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Takht-e Rostam, A Coastal Camp in the Southeast of the Caspian Sea during Late MIS3: A Preliminary Report of Archaeological Excavation

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Abstract

The southern region of the Caspian Sea is regarded as a potential dispersal corridor through which humans migrated from western Eurasia to Central Asia during the Pleistocene epoch. In the last decade, new research has focused on the Palaeolithic archaeology of this area. One significant site is Takht-e Rostam, an open-air Paleolithic location situated west of Neka City in the southeastern part of the Caspian Sea. In 2020, 13 test trenches were excavated as part of a site delimitation project. Takte-e Rostam features a Lower Pleistocene marine terrace landform, surrounded by Late Pleistocene deposits, formed on the Lar limestone formation, rising about 40 to 50 metres above sea level. Palaeolithic artefacts were discovered within a chocolate-coloured sediment deposit. For dating purposes, two soil samples were collected from the excavated trenches and analysed using the OSL method, conducted by the Geophysics Institute, University of Tehran. A total of 2,659 lithic artefacts were recovered from both in situ and secondary layers, underscoring the site's historical importance. The OSL dating and lithic analyses suggest that the Takht-e Rostam site likely served as a campsite for lithic production and hunting along the coast of the Caspian Sea during the transition from the late Middle to early Upper Palaeolithic periods. Furthermore, the geological landmark of this site may have played an essential role in the hunting strategies of Palaeolithic human groups, and their ability to monitor and dominate the surrounding environment. This research indicates that the deposit's formation is associated with the Khvalynian stage of the Caspian Sea, with the last layer of loess dating back to marine isotope stage 3.

Keywords: Palaeolithic, Caspian Sea, Loess, Takht-e Rostam, MIS3.

Article Type: Research Article

Introduction

Fossil evidence shows that during the late Pleistocene, hominin species migrated from the western regions of Eurasia along the northern route to Central and Eastern Asia (Zwyns *et al*. 2019: 1). Palaeolithic research suggests that modern humans were present in this migration route during the last glacial period about 40 to 45 ka (Hublin 2015: 194). Overall, during the Late Pleistocene, Eurasia witnessed two major dispersals of anatomically modern humans (AMHs); early, ca. 120–60 ka, and late, ca. 60–30 ka (Groucutt *et al*. 2018). The Iranian Plateau is one of the crucial areas for the hominin migration route toward the east and north (Heydari-Guran 2015. Vahdati Nasab *et al*. 2013). As part of western Eurasia, has the south of the Caspian Sea been affected by human movement in the northern route? Considering the environmental conditions and the presence of caves and rock shelters, this area provided a suitable habitat for human life during the Palaeolithic period. Recent modelling shows that this region was the fastest and

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most suitable corridor for various human species, including Neanderthals and Homo sapiens, to reach Central Asia (Ghasidian *et al*. 2023: 14).

Since the 1930s, several attempts have been made to identify hominin remains from the Pleistocene period in the southeast region of the Caspian Sea by exploring the Hotu, Belt, Komishan, Altape, and Keyaram caves (Coon 1956, McBurney 1964, Jayez and Vahdati Nasab 2016). However, except for Keyaram, located at the easternmost part of the region- which contained totally undated, heavily disturbed, and mixed finds from the Iron Age and Middle Palaeolithic (McBurney 1964, Ghasidian 2021)- none of these sites yielded archaeological remains older than the Mesolithic period. Additionally, some open sites in the southeast Caspian Sea were identified by a joint archaeological expedition from Iran and Russia (Derevianko *et al*. 2013).

In the past decade, over twenty open-air sites, rock shelters, and caves from the Palaeolithic period have been identified in the southeastern region of the Caspian Sea (Figure. 1) (Ramzanpour 2020: 46). Among these newly discovered sites, Kolt has been recognised as a Middle Palaeolithic marine camp located along the former shore of the Caspian Sea (Ramzanpour and Moradian 2021). Additionally, Khane-sar 1 has been introduced as a site with chocolate soil, dating to the late Middle Palaeolithic and early New Palaeolithic periods (Ramzanpour *et al*. 2024).

Takht-e-Rostam stands out as one of the most significant Palaeolithic open-air sites in the southeastern Caspian Sea region. This site was excavated by one of the authors, H. Ramzanpour. Its importance lies in the presence of Palaeolithic artefacts within deposits formed by fluctuations of the Caspian Sea and the loess formation process. Understanding the relationship between these phenomena is crucial for reconstructing human conditions during the Palaeolithic period in the southern Caspian Sea area. Since the nature of deposits is directly influenced by climatic conditions, such conditions affect the lives of plants and animals, as well as human interactions with them

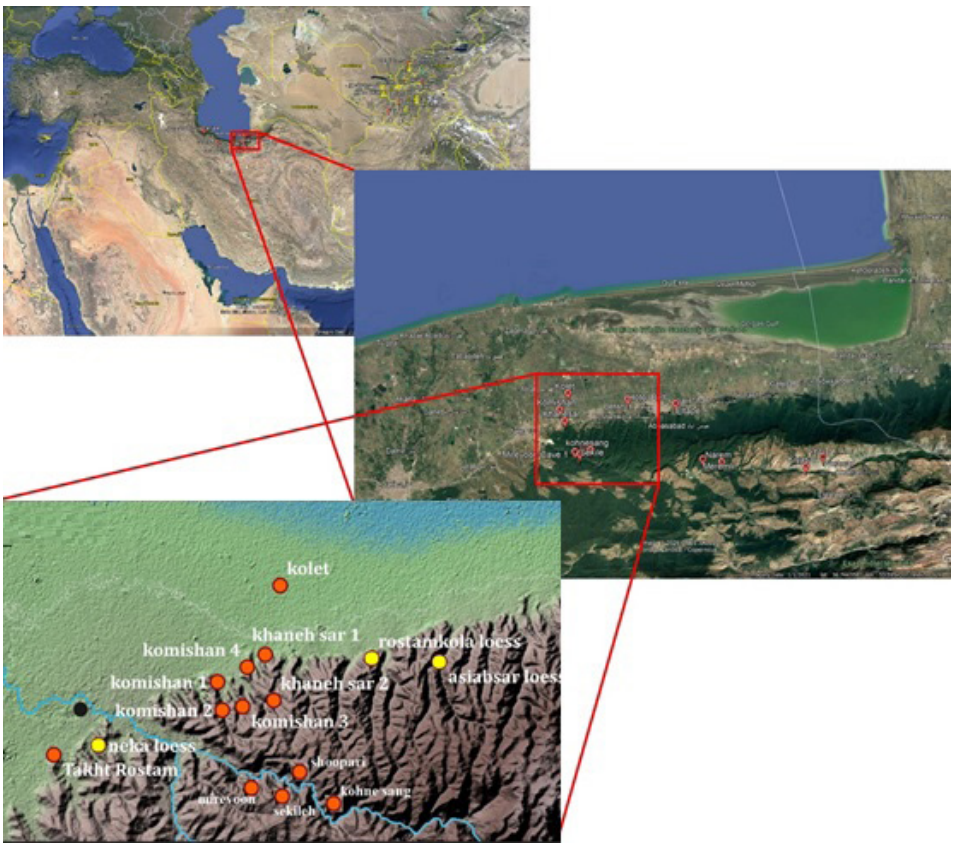


Figure. 1: *Location of Takht-e Rostam; a palaeolithic site in the southeast of the Caspian Sea region.*
(After: Google Earth 10/ 07 /2024)

This paper presents an overview of the techno-typological characteristics of the lithics from this site. It seeks to understand the human-environment relations during one of the key chronological periods, Marine Isotope Stage 3 (MIS 3). During this time, two species of Neanderthals and homo sapiens likely coexisted in Eurasia. The optically stimulated luminescence dating obtained from this site provides invaluable insight into its chronology. In addition, the correlation between environmental, cultural, and temporal factors identified at this site will enhance our understanding of the hominin dynamics and lifeways in this relatively unexplored area of research during the late Pleistocene.

Takht-Rostam in the Southeast of Caspian Sea Context

Takht-Rostam outcrop is a marine terrace landform of the Caspian Sea from the Lower Pleistocene (Khazarian stage), located southwest of Neka city, standing between 40 and 50 metres above sea level (Figure. 2). This morphological complex features a small raised platform with a sequence of horizontal sediments resting on the limestones of the Lar Formation. Among the limestone layers of the Lar formation, there are naturally large nodules of purple and dark brown chert, which serve as the raw material (Heydari 2004: 127) for the artefacts obtained from the site. This landform created a sedimentary trap where chocolate-coloured sediments accumulated in the pitted environments surrounding it. Probably, the sedimentation process of this deposit resembles that of chocolate clay (Yanina *et al*. 2018: 91) belonging to the Khvalyn in the northern basin of the Caspian Sea. Chocolate clay is a sediment that originates from periglacial environments (Yanina *et al*. 2018: 91) and is deposited in depressed and U-shaped environments (Makshaev and Svitoch 2016: 4) during the MIS3. Due to the formation of these sediments in the end depression of a limestone formation in the Takht-Rostam site, its origin can be considered periglacial environments such as neighbouring loess hills, which alternately contain layers of paleosol. Is there a significant coincidence between the deposits of Takh-e Rostam and the climatic and geological phenomena that occurred in the region? The formation of the upper paleosol ended around 37 thousand years ago, followed by the development of the upper loess layer (Kehl *et al*. 2005: 158). This event coincided with the transgression of the Caspian Sea in the early Khvalyn stage, around 35 ka. During this time, the region experienced colder and drier climatic conditions, likely facilitating the formation of ice sheets and a periglacial environment. Consequently, it is possible that the chocolate-coloured deposit at Takht-e Rostam originated from the nearby loess hills. The presence of cultural remains from the Palaeolithic period within this chocolate-coloured



Figure. 2: *Aerial photograph of the lower Pleistocene marine terrace landform at Takht-e Rostam, located in Neka city. The view is from south to north. (After: Google Earth 10/ 07 /2024 and Modified by Ramzanpour)*

sediment, suggests a relationship between the human settlements along the former shores of the Caspian Sea during the Palaeolithic period. Sites with such sediments may provide valuable data for studying human adaptation to the coastal environment during the Pleistocene period. The Palaeolithic site above the Komishan cave (Ramzanpour 2020: 31) and the Khanesar 1 (Ramzanpour *et al*. 2024: 193) also have deposits similar to the chocolate-coloured deposit of Takht-e Rostam.

Archaeological Excavation

The archaeological excavation at the Takht-e Rostam site has focused on delimiting the area to establish the archaeological zone and boundaries. This research project was carried out with the permission of the Cultural Heritage Research Institute in September 2020. The present research aimed to identify the extent of the site and determine the boundaries of human activities during the Palaeolithic period. Given that the Takht-e Rostam site is situated within the modern area of Neka City, the development of urban space and construction activities pose a threat to this location. A total of 13 test trenches, each measuring 1 square metre, were excavated around the marine sandstone landform (Figure. 3). The results indicated that 5 trenches on the northern front of the site contained in situ archaeological remains.

Excavation in these trenches was limited to harvesting a thin layer of contemporary soil and vegetation to uncover cultural remains within the *in situ* deposits. The depth of excavation did not exceed 10 to 20 cm. A notable characteristic of the trenches with *in situ* cultural remains was the relatively dense accumulation of dark brown chert pieces within chocolate-coloured sediments. The presence of cores, debitages, and both small and large chips, and chunks indicates that the Chaîne opératoire was carried out at the site (Figure. 4). In total, 1684 artefacts were sampled from the trenches. Eight test trenches contained secondary remains, which were the result of the artefact dispersal in the area. These trenches were located to the west, east, and south of the site, yielding 535 artefacts in total. Two soil samples were extracted from the in situ chocolate-coloured sediments at the Takht-e Rostam site for dating using the OSL method. The samples were analysed in the dating laboratory of the Geophysics Institute, University of Tehran.

Takht-e-Rostam Dating Sample

The Optically Stimulated Luminescence (OSL) sample was collected by driving a stainless steel tube into the ground at the Takht-e-Rostam site. It was then transferred to the OSL laboratory at the Institute of Geophysics, University of Tehran. The OSL sample preparations were conducted under subdued red-light conditions. A portion of the sample, containing sediments from each end of the stainless-steel tube, was scraped off to assess water content and calculate the percentage of radioactive



Figure 3: *Archaeological excavation at Trench 1 (In situ remains) and Trench 12 (secondary remains).*

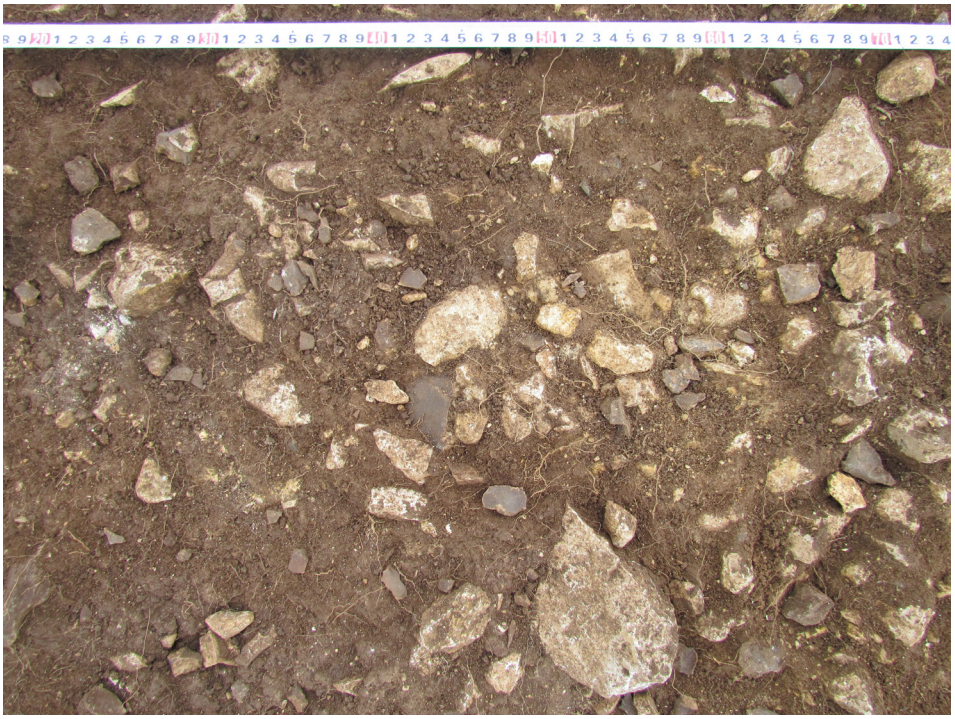


Figure. 4: *Density of in situ artefacts within chocolate-coloured deposits in Trench1.*

elements (U, Th, and K) using the ICP-Mass method, which is necessary for dose rate measurements. The remaining part of the sample was used to estimate the equivalent dose. This portion was firstly sieved to separate suitable grain sizes (90- 250 µm). Next, carbonate and organic materials were removed by treating the sample with HCl 37% and H2O2 35%, respectively. Lastly, a heavy liquid with densities of 2.58 and 2.7 g/cm^3 was applied to extract Quartz and Feldspar grains.

The grains were mounted in 1 cm aluminium cups using a silicone oil, called Aliquot. All the luminescence measurements reported here were carried out using a lexsygsmart-Automated TL/OSL Reader (equipped with a $_{90}$Sr-$_{90}$Y beta source (Model 3203) with an activity of 1.85 GBq and a maximum energy of 2.27 MeV) fitted with blue and IR laser diodes as stimulation sources. The intensity of the blue light (458 nm for quartz) and IR light (850 nm for feldspar) incident on the sample was approximately 50 mW/cm^2 and 200 mW/cm^2, respectively (according to the Lexygsmart manual). The detection unit contained a standard bi-alkaline cathode PMT (HAMAMATSU).

About 20 Aliquots were prepared and measured for this sample. The equivalent dose distribution for this sample is shown in Figure 5. Moreover, Tables 1 and 2 present the results for estimating the total dose rate and the age of this sample.

Lithic Techno-Typological Analysis

During the excavation, only stone tools were discovered; no pottery or bone fragments were recovered. A total of 2,659 lithic artefacts were obtained from both in situ and secondary layers (Figure. 6). The most commonly used raw material was brown chert. Its nodules existed naturally in the limestone rocks of the Lar formation at the Takht-e Rostam site. Flakes dominated the collection, while blades/bladelets were rare. The primary flake production methods included single-platform flake cores and multi-platform cores, which exhibited irregular debitage directions. Additionally, there were core-on-flake and biface pieces with centripetal flaking direction (Levallois core?) in the collection. Retouched tools were mostly created on flakes (accounting for 12.7% of the total removals (82 pieces)). Blades/bladelets were limited to those featuring straight or convergent retouching. The majority type in the collection was retouched flakes, with the notched/denticulated tools being the second most frequent type. Furthermore, the collection included a piece of convergent-like scraper, an end scraper, a truncated, a truncated-faceted, two pieces of burins, and utilised flakes (Figures. 7 and 8). Remarkably, all artefacts were obtained from a single stratigraphic context, indicating the coexistence of tool types and lithic technologies from both the Middle and Upper

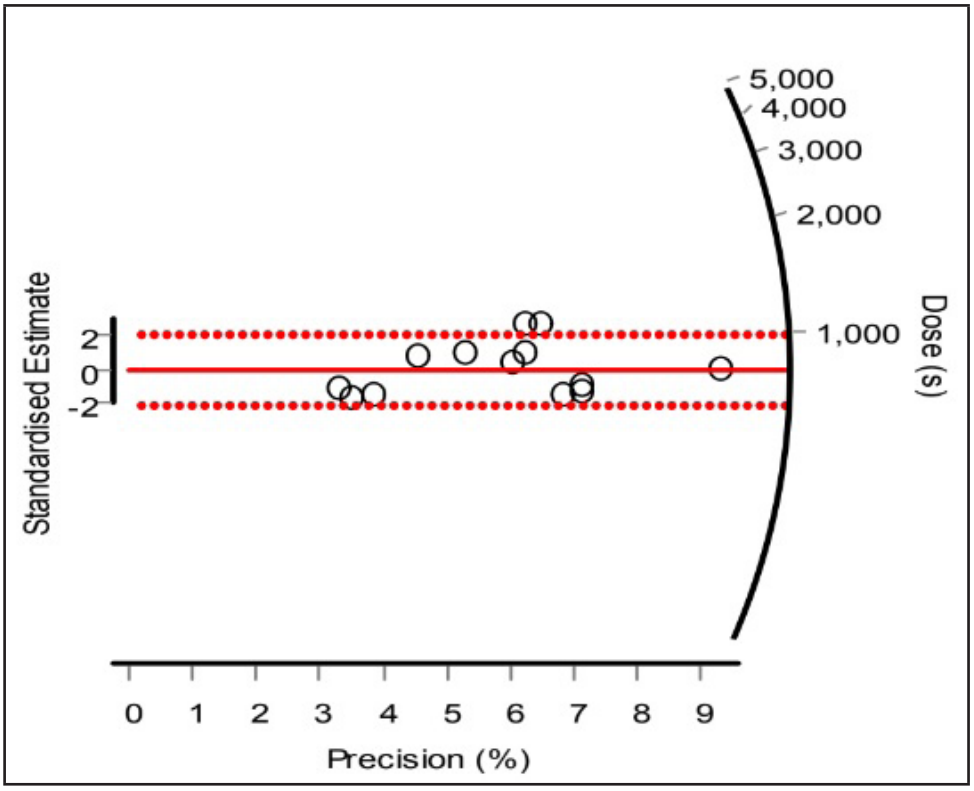


Figure. 5: *Equivalent dose distribution of the Takht-e-Rostam sample.*

Table. 1: *Values used to calculate the total dose rate of the Takht-e-Rostam sample.*

Depth (m)	±	Water (%)	±	K (%)	±	U (ppm)	±	Th (ppm)	±	Cosmic (Gy/ka)	±	Total (Gy/ka)	±
0.4	0.05	4	4	1.40	0.051	1.7	0.05	9.13	0.16	0.18	0.08	2.97	0.12

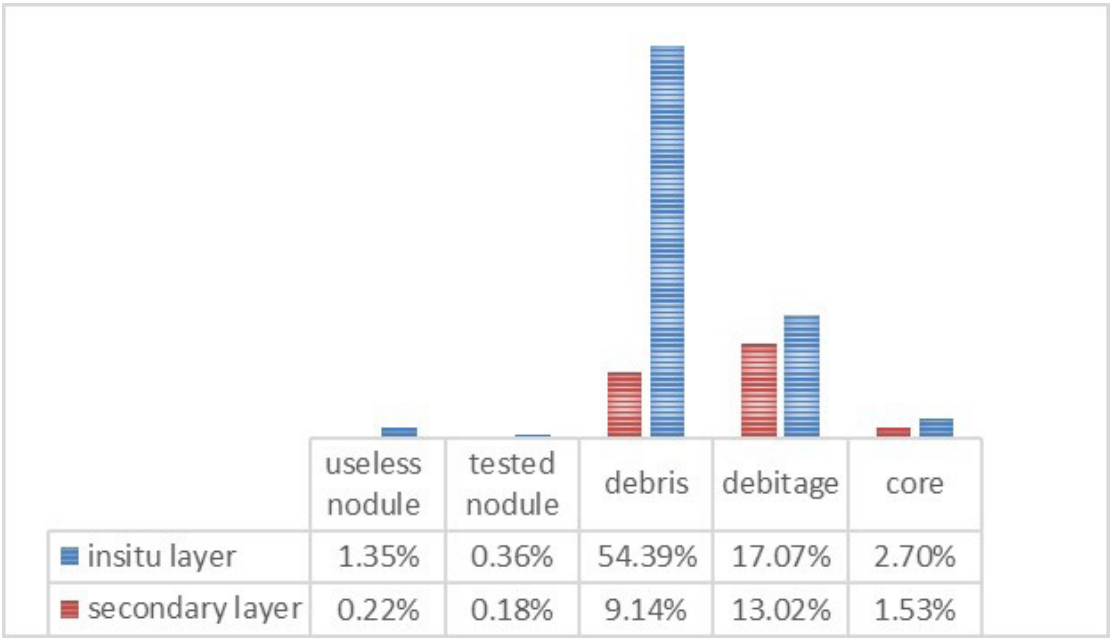
Table.2: *Values used to calculate the age of the Takht-e-Rostam sample.*

De (Gy)	±	Total (Gy/ka)	±	Age (ka)	±
93.73	3.81	2.97	0.12	31.56	1.8

Palaeolithic periods. This finding is comparable to the Warwasi rock shelter (Olszewski and Dibble 2006: 355) in Zagros and the Mirak open-air site in the Iranian Central Plateau, which also features both Middle and Upper Palaeolithic layers, as well as an "intermediate" layer between the two (Vahdati Nasab *et al*. 2019: 472).

Discussion and Conclusion

The excavation of Takht-e Rostam revealed that archaeological remains are scattered across an area of 12350 square metres. In situ remains have been preserved in an area of 5400 square metres, primarily on the northern edge of the site and in rounded depressions or U-shaped parts. This sedimentation process can be likened to the chocolate clay of the early Khvalynian stage in the northern basin of the Caspian Sea. Here, three important phenomena of the MIS3 should be considered for comparison: 1. The Khvalynian transgressive phase of the Caspian Sea, approximately 35,000 years ago; 2. The stabilisation of cold and dry climatic conditions, along with the formation of the upper loess unit in the region dating back to around 35 thousand years



	useless nodule	tested nodule	debris	debitage	core
insitu layer	1.35%	0.36%	54.39%	17.07%	2.70%
secondary layer	0.22%	0.18%	9.14%	13.02%	1.53%

Figure. 6: *Composition of the lithic collection.*

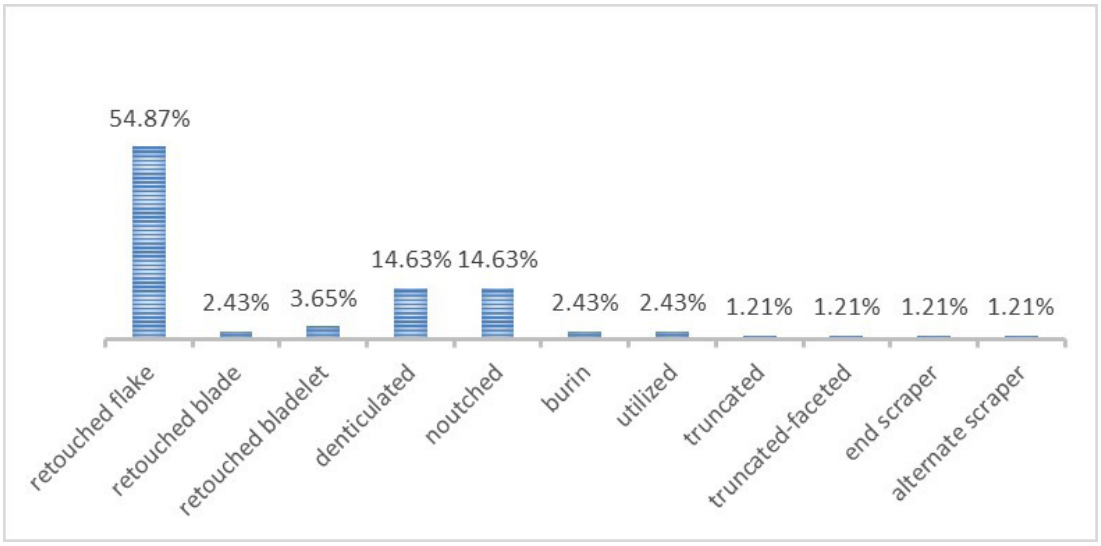


Figure. 7: *Distribution of tool types.*

ago; and 3. The analysis of the formation of sites such as the Komishan Palaeolithic site, Khane-sar 1, and Takht-e Rostam, which feature chocolate-coloured deposits dating back around 31ka years ago. By integrating these three phenomena, one can conclude that with cold and dry climatic conditions prevailing around 35 ka years ago and the Caspian Sea level reaching about 40 to 50 metres, favourable conditions emerged for the formation of sites such as Takht-e Rostam in the southeastern region of the Caspian Sea. This process facilitated the proximity of the Takht-e Rostam terrace landform to the Caspian Sea coastline during MIS 3, about 31 ka years ago. This closeness to the coast may have provided favourable conditions for Palaeolithic human groups, who could have utilised this geological complex as a landmark for hunting strategies targeting sea-related habitats such as fish, Birds, and the Caspian seal or dominating and monitoring the surrounding environment and even gathering raw materials to create their own stone tools. It can also be concluded that the loess

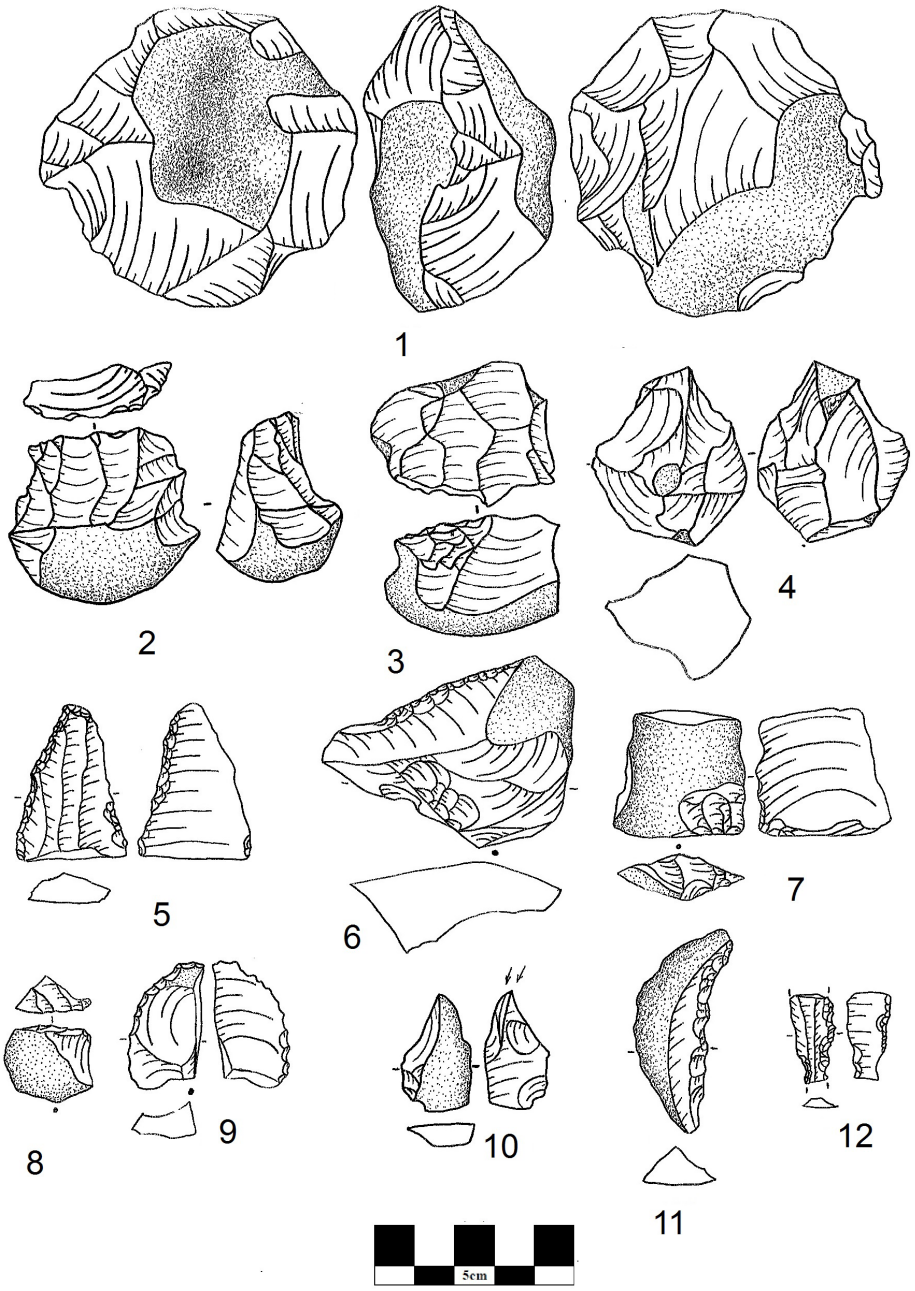


Figure. 8: *Lithic artefacts from Takht-e Rostam. 1-discoidal centripetal flake Core, 2-unidirectional blade/ bladelet core, 3-unidirectional flake core, 4-atypical flake core, 5-alternate scraper, 6-retouched flake on distal end, 7-truncated faceted, 8-End scraper, 9-retouched flake, 10-burin, 11-retouched cortical flake, 12-alternately retouched bladele.*

hills situated south of Takht-e Rostam could have served as a periglacial environment during the MIS 3 stage. The chocolate-coloured deposits may have originated from the paleosols in these hills and were subsequently combined with the artefacts remains left by the human presence in the Takht-e Rostam. Finally, based on the lithic analysis and matching with the dating sample, Takht-e Rostam can be viewed as a workshop for providing raw materials for stone tools, as well as a temporary camp for hunting marine animals during the transitional period between the Middle and Upper Palaeolithic

eras in the cold and dry MIS 3 phase. This site is more recent than similar sites from the same period sites, such as Mirak and Warwasi. At the river terrace site of Garm Roud 2, located along the southern Caspian Sea shore, a very rich lithic assemblage has been recovered, dating back to around 28-30,000 years ago. Unlike Takht-e Rostam, these assemblages are highly laminar specialised in bladelet production from small platform bladelet cores. Based on techno-typological characteristics, Takht-e Rostam shows no similarities with Garm Roud 2. This discrepancy indicates a highly complex picture of population dynamics in the region south of the Caspian Sea. The data from Takht-e Rostam suggests that the southeastern Caspian Sea area could be potentially considered a suitable habitat for populations during the transitional stage between the Middle and Upper Palaeolithic. The conditions provided by the Kavalynian transgression stage of the Caspian Sea, along with the proximity of the coast and the northern slopes of the Alborz mountains, created an environment rich in resources for human life during this cold and dry climate period, potentially transforming the area into a refugium for both hominin and animal species.

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