was completely automatic and without manual intervention because a multi-rotor drone was used. After traversing the designed paths and acquiring images at the designated

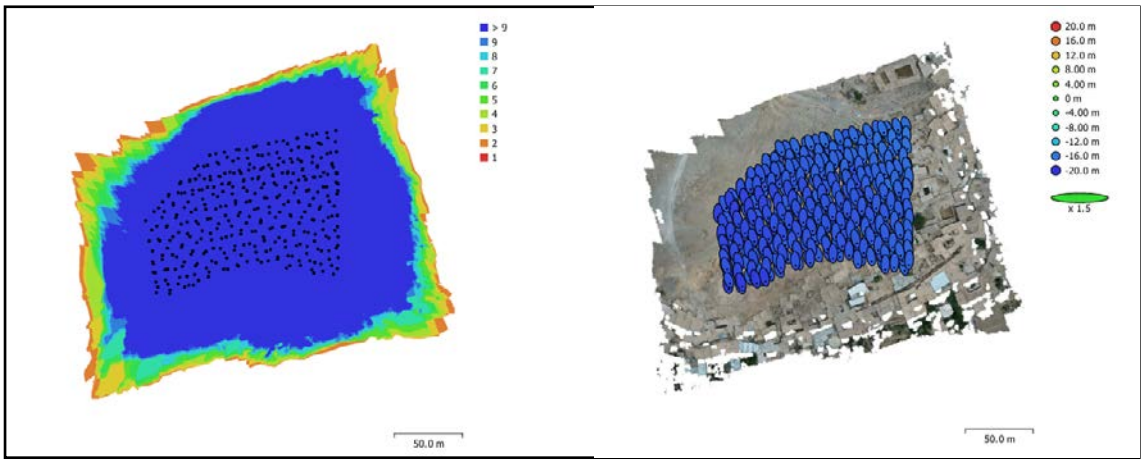


**Fig. 2: Left, Camera locations and error estimates; Right, Camera locations and image overlap (Authors, 2024).**


**Fig. 3: Flight design of Forg castle in PIX4D software (Authors, 2024).**

points, the drone was landed by the operator (pilot). Ultimately, during this aerial photography, 358 aerial photos with good quality and specific geographical locations were recorded.

## 5.2. Photogrammetric Image Processing

Prior to processing, the aerial images were georeferenced using the flight information. These images were reviewed before being loaded into the processing software. Fortunately, all 358 photos of the Forg Castle were successfully loaded in high quality into Metashape software. Subsequently, the software detected the camera position and orientation for each image, and tie points were automatically identified and extracted. The photogrammetric processing of the acquired images was performed using Agisoft Metashape, version 2.2.1. This software is an advanced image-based 3D modeling package. The workflow for generating a 3D model from the images in the software is summarized in the following stages: image alignment, dense point cloud generation, and mesh creation.

After loading the images, the software begins the alignment stage by detecting and matching corresponding points in overlapping images. It then calculates and determines the camera's position for each exposure and refines the camera's calibration parameters. This process results in a sparse point cloud that illustrates the camera positions (Fig. 4). In the next stage, based on the estimated camera positions, the software generates a dense point cloud. Finally, based on the dense point cloud derived from the measurements taken from the surface of the imaged subject, it reconstructs a 3D polygonal mesh. By applying the texture extracted from the images onto this 3D mesh, a final 3D model with a realistic texture is achieved.

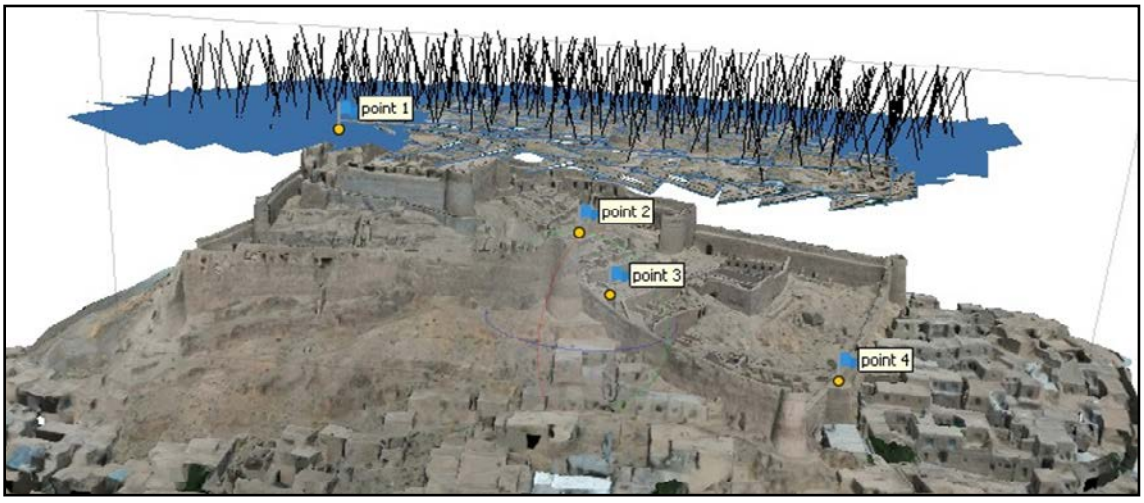


**Fig. 4: Determining the location of aerial images and generating scattered sparse point clouds in the Forg castle (Authors, 2024).**

## 6. Result

The accuracy of the resulting model for Forg castle is as follows, according to the tables below. For the Forg castle, four ground control points (GCPs) were utilized with a multi-frequency GPS (Fig. 5). These points were strategically placed to be readable both directly and from the 3D model (Fig. 6). The table displays the values that were read directly and those obtained from the

**Table 2: Determining planar and elevation errors of Forg castle control points (Authors, 2024).**

| Label | X error (cm) | Y error (cm) | Z error (cm) | Total (cm) | Image (pix) |
|---|---|---|---|---|---|
| Point 1 | -3.08213 | 0.714379 | 1.43184 | 3.47275 | 4.099 (14) |
| Point 2 | 4.16879 | -5.19675 | -1.13059 | 6.75746 | 0.913 (59) |
| Point 3 | -0.612847 | 3.91492 | -0.977236 | 4.08132 | 0.943 (56) |
| Point 4 | -0.473791 | 0.567434 | 0.675988 | 1.00171 | 1.097 (74) |
| **Total** | **2.62099** | **3.28501** | **1.08862** | **4.34119** | **1.444** |

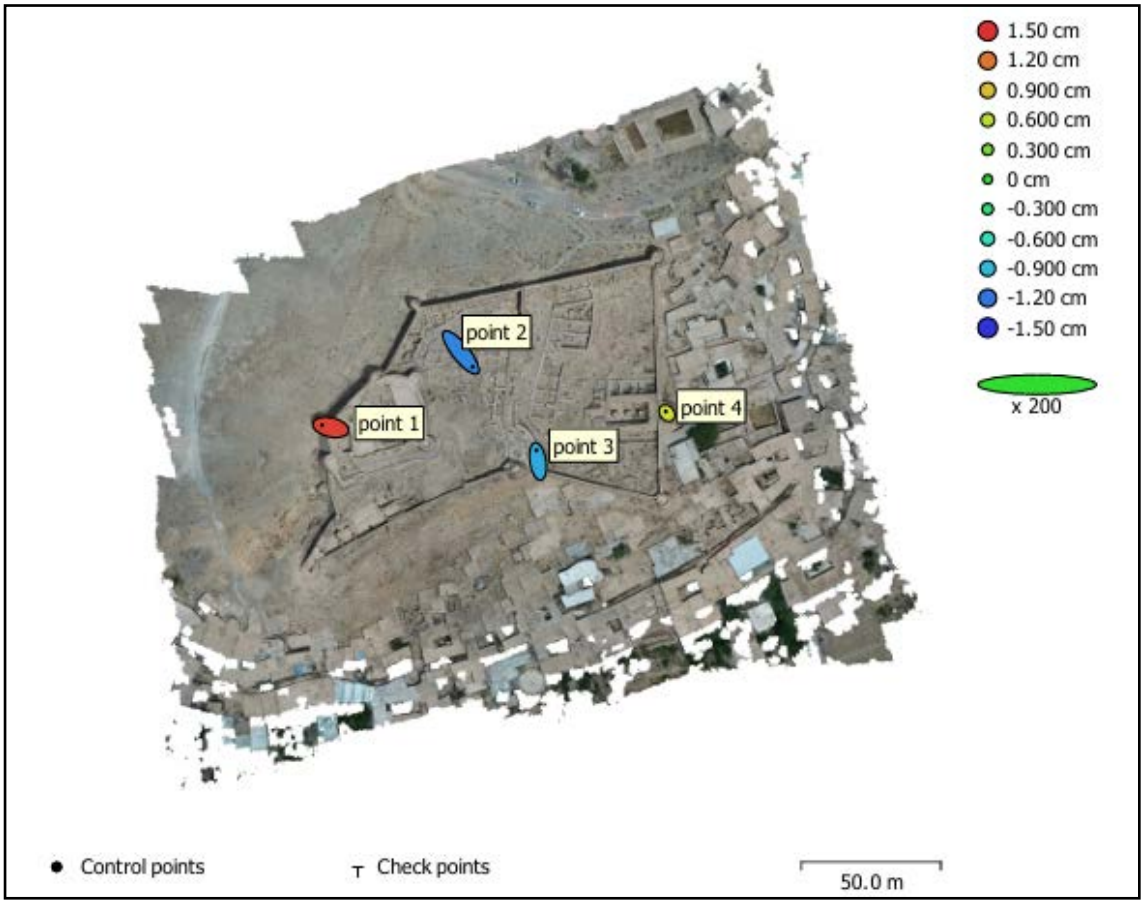


**Fig. 5: Ground Control Points (GCP) locations and error estimates (Authors, 2024).**

3D model (Table 2). As it can be observed, the error rates along the longitudinal (Y), transverse (X), and vertical (Z) axes are 3.28501, 2.62099, and 1.08862, respectively. In addition to the 3D model, a digital elevation model (DEM) was also obtained (Fig. 7). In figure 8, the details of the most important and highest part of the castle, namely the western section, are clearly visible (Fig. 8).

## 7. Disscusion

Documenting mountainous castles in 3D has always been more challenging than documenting

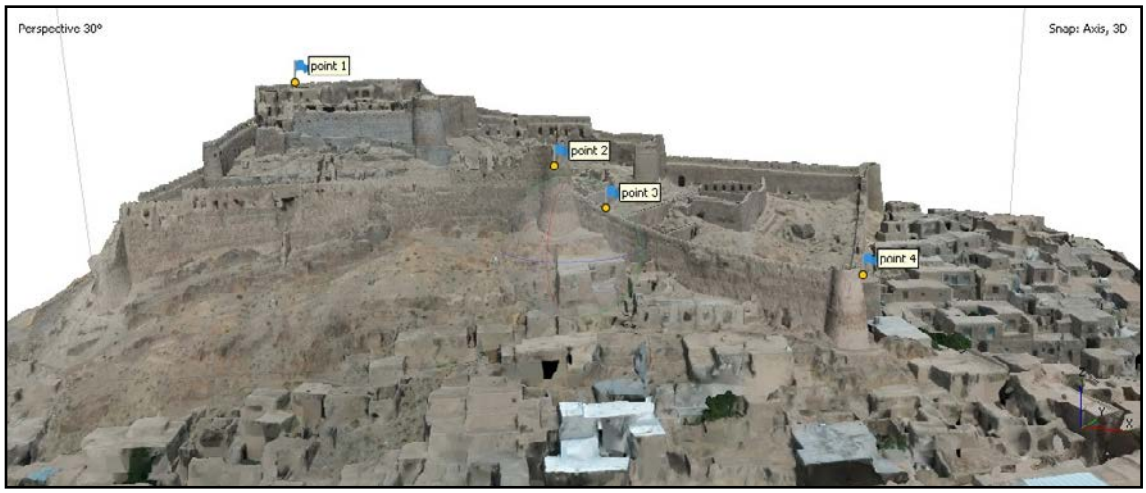


**Fig. 6: Output of the 3D model of the Forg castle with real texture (Authors, 2024).**

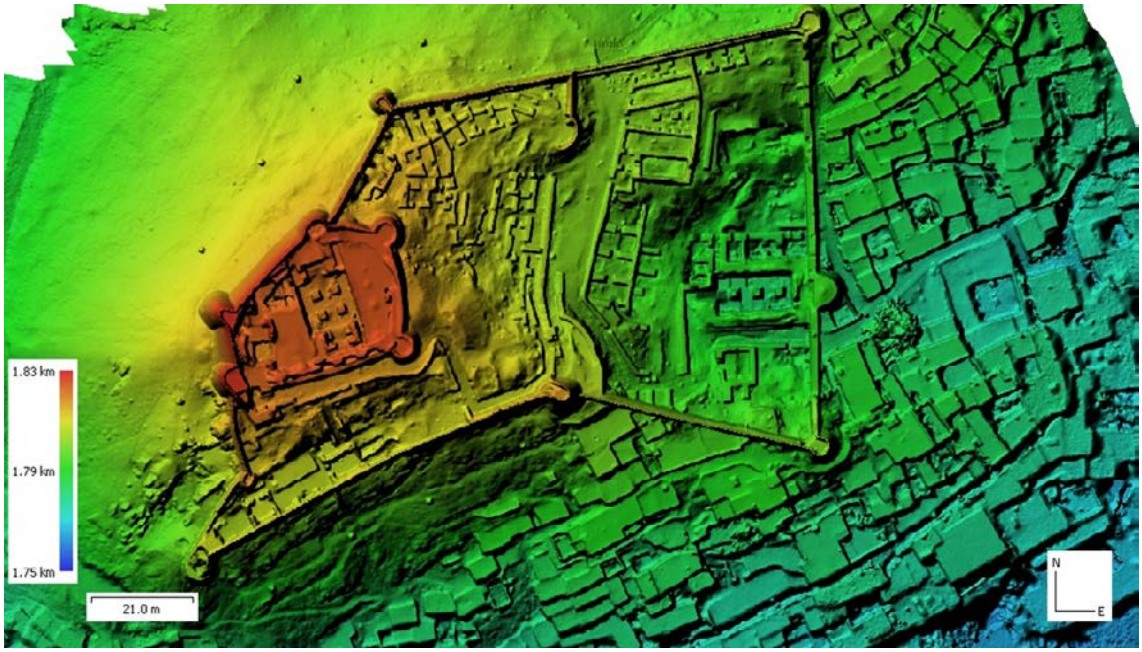


**Fig. 7: Output of the Reconstructed digital elevation model (DEM), (Authors, 2024).**

sites located on flat terrain due to their positioning on rugged mountainous landscapes and significant elevation differences. Additionally, because fortresses typically cover smaller areas compared to large-scale open archaeological sites, drone-based documentation activities can be somewhat restricted. For instance, in a site with considerable elevation variation, it is possible to set the drone's flight mode based on the area's DEM (Digital Elevation Model), allowing the drone to automatically adjust its altitude according to the site's topography without pilot intervention. However, this approach becomes difficult in smaller sites like the Forg mountainous castle which, despite having elevation differences and spanning about 9200 square meters, is located on a hilltop and includes towers and ramparts. Although flying based on the DEM would have been beneficial in such a terrain, the limited area of the site made this flight mode impractical. Therefore, the


**Fig. 8: The highest part of the castle, located in the western section, is guarded by two watchtowers (Authors, 2024).**

drone's flight was initiated from the center of the fortress, and a flight altitude of approximately 40 meters was chosen. In this documentation project, in addition to the four Ground Control Points (GCPs) discussed in the results section, three test points were also defined.

In addition to providing high accuracy in identifying the location of architectural structures, this 3D model can also be used to calculate the volume of archaeological excavations at the site of Forg castle. For example, the exact area of soil removal can be marked on the DSM models before and after excavation, allowing the software to calculate the volume of material removed (excavation) and, if applicable, the volume of material added (backfilling). Another important application of this 3D model of the castle is in analyzing damage caused by erosion and natural hazards over time.

To calculate the root mean square error (RMSE) in the X and Y directions, the following formula was used. The second formula is a simplified version of the first formula.Here, $X_1$ and $Y_1$ represent the model points, and $X_2$ and $Y_2$ correspond to the sample test points.

$$RMSE = \sqrt{\sum_{i=1}^{n} \frac{(\hat{y}_i - y_i)^2}{n}} \qquad \text{a)}$$

$X_1 - X_2 = X$

$Y_1 - Y_2 = Y$

$$\sqrt{X^2 + Y^2} = RMSE$$

**Table 3: Determining root mean square error (RMSE) of Forg castle (Authors, 2024).**

| Test Points | X error(cm) | Y error(cm) |
|---|---|---|
| Point1 | 2 | 3 |
| Point2 | 6 | 3 |
| Point3 | 6 | 6 |
| Total | 6/2 cm | |

## 8. Conclusion

In this study, conducted to evaluate the capability of drones in the 3D modeling of the mountainous Forg Castle, a multi-rotor UAV was used to collect aerial data. The results demonstrate that, depending on the specifications of the equipment used and the flight altitude, drones can provide accurate metric documentation of mountainous castles with varying elevations. The generated 3D model successfully captured all geometric, spectral, and textural details of the site. The key advantages of this method include rapid, low-cost, and non-destructive data acquisition from complex, expansive sites with limited accessibility. In the case of Forg Castle, a 3D model was created using four control points and three test points, achieving a Ground Sampling Distance (GSD) of 0.97 cm. The model reached an accuracy of 4.34 cm at the control points, with a final overall accuracy of 6.2 cm. The castle, located in a natural mountainous setting with a 50-meter elevation difference between its highest and lowest points, was thoroughly documented and modeled in 3D. The model preserved the photorealistic texture of the castle, and precise dimensions of the construction materials, as well as all architectural angles, were accurately recorded. This study, which tested the use of UAV-based 3D photogrammetry in elevated mountainous environments such as this, concludes that the most effective way to minimize error in large areas with significant elevation differences is to fly the drone following a Digital Elevation Model (DEM) of the region. However, due to the relatively small size of the castle and the presence of high walls and towers, DEM-based flight was not feasible in this case. Instead, by setting a fixed flight altitude of 40 meters and starting from the center of the site, and by defining control points, the error could be reduced to an acceptable level. A limitation of the current study was in data acquisition across the site, which highlights the need to integrate this method with complementary technologies. The authors offer suggestions for improving future research, including the use of drones equipped with RTK/PPK technology to enhance the accuracy of 3D modeling and mapping. This approach is particularly well-suited for mountainous sites such as Forg. A data fusion approach can also be utilized. In this approach, data from various sources such as 3D laser scanning, aerial data, and ground-based surveys are combined to create a more accurate and comprehensive final model. In the data fusion approach, in addition to laser scanning, LiDAR data can also be used. LiDAR can provide more accurate elevations of rocky surfaces and castle walls, which is crucial for 3D modeling and structural change analysis. Furthermore, LiDAR can identify subsurface features, which complements the 3D photogrammetry process of the castle.However, in many areas of Iran, the use of LiDAR-equipped aircraft is prohibited, and researchers may face certain limitations. Therefore, the authors in this paper have adopted a cost-effective and relatively accurate method suitable for Iran.

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## Conflict of Interest

Authors declared no conflict of interest.

## Authors' Contribution

Conceptualization, Fereshte Azarkhordad and Hasan Hashemi Zarajabad.; methodology, Hasan Hashemi Zarajabad; software and modeling , Fereshte Azarkhordad . formal analysis, Fereshte Azarkhordad .investigation, Fereshte Azarkhordad , Hasan Hashemi Zarajabad.; resources, Fereshte Azarkhordad. data curation, Fereshte Azarkhordad.; writing original draft preparation, Fereshte Azarkhordad.; writing review and editing, Hasan Hashemi Zarajabad. All authors have read and agreed to the published version of the manuscript.

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# مـطالعات باسـتان‌شـنـاسی

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# مستندسازی و مدل‌سازی سه بُعدی قلاع کوهستانی با استفاده از فتوگرامتری با پهپاد مطالعهٔ موردی: قلعهٔ تاریخی فورگ


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**چکیده**

قلعه فورگ، ازجمله قلاع کوهستانی است که مربوط به دورهٔ متأخر اسلامی (افشاریه تا قاجار) می‌باشد این قلعه به‌دلیل موقعیت استراتژیک و معماری منحصربه‌فرد همواره موردتوجه بوده و نیاز به مستندنگاری دقیق با استفاده از روش‌های نوین می‌باشد. فتوگرامتری پهپاد، یکی از روش‌های نوینی است که با پیشرفت تکنولوژی در دهه‌های اخیر در این زمره از مطالعات قرار گرفته است که به‌صورت منفرد یا در ترکیب با روش‌های دیگر، به‌طور گسترده‌ای در مدل‌سازی سه‌بُعدی میراث‌فرهنگی غیرمنقول و محوطه‌های باستان‌شناختی استفاده می‌شود. این فناوری، با استفاده از تصاویر دو بعدی، مدل‌های سه‌بُعدی دقیق و فتورئالیستی از آثار و محوطه‌های تاریخی تولید می‌کند. این نوع مستندنگاری جهت اقدامات حفاظتی و توسعهٔ پایدار آن‌ها سودمند است. پژوهش کاربردی حاضر با هدف ارزیابی توانایی فتوگرامتری پهپاد در یک قلعهٔ کوهستانی با اختلاف ارتفاع قابل‌توجه صورت گرفته است که به مدل‌سازی قلعه فورگ جهت مستندنگاری و تهیهٔ نقشهٔ سه‌بعدی پرداخته شد. این پژوهش در سه مرحلهٔ میدانی، نرم‌افزاری و اسنادی و به روش تحلیلی انجام شده است که نتیجهٔ آن ایجاد مدل سه‌بُعدی قلعه کوهستانی فورگ با بافت واقعی و اندازهٔ نمونهٔ زمینی (GSD) ۰/۹۷ سانتی‌متر بر پیکسل به‌دست آمد. در این پژوهش، ارزیابی نتایج تدقیق‌شده توسط چهار نقطهٔ کنترل زمینی و سه نقطهٔ آزمایشی، بیانگر عملکرد بالای فتوگرامتری پهپاد به‌عنوان روشی سریع در مستندنگاری و مدل‌سازی سه بُعدی قلاع کوهستانی با اختلاف ارتفاع در بستر کوه و آثار معماری آن‌ها با دقت زمینی ۲/۶ سانتی‌متر است.



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## فهرست مطالب

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