University of
Sistan and Baluchestan

Iranian Journal of Archaeological Studies

Print ISSN: 2251-743X Online ISSN: 2676-2919

Archaeological Sciences
Research Centre

Human, Environment and Food: Human Productivity of the Environment in the Mesolithic and Neolithic Periods in the Southeast of the Caspian Sea

Mojtaba Safari [*,1] , Hassan Fazeli Nashli[2], Rahmat Abbasnejad Seresti[1] and Mina Madihi[2]

[*]*Corresponding Author,[1] Department of Archaeology, University of Mazandaran, Babolsar, Iran.*
E- mail: m.safari@umz.ac.ir

[2]*Department of Archaeology, University of Tehran, Tehran, Iran.*

Received: 09/ 03/ 2024; Received in Revised form: 11/ 04/ 2024; Accepted: 18/ 05/ 2024; Published: 20/ 06/ 2024

Abstract

The Mesolithic and Neolithic periods mark pivotal junctures in the evolving relationship between humans and the environment. During these epochs, millennia-old hunter-gatherer lifestyles underwent a profound transformation, giving rise to new modes of existence. A cornerstone of this shift was the development of strategies to harness and optimize the diverse resources offered by the natural world. The Neolithic period, in particular, is often considered the dawn of the Anthropocene, as human activities began to exert a substantial and often irreversible impact on ecosystems. To explore the dynamics of this transformation in the southeastern Caspian Sea region, this article examines archaeological evidence from the Hotu, Kamarband, Komishan caves, and Komishani Tepe. Through the analysis of archaeobotanical, zooarchaeological, and lithic artifacts, we seek to reconstruct the multifaceted changes experienced by communities as they transitioned from hunting and gathering to agriculture. Our findings reveal a period of remarkable adaptability. Humans intelligently modified their environments to meet their needs and employed diverse strategies to mitigate the challenges posed by climatic fluctuations, such as cold and warm. These adaptations underscore the ingenuity and resilience of early human societies as they navigated the complexities of their changing world.

Keywords: Mesolithic, Neolithic, Anthropocene, Human, Environment.

Article Type: Research Article

Introduction

Approximately 12,000 years ago, a transformative shift occurred in parts of the ancient Middle East, marking one of the most pivotal developments in human history (Darabi 2022; Zeder 2024; Watkins 2024). Human societies entered a new era called the Neolithic period. However, recent archaeological discoveries from the Eastern Mediterranean to the Anatolian regions have revealed important insights. One of the most significant findings is that instead of focusing solely on the Neolithic period, we should consider the last 15,000 years of life centered around hunting and gathering (Flannery and Marcus 2012; Graeber and Wengrow 2023). These researches demonstrated how hunters and foragers forever transformed human society by establishing permanent settlements, constructing public buildings, creating symbolic works, and managing domestication and agriculture. The event known as the Bølling-Allerød (a period of warming and increased humidity) occurred between 14,000 and 13,000 BCE, marking a shift from a cold, dry period to a warmer climate that persisted into the Younger Dryas (Zeder 2024). During the Natufian period in regions like Palestine, Syria, and the Levant, archaeologists such as Don Henry (1989) coined the term “pre-agricultural revolution” to describe this era. Investigating and reconstructing the shift from a hunting and gathering subsistence economy to agriculture, along with the environmental productivity necessary to meet basic human needs, has made the Neolithic period and its transition from the Mesolithic a focal point of global research. Questions surrounding the emergence of

© The Author(s):

farming communities and the socio-economic and ideological changes associated with this transition (from thousands of years of hunting, seasonal migration, and foraging to sedentary lifestyles, plant cultivation, and herding) have consistently intrigued researchers (Matthews 2013; Matthews and Fazeli Nashli 2013; Matthews and Fazeli Nashli 2022). Additionally, the relationship between humans and the environment, as well as the impact of environmental changes on human productivity, has become a central question for researchers. While much archaeological research related to this period focuses on the central Zagros region, recent field activities and findings in the northern Iranian Neolithic period have drawn attention due to the region's significant environmental characteristics. The proximity to the sea and mountains, coupled with diverse ecosystems, access to freshwater sources, and abundant flora and fauna, has made this region a key area for studying the transition from hunting and gathering to agriculture and the subsequent changes in the subsistence economy, such as the substitution of sheep and goats for gazelles and seals. These changes may be connected to climate change (Matthews and Fazeli Nashli 2022). The Mesolithic and Neolithic periods of this region are represented by known sites such as Ali Tepe Cave (McBurney 1968), Hotu and Kamarband Caves (Coon 1957; Fazeli Nashli 2021; Fazeli Nashli 2022), Komishan Cave (Vahdati Nasab and Jayez 2011; Vahdati Nasab *et al*. 2020), and Komishani Tepe (Figure.1) (Fazeli Nashli 2017; 2023). Some of these sites were excavated in the 1950s, while others were identified during construction activities. Most of the analyses conducted during this period have focused on the technology of stone artifacts (Jayez 2012; Hashemi and Vahdati Nasab 2014; Jayez and Vahdati Nasab 2016; Jayez and Vahdati Nasab 2020).

However, existing studies have not yet provided a comprehensive understanding of livelihood, economy, social relations, human-environment interactions, and other aspects of life during this period. A significant gap remains in the interdisciplinary approach to studying the southern Caspian Sea region. To address these questions, recent research has revisited Coon's excavations of the 1950s at Hotu Cave, Kamarband Cave, and the Komishani site. An interdisciplinary approach, incorporating paleoclimatology, soil studies, archaeozoology, and archaeobotany, aims to provide a broader and more complete picture of the biological and cultural landscapes of each settlement period.

The purpose of this research is to investigate the environmental changes that occurred at the end of the Pleistocene and beginning of the Holocene in

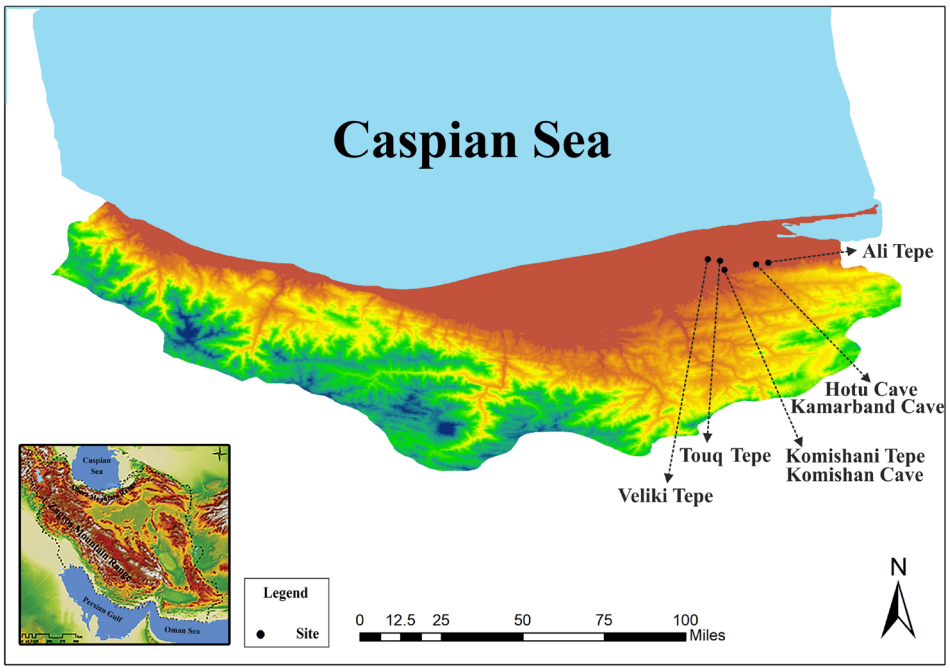


Figure. 1:*location of Hotu, Kamarband (Belt cave), Komishan caves and Ali Tepe and Komishani Tepe (photo by Authors)*

this region and their impact on the livelihoods of its inhabitants. Additionally, the research seeks to explore the domestication of animals, such as goats and sheep, and plants, particularly wheat families in northern Iran, as well as reconstructing the dietary habits of the region's inhabitants and their connection to environmental changes.This study will involve a comprehensive review and analysis of existing research, focusing on the productivity of plants and animals and their relationship to settlement patterns and ecosystems.

Analysis of Mesolithic and Neolithic Research in the Southeast of the Caspian Sea

Mesolithic and Neolithic research in the southern Caspian Sea region began with Coon's excavations at the Kamarband (Figure.2) and Hotu cave (Figure.3) in 1949 and 1951, respectively. Despite being a pioneer in his field, Coon's investigations and research suffered from certain shortcomings. His methods of recording cultural findings and stratigraphic analysis were influenced by the theories of physical anthropology, which at the time were limited in scope. Moreover, while Coon emphasized the importance of interdisciplinary science, his excavations were often conducted hastily, lacking sufficient precision and oversight (see Vahdati Nasab 2020).

During his excavations, Coon established three trenches at the "Belt Cave," uncovering 28 layers and four distinct cultural horizons. At the Kamarband Cave, he discovered architectural remains, stone artifacts, tools, and ground stones,



Figure.2:*A: Landscape and location of Hotu and Kamarband caves; B: Kamarband Cave Plan (After: Coon,1957); C: The cave entrance in 1949; D: The surface layer of the cave in 1949, which was the habitat of Gypsie; E: Stratification section in 1951 (photes C, D and E After: Coon,1957); F: The cave entrance in 2022; G: A view of trench D in the Revision Excavation of this cave in 2022; H: Stratification section of the western wall of Trench D (excavation conducted by one of the writer of this paper HFN) (photos F, G and H by Authors)*



Figure.3: *A: The Hotu cave entrance in 1951; B: Hotu cave excavation by Coon and the extent of excavation in this cave; C: Abbas in the state of excavating human skeletal remains in 1951 (photes A, B and C After: Coon 1957); D: View from the top of the revision trench in 2021; E: Stratification section in 2021; F: Documenting cultural layers in the Re-excavation in 2021(photos D, E and F by Authors)*

as well as bone tools, stone pendants, animal bones, and human burials.

During the first excavation season, Coon discovered over 17,000 stone artifacts, suggesting that Kamarband Cave served as a site for chipped stone production, particularly in the early Mesolithic period (Coon 1951: 69). Coon suggested that Kamarband Cave served as a site for flake production during the early Mesolithic period (Coon 1951: 37). Kozlowski conducted a study of the stone artifacts from Kamarband Cave and published his findings (Kozlowski 1999). Additionally, the first excavation season yielded 1170 animal bone samples, of which 94% were ungulate bones, primarily gazannas. Coon believed that Mesolithic inhabitants were hunters who obtained their main resources, including gazelles, wild cattle, goats, and sheep, from the surrounding forests and plains (Coon 1951). In 1981, Peter Uerpmann and Wolfgang Frey re-examined the faunal data from Kamarband Cave and Ali Tepe Cave. They criticized Coon's selective collection of animal remains and questioned the accuracy of his analyses. By comparing the sequence of animal findings in both caves, these researchers suggested dating the Mesolithic settlement of these caves from 9500 to 8600 years ago (Uerpmann and Frey 1981). In 2012, Gregg and Thornton revised the stratigraphy of Kamarband and Hotu caves, drawing on archival materials and unpublished Coon manuscripts. They recalibrated radiocarbon dates and reconstructed the sequence of cultural deposits. For the Early Mesolithic layers of Kamarband Cave, the calibrated dates range from 13210-11000 BCE and 10875-13110 BCE. For the Gazelle Mesolithic, the calibrated date is 7750-9155 BCE. In Hotu Cave, during the Mesolithic period, they suggested three calibrated dates: 13920-11350 Cal BCE, 9875-8000 Cal BCE, and 9800-7975 Cal BCE (Gregg and Thornton 2012).

Hotu Cave, located a short distance from Kamarband Cave, was discovered by Coon during his excavations at Kamarband Cave. He excavated Hotu Cave for five weeks in 1951, and the results were published in an article in 1952. (Coon1952).

Coon excavated three trenches within the cave, identifying eight cultural periods and four horizons spanning from the Mesolithic period to the modern era, similar to Kamarband Cave. These cultural periods, from newest to oldest, include the Islamic period, Parthian, Early Iron Age, Painted Pottery, Neolithic Software, Sub-Neolithic, Vole-Eaters Mesolithic, and Seal-hunters Mesolithic. (Coon 1957:208). Dupree classified and published the stone artifacts from this cave. Studies indicate that the collection of flint artifacts from Hotu Cave is primarily composed of amorphous flakes and pebble tools (Dupree 1952: 257). More than 1000 pieces of animal bones were recovered from this cave. Some of these bones were studied by Fraser from the British Museum, while others were analyzed by Coon based on his knowledge from Kamarband Cave, and still others were examined by Fred Ulmer from the Philadelphia Zoo (Coon 1952:244). The animal species found in this cave include gazelles, deer, sheep, goats, pigs, seals, birds like partridges and pigeons, and rodents such as marmots, hedgehogs (one sample), rats, and squirrels (Coon 1951). Coon hypothesized that the initial settlement occurred in a humid climate, followed by a drier period. Subsequent zooarchaeological studies suggest that the conditions on the southern shores of the Caspian Sea were similar to today. There were likely three cycles of wet and dry conditions, punctuated by periods of varying temperatures.

In 2013, Jennifer McAuley, an anthropology student at the University of Pennsylvania, conducted genetic and dating experiments on burials from Kamarband Cave and Hotu Cave. Analyzing three samples from Hotu and one from Kamarband Cave (layers 19-21), she obtained significant findings. Regarding skeleton number one tested in Hotu Cave, she concluded that it belonged to an intelligent human species and dated it to 11045±15 B.P., significantly older than Coon's estimate of 9100±950 B.P. for all three bone samples. McAuley's findings challenged the accuracy of Coon's dating and raised questions about other aspects of his research, particularly regarding domestication and its onset.

Between 1962 and 1964, Charles McBurney conducted research on the Paleolithic period in northeastern Iran. He investigated 25 caves and excavated 10 of them to explore the characteristics and chronology of this ancient era.

The Ali Tepe Cave (Figure. 4) is a significant archaeological site that underwent excavations over six weeks. A Mesolithic layer was identified within the cave. The excavations were conducted in two phases: the first season uncovered artifacts from the Islamic period, the Iron Age, and the Mesolithic period, while the second season focused on a detailed study of the Mesolithic deposits. To further explore the site, additional excavations were carried out in 1964, establishing three trenches. Thanks to the multi-layered sieves he and his colleagues developed in Cambridge, Coon was able to accurately record the layers of sediment. This innovative approach also allowed for the

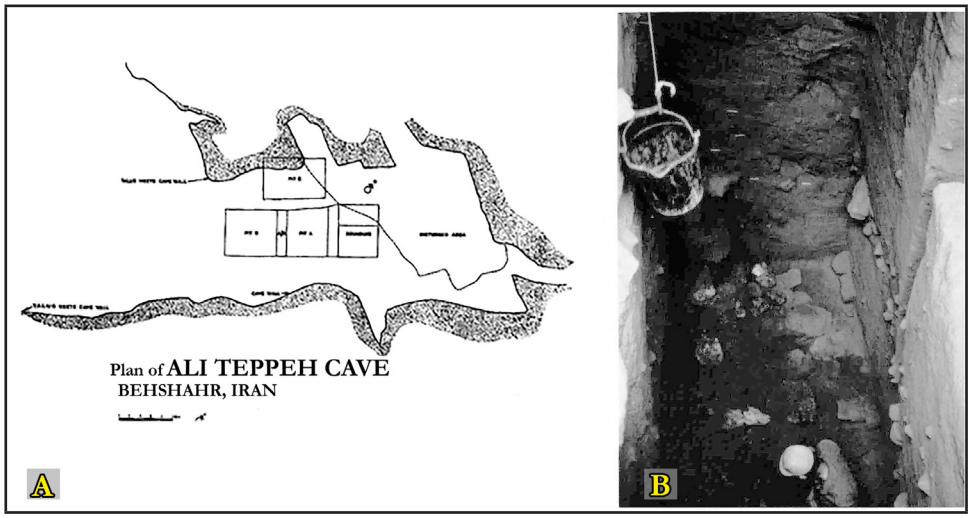


Figure. 4: *A: Plan of Ali Tepe cave and excavated trenches;B: Excavation in Ali Tepe*

(After:McBurney 1968: Figure. 1)

identification of microliths, small fragments, and tiny animal remains. By using a microscope, he meticulously studied the microwear patterns on the tools. (McBurney 1968). Stage I (12,300-12,400 B.P.) is characterized by an abundance of gazelles (60%), goats/sheep (20%), aurochs, onager, jackals/foxes, birds, insectivores, snails, and rodents. In Stage II (12,300-12,000 B.P.), there's a notable decline in gazelles to less than 40%, with the first appearance of seals and wild pigs. Additionally, this stage witnesses a significant increase in jackals/foxes, a slight increase in sheep/goats, and a sudden decrease in small mammals. Stage III (12000-11800 B.P.) is marked by a significant increase in gazelles, along with wild pigs, aurochs, and small mammals. Stage IV encompasses two phases: IVa (11800-11300 B.P.) and IVb (11000 years ago). In phase IVa, seals experienced a substantial increase (30% compared to gazelles), while sheep/goats, aurochs, wild pigs, and deer declined by about 15%. Jackals and foxes increased, and small mammals decreased. In phase IVb, there was a resurgence of gazelles, accompanied by increases in goats/sheep, wild pigs, onagers, deer, and aurochs, while seals declined. Stage V (11100-10800 B.P.) concluded with a notable increase in goats, sheep, and gazelles of around 30%. (McBurney 1968). The faunal spectrum reveals significant changes in prey selection at the end of the Epipaleolithic (end of stage IVb), characterized by a sudden increase in wild goat/sheep and jackal/fox remains, followed by their gradual decline at the end of the occupation. This coincided with a surge in gazelle remains (30%), onager, wild pig, aurochs, and deer (McBurney 1968:397). The findings from Ali Tepe indicate that there was no evidence of domestic animals in the region during the Mesolithic period. This suggests that the communities in the area maintained their hunter-gatherer lifestyle until the end of the Epipaleolithic/Mesolithic era. Uerpmann and Frey link these changes to fluctuations in the Mazandaran sea level, suggesting that animal species may have started shifting at the beginning of stage IV. They posit that rising water levels accompanied these changes (Uerpmann and Frey 1981). Susan Leroy's environmental and paleoclimatological studies corroborate McBurney's 1968 hypothesis, which proposes that Mesolithic hunters relied on seals and deer when the Caspian Sea level was at its highest. As water levels receded, a wide coastal plain emerged, leading to a shift in prey species consumed by hunters. These species included auroch, onager, boar, gazelle, sheep, and goat. Various proxies indicate the diverse ecological niches and the continuous presence of wetlands. During the Younger Dryas, the region maintained diverse deciduous trees, suggesting favorable climatic conditions for human survival and abundant plant and animal resources. This may explain the early Neolithization process on the southern coastal plain of the Caspian Sea, which was likely influenced by the relatively benign impact of the Younger Dryas stadial (Leroy *et al*. 2019). Additionally, the eastern part of Mazandaran offered favorable living conditions during this period. In 2021, Jayez studied some of the stone artifacts from this site, finding that the technology of blade production, specifically prismatic removal, was prevalent in both the Mesolithic and Neolithic periods and employed pressure techniques (Jayez 2021: 55). Archaeological botanical studies on the plant species used around Ali Tepe Cave revealed that the inhabitants utilized a variety of plants from steppe-forest, steppe, riparian forest, Garmsir, and mountainous environments. This diversity suggests the use of these trees for fuel in daily life (Shirazi 2018: 7).

Following a period of inactivity, archaeological investigations led by Ali Mahfrozi in the Behshahr and Neka plains, located in the southern Caspian Sea region, resumed in the 2000s. These efforts resulted in the identification of Neolithic and Mesolithic sites within this area. Concurrently, the remains of animals found in front of the Komishan Cave were studied. Based on these animal remains, it was determined that the hunting societies of the period incorporated gazelles, foxes, Caniformia, Feliformia, seals, and birds into their diet. (Mahfrouzi 2003; Mashkour *et al*. 2010). During the archaeological project "Surveys of the East of Mazandaran," Komishan Cave was excavated by Hamed Vahdati Nesab in 2009, marking a new chapter in Mesolithic research in the southeastern Mazandaran Sea region. Archaeologists also investigated the technology of stone artifacts (Jayez 2012; Hashemi and Vahdati Nasab 2014; Jayez and Vahdati Nasab 2016). Despite extensive research, the Mesolithic and Neolithic periods in this region continue to hold many unanswered questions. Based on the findings regarding livelihood, settlement, and climate from the excavations of Ali Tepe, Kamarban,

Hotu, Komishan caves, and the Sang-i Chakmak (pre-pottery Neolithic) site on the northern edge of the Iranian desert plain, attempts have been made to understand the Neolithic process in the southeastern Mazandaran Sea region. One hypothesis suggests that the Neolithic and Neolithization processes originated in the eastern Fertile Crescent and spread exogenously into the region. (Vahdati Nesab and Nikzad 2016). Nikzad's research focused on the evolution of human societies in the southern Caspian Sea region during the Mesolithic-Neolithic transition, drawing primarily on the findings from the Komishan Cave (Nikzad 2017). While his study was contemporary, it contained several areas of ambiguity.

In response to the discovery of stone artifacts and tools during construction activities near the Komishan Cave, a rescue excavation was initiated at the Komishani Tepe site (Figure. 5)[1] in 2017. This decision was driven by the need to preserve valuable archaeological evidence and to employ interdisciplinary research methods. It's important to note that Komishani Tepe is located in the outer area of the Komishan Cave. Furthermore, this excavation has opened up new avenues for archaeological research in this significant geographical region. The excavation of Komishani Tepe provided new archaeological evidence related to the 9th millennium BCE, which is the key period of the transition from Mesolithic to Neolithic or

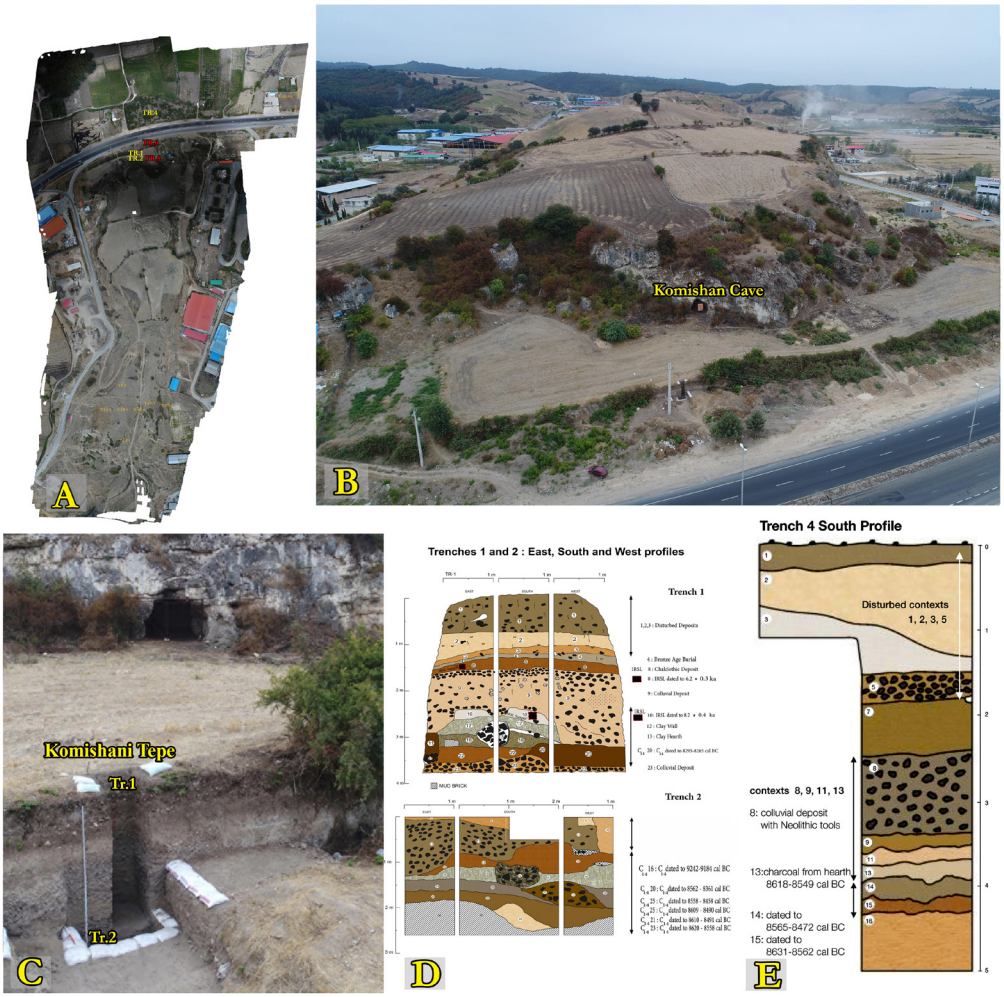


Figure .5: *A:Orthophoto map of Komishani Tepe and Komishani cave (location of the trenches of season 1 of Komishani excavation);B: Aerial photo of Komishani Tepe (location of the cave and excavated trenches);C: Trench one and two in the first season of excavation;D: Stratification section of Trenches 1 and 2; E: Stratification section of Trench 4 (photo by Authors)*

[1]Komishani Tepe is the outer area of Komishan Cave.

(Transitional Neolithic) to the Neolithic period (Fazeli Nashli 2017). The excavation findings at Komishani Tepe clearly demonstrate the widespread use of stone artifacts, such as grindstones, ground stone, and stone hammers, within this settlement. The discoveries also indicate that the Transitional Neolithic communities inhabiting this area utilized various types of plants and forest food sources. These excavation findings support the hypothesis of initial stages and efforts to form early societies based on domestication in the region. In 2012, Jayez studied the chipped stone at this site, finding that the chipped stone assemblage of Komishani reflected a focus on raw material acquisition, indicating access to sufficient chert sources in the vicinity. The occupants employed direct/inverse soft hammer percussion techniques. The assemblage is characterized by large concentrations of blades/lets, notches/denticulates, scrapers of all forms (especially end scrapers), borers, and backed pieces. Moreover, the study of lithic materials suggests that Komishan served as a base camp where most core reduction processes took place (Leroy *et al*. 2019). In terms of technology, this complex is similar to sites along the southern shores of the Caspian Sea, including Kamarband, Hotu, and Ali Tepe caves. It also shares similarities with Mesolithic industries in Turkmenistan but differs from Mesolithic periods in Central Asia, such as northern Afghanistan, eastern Uzbekistan, and southern Tajikistan (Jayez 2012).

To date, Paleolithic, Mesolithic, and Neolithic sites have primarily been reported in the lowlands of the Caspian Sea. This pattern is likely attributed to fluctuations in the Caspian Sea's water level, a significant natural factor influencing the location of archaeological sites in this region. Prior to this excavation, Paleolithic, Mesolithic, or Neolithic sites had not been identified in the plains of the Caspian Sea. This absence is likely due to rising sea levels during the Khvalynian transgression, which influenced the choice of settlement locations in the region. However, evidence of sea resources, such as seals, fish, and shells, found in caves like Kamarband, Hotu, Kamishani, and Ali Tepe, combined with GIS-assisted analysis of settlement patterns, supports this theory for the Khvalynian period (Heydari *et al.* 2022:12-13). Following these findings, Neolithic research in the plains of this region continued with the excavations of Veliki and Touq Tepe by Rahmat Abbas Nejad Sarasti in the Neka plain. (Abbasnejad Seresti *et al*. 2022; Tavakoli Zaniani *et al*. 2022).

Veliki Tepe[1] (Figure.1) is a Neolithic site situated in the Neka plain. Excavations were conducted at this site to identify and delineate its boundaries. Numerous trenches revealed a variety of ceramic artifacts, including Neolithic period pottery (similar to Touq Tepe), regional pottery (Hotu type and Kamarband type), and extra-regional pottery (resembling the pottery of Dasht Gorgan, Dasht Shahroud, northeastern Iran, and southern Turkmenistan) (Abbasnejad Seresti et al. 2022). The stone tools of this period demonstrate the use of direct/inverse soft hammer and pressure techniques. Two trenches were excavated at Touq Tepe[2] , revealing evidence of settlement from the beginning of the Pottery Neolithic period until the Iron Age.

Despite targeted studies conducted by various researchers in recent years, numerous questions remain unanswered, necessitating a review and revision of existing findings. In 2021, Hotu Cave was re-excavated by Hassan Fazeli Nashli to address some of the key questions related to the Neolithization of the region. This excavation aimed to investigate environmental changes at the end of the Pleistocene and the beginning of the Holocene, human-environment interactions, and the domestication and management of animals and plants (Fazeli Nashli 2021).

The excavation yielded archaeological finds, including animal and plant remains, stone artifacts (see Jayez *et al*. 2024), human burials, stone and clay artifacts, ornaments, and fireplace spaces. The stratigraphy of this cave reveals evidence of the Mesolithic period, Pre-pottery Neolithic, Pottery Neolithic, Formative period, Transitional

[1]According to research, the Veliki Tepe site encompasses three hills covering an area of approximately 16 hectares. Unfortunately, significant portions of the site have been damaged due to human activities and agricultural practices.

[2]Pottery known as Caspian Neolithic Software pottery, a characteristic of the Neolithic period in the southern Mazandaran Sea area, and Hotu and Kamarband sites, was also found at Touq Tepe. Additionally, Djeitun-type pottery, similar to Eastern Sang Chaqmaq, is the second type of ceramic obtained from this area. The third type of pottery has a distinct style and appears to be produced using a more primitive method than the pottery from Hotu and Belt areas. Furthermore, 347 pieces of stone artifacts were recovered from this site, with a notably high percentage of blades.

Chalcolithic, Iron Age, and Parthian period. While the settlement occupation was irregular, the cave was abandoned at times. Following these findings at Hotu Cave, the Kamarband Cave was also re-excavated in 2021 to achieve similar goals. Excavation findings there include plant remains, stone artifacts, animal remains, and fireplace spaces. Unfortunately, due to human factors, the upper layers of the cave, previously published in Coon's report on Kamarband Cave, were not obtained, limiting the evidence to the Mesolithic period. Studies in soil, paleoclimate, zooarchaeology, and plant archaeology are ongoing (Fazeli Nashli 2022). After the two revisions of excavation in Hotu and Kamarband caves, the team excavated Komishani Tepe in 2023, focusing on a horizontal trench in front of the Komishan cave and conducting stratigraphic revision excavations. The cultural materials found in front of Komishani Cave date back to the ninth millennium BCE (Fazeli Nashli 2023).

Environment/Food/Human in the Mesolithic and Neolithic Period: the Beginning of Hypothesis

In 1968, McBurney proposed five stages, spanning from 12,400 to 10,800 years ago, based on the subsistence patterns of the community living in Ali Tepe Cave. These stages were derived from a detailed analysis of faunal data and its correlation with environmental changes (McBurney, 1968). He suggests that Steppe animals were employed in the early stages of Ali Tepe. In the second stage, the first remains of seals appeared, and the proportion of mountain animals increased slightly compared to the previous stage. In the third stage, similar to stage 1, Steppe animals were abundant in the animal remains collection. The IV stage witnessed sudden changes in animal remains, with a significant increase in seals. In phase IVb, these changes continued, and no seal evidence was observed. Conversely, plains and mountain animals increased again during this stage.

Based on these changes, McBurney hypothesized that the rising water level of the Caspian Sea led Mesolithic hunter-gatherers to rely on seals and deer for hunting. However, as water levels receded and a vast coastal plain emerged, this group consumed a different range of herbivorous mammal species, including auroch, onager, gazelles, goats, sheep, and boars (Leroy *et al*. 2019). Additionally, Coon's excavation reports from Hotu and Kamarband caves reveal that the Neolithic layers primarily feature the use of sheep and goats. Gazelle hunting was more prevalent during the Mesolithic period, with little to no evidence in the Neolithic period. McBurney's hypothesis suggests that the shift in focus from gazelles to sheep and goats by the Neolithic inhabitants of Kamarband Cave marks the beginning of domestication practices. This transition, along with the appearance of pottery and the first morphological evidence of domesticated goats and sheep, indicates a rapid and significant change in the animal spectrum (McBurney 1968:408-409).

The proportion of goats and sheep increased from 12% to 84%, while gazelles declined from 62% to 8%, and aurochs disappeared entirely. Analyzing the fauna of Komishan Cave during the Mesolithic period (12,000-10,700 years ago), hunters utilized gazelles, Saiga, canids, birds, fish, and boars. The dominance of gazelles in the Mesolithic fauna of the southeastern Caspian Sea suggests a steppe environment, which is further supported by the presence of Saiga tatarica and Equus hemionus. Additionally, other faunal elements[1] , such as aurochs, red deer, and boar (Mashkour *et al*. 2010: 36-37), suggest the exploitation of various ecological biotopes by the inhabitants of this ecosystem during the 9th millennium BCE.

Charcoal studies conducted on samples from Ali Tepe Cave reveal the use of various plant species during the Mesolithic period on the northern slopes of Eastern Alborz. Archaeological botanical evidence from this cave indicates the presence of different plants, including Prunus/Amygdalus, Quercus sp., and Juniperus (Steppe-forest plants); Salix Sp., Vitis, and Ulmus sp. (Riparian forest plants); Chenopodiaceae, Fabaceae, and Rhamnaceae (Steppe plants); and Ericaceae (Mountainous plants). The relative abundance of Ulmus, Prunus/ Amygdalus charcoal among these samples suggests that these trees were used as fuel by the region's residents (Shirazi 2018: 20-21).

A study of 362 liters (5489 identified samples) of pre-pottery Neolithic and Mesolithic material from Komishani Tepe was published. The majority of the large seeds, including Avena, Hordeum, Aegilops, Stipa, and legume seeds, likely entered archaeological horizons at the site through intensive

[1]This study was conducted on an illegal smuggling hole, and most of the data was collected from undated and disturbed layers.

collection and processing for human consumption (Weide *et al*. 2017). These findings align well with the pattern of pre-Neolithic plant exploitation in the region (Arranz-Otaegui *et al*. 2016). These findings align with the pattern of plant exploitation observed at pre-Neolithic sites like East Chia Sabz (53%) and Chogha Golan (55%) (Riehl *et al*. 2012). Elements of steppe vegetation, such as Adonis, Stipa, and Nesslia, regularly appear in the archaeobotanical assemblages, indicating the prevalence of this habitat in the site's surroundings. Adonis and Nesslia are weed species that were incorporated into cultivated field systems in later periods (Whitlam *et al*. 2018).

Animals generally avoid Stipa due to its awns, and whole florets can be dangerous if swallowed, causing intestinal damage. Therefore, Hillman (2000) proposed that people gathered and processed Stipa for consumption during the Near East's Epipaleolithic and early Neolithic periods. The abundance of Stipa found at early Neolithic Sheikh-e Abad, western Iran (Whitlam *et al*. 2018: 826-27), can also be interpreted as evidence of human use of this large wild species as a staple food. Phalaris species have been observed to be seasonal forage for herbivorous mammalian species (Goodin and Northington, 2013).

The abundant botanical remains of Phalaris and other small seed species, less numerous in archaeobotanical finds (like Astragalus spp., Chenopodium spp., Malva spp., Medicago/ Trifolium, and Rumex spp.), are indicators for the use of dung as fuel at archaeological sites (Van Zeist *et al*. 1984; Whitlam *et al*. 2018). This indirectly suggests the increasing intensity of animal management at Komishani Tepe.

The underground storage organs of Bolboschoenus have recently been identified as the source of flour in bread from a 14,000-year-old Natufian hunter-gatherer encampment in northern Jordan (Arranz-Otaegui *et al*. 2018). Its seeds frequently occur in the samples, most probably because they were processed for food consumption through roasting (Hillman 2000) and thus preserved in the cultural layers in the charred state, as observed at Chogha Golan (Weide *et al*. 2017). This plant could have been used as a food resource for matting and dwelling construction at Komishani Tepe. The findings of Hyoscyamus raise questions concerning its potential use for medicinal, spiritual, or ritual purposes. The plant typically thrives in areas close to humid, disturbed habitats rich in nutrients. Together with Bolboschoenus, they represent the use of wetland areas that were likely plentiful in the coastal plains near the site (Leroy *et al*. 2019:358).

The animal remains of the Mesolithic and Neolithic periods of the Komishani Tepe have obvious similarities, indicating a degree of continuity and continuity and consistency in these two cultural periods. Faunal assemblages have a wide spectrum and indicate the use of different ecosystems in Kamishani during this period. For example, water birds are a sign of access to the shores. Regarding the caprines, although wild goats tend to inhabit higher altitudes than sheep, both species may be found at any altitude, and their ranges reflect their habitat preferences. Wild bezoar goats are adapted to rocky substrates and steep slopes, habitats where their morphology enables them the agility to evade predators (Korshunov 1994; Shams *et al*. 2010; Weinberg 2001). Extant populations of Asiatic mouflon (Ovis orientalis) inhabit moderately to very arid habitats, particularly grasslands, including mountains, foothills and rolling plains (Bashari and Hemami 2013; Vié *et al.* 2008). These habitat preferences mean minimal competition for food resources exists between wild sheep and goats (Korshunov 1994). It would be expected for these animals to follow seasonal migrations, utilizing available resources at different altitudes throughout the year (Korshunov 1994; Shams *et al*. 2010). Consequently, the hunted animals would provide insights into the accessibility of various habitats from Komishani Tepe and possibly point to seasonal hunting practices (Fazeli Nashli *et al*. 2024: 388; Leroy *et al*. 2019: 360).

The evidence of plant and animal remains and archaeological findings from Komishani Tepe indicate that the management of wild plant and animal resources existed prior to the emergence of a local society with a low level of food production on the coastal plain. The continuity of plant and animal collections in the Mesolithic and Neolithic horizons suggests that the Neolithic process occurred over a prolonged period between 8600 and 8200 BCE. Moreover, the first circular stone artifacts appeared in this region during the Mesolithic period (around 8600 BCE) and the Transitional Neolithic period. The presence of small flint blades and pressure-flaked, single-platform cores makes Komishani

Tepe significantly older than any other Neolithic site in the Caspian basin and one of the earliest Neolithic sites in Iran around 8600 and 8200 BCE. Favorable environmental conditions facilitated the transition from the Mesolithic to the Neolithic.

In 2019, Leroy and colleagues conducted core sampling in the Gorgan Gulf and compared the results with archaeological findings from prehistoric sites such as Ali Tepe, Komishani Tepe, Hotu, and Kamarband caves. All proxies indicated the diversity of ecological niches and the continuous presence of wetlands in the region. During the Younger Dryas, diverse deciduous trees persisted, suggesting favorable climatic conditions for human survival and various plant and animal food resources. This may explain the early process of Neolithization on the southern coastal plain of the Caspian Sea, which was likely influenced by the relatively benign impact of the Younger Dryas stadial.

Faunal, botanical, and archaeological evidence from Komishani Tepe demonstrates that the Neolithization process was a gradual, low-cost adaptation to new ways of life, involving neither the complete abandonment of hunting and gathering nor a climatic trigger event for the emergence of a low-level, food-producing society. This evidence suggests that Mesolithic hunters and gatherers targeted sheep and goat populations, collected wild oats, barley, and legumes, and used ground stone tools as early as 8600 cal. BCE. Furthermore, evidence recovered from Mesolithic/Transitional Neolithic occupations of this site indicates that its inhabitants continued to rely on wild plant and animal resources for at least 400 years following the first appearance of small flint blades and pressure-flaked, single-platform cores circa 8600 cal. BCE (Leroy *et al*. 2019 355-361).

To further investigate the relationship between environmental changes and human lifeways, the excavation of Hotu Cave focused on the Mesolithic-to-Neolithic transition. The site, located on the southeastern shores of the Caspian Sea, aimed to address hypotheses related to this region during the early Holocene (10,000 to 7,000 BCE). The excavation studied the initial management of animal and plant remains, reflecting the shift from hunter-gatherer subsistence to early agricultural practices. (Fazeli Nashli 2021). Studies of animal remains from the Mesolithic and Neolithic periods were published in 2023 (Groene *et al*. 2023), revealing significant changes between the two layers. Seals and large deer were found in the Mesolithic layers of gazelles (64% of the total mammal collection). However, gazelles and seals were not observed after the transition from the Mesolithic to Neolithic periods. Instead, evidence of the use of sheep and goats has become prevalent during this time (Figure. 6), indicating a major shift in the productivity and

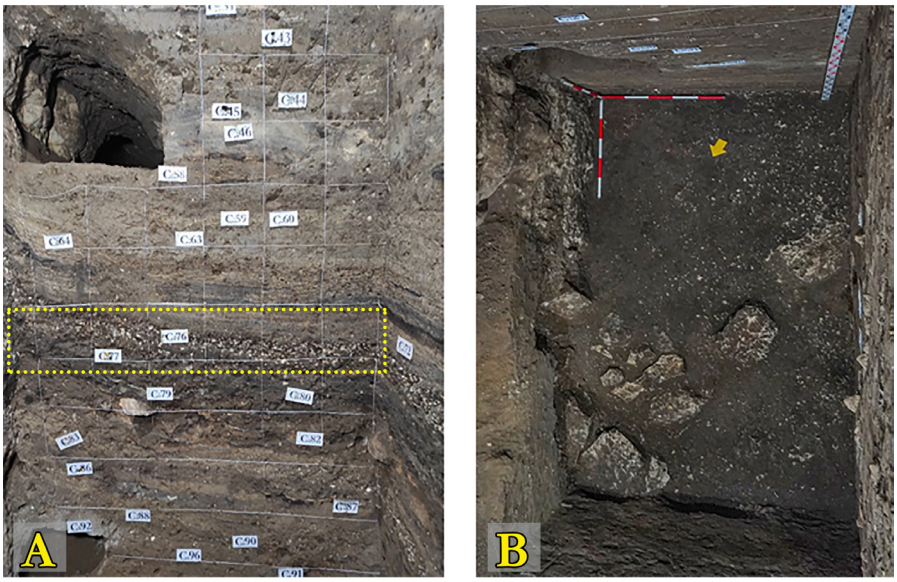


Figure. 6: *A: Stone deposits in the stratigraphic section led to a collapse between the pottery Neolithic and pre-pottery Neolithic in Hotu Cave; B: A view of Stone deposits that were probably caused by an earthquake in Hotu Cave (photo by Authors)*

management of animals at the beginning of the Early Neolithic in the early 8th millennium BCE.

Goats were more abundant than sheep in both the pre-pottery Neolithic and pottery Neolithic periods, with a ratio of approximately 2:1. This, along with the findings at Komishani Tepe, suggests potential competition between sheep and wild goats for food resources. Pigs (likely domesticated) appeared for the first time in the animal assemblage at Hotu Cave during the Pottery Neolithic period. Due to fragmentation, the assemblage includes a significant quantity of perinatal remains, not all of which could be identified. In addition to these numerous fetal and neonatal bones, sheep and goats generally died young in the Early Neolithic. The absence of sheep/goats in the Mesolithic contexts at Hotu Cave contrasts sharply with their dominance in the faunal assemblage in later levels.

At first glance, this pattern might suggest a hiatus in occupation. However, we also observe changes in stone artifacts, such as ground stone for plant cultivation in Hotu Cave (Figure. 7) and Komishani Tepe (Figure. 8). There is no evidence of a gradual transition towards reliance on sheep and goats rather than gazelle, cervidae, and seals. This shift in the zooarchaeological assemblage indicates that a decline in the availability of gazelles led local populations to exploit sheep/goats instead. This represents a sudden change in the way of life during this period, and these studies align with the results published by Coon. He also suggested that domesticated sheep, goats, pigs, seals, and birds were present in the Neolithic layers, while gazelles, deer, and blue jaws were obtained in the lower layers (Coon 1951, 1957).



Figure. 7: *Stone artifacts in Hotu Cave: A: Ground Stone Pestle; B: The Rim of a Stone Vessel; C: Tillage Stone ((photo by Authors)*



Figure. 8: *Stone artifacts in Komishani Tepe:A: Ground Stone Vessel; B and C: Ground Stone Pestle (After: Fazeli Nashli et al. 2024)*

To categorize animal species, Coon divided them into wet and dry species, as well as those capable of living in both wet and dry climates. Like McBurney, he believed that Hotu Cave formed initially during a wet climate period on loess soil and the cave's natural bed. Subsequently, an increase in dry species suggests a shift towards drier weather conditions, followed by a return to wetter conditions in the region and caves of Hotu and Kamarband (Coon 1952).

The shift in the zooarchaeological assemblage indicates that the reduced availability of gazelles led the local population to adopt sheep/goats as a primary source of food. Regarding the Caspian seal, McBurney's hypothesis suggests that when the water level of the Caspian Sea was high, and the coastal plain was narrow, hunting and transporting seals to the cave were convenient for hunter-gatherers. However, with climate change, the widening of the plains, and receding seawater, hunting this species became more difficult. This may explain the absence of evidence for Caspian seal use in the cave during later periods. The inhabitants of the cave hunted a wide range of species. Aurochs, gazelles, sheep, and goats lived on the plains, and the palynology of cores taken in Shahkileh and Gharasoo further supports this hypothesis. Both sheep and wild goats were present in the Mesolithic period in the region, as found at Kamishani Tepe and Kamarband Cave, while wild sheep were present at Ali Tepe and in small numbers at Hotu Cave.

The presence of these animals in the Neolithic period is highly probable. It is possible that incoming groups introduced domesticated animals or implemented new management practices. Alternatively, these groups may have brought domesticated or managed animals in some form. One possible scenario is that settlers from the Zagros region of western Iran, where Neolithic developments began very early (e.g., goat management around 8000 cal BCE), traveled eastward along the Great Khorasan Road on the northern edge of the central Iranian plateau, introducing Neolithic lifeways. (Harris and Coolidge 2010; Roustaei and Gratuze 2020; Matthews and Fazeli Nashli 2022). Although the Pottery Neolithic sample size is small, it suggests a preference for culling young males. In the Early Neolithic, male sheep outnumbered females, possibly indicating a focus on hunting. In the Pottery Neolithic, the use of sheep and goats declined compared to the preceding period. This could be attributed to a decrease in animal body size or a shift in management practices. The abundance of perinatal sheep/goat remains (30%) in the Early Neolithic at Hotu suggests that these animals were kept in or near the cave, indicating a shift from hunting to herding. While it's unclear if all sheep/goats were confined to or near the cave or if the cave served as a shelter for pregnant animals, this evidence points to a change in the cave's function rather than a dietary shift (Figure. 9) (Groene *et al*. 2023).

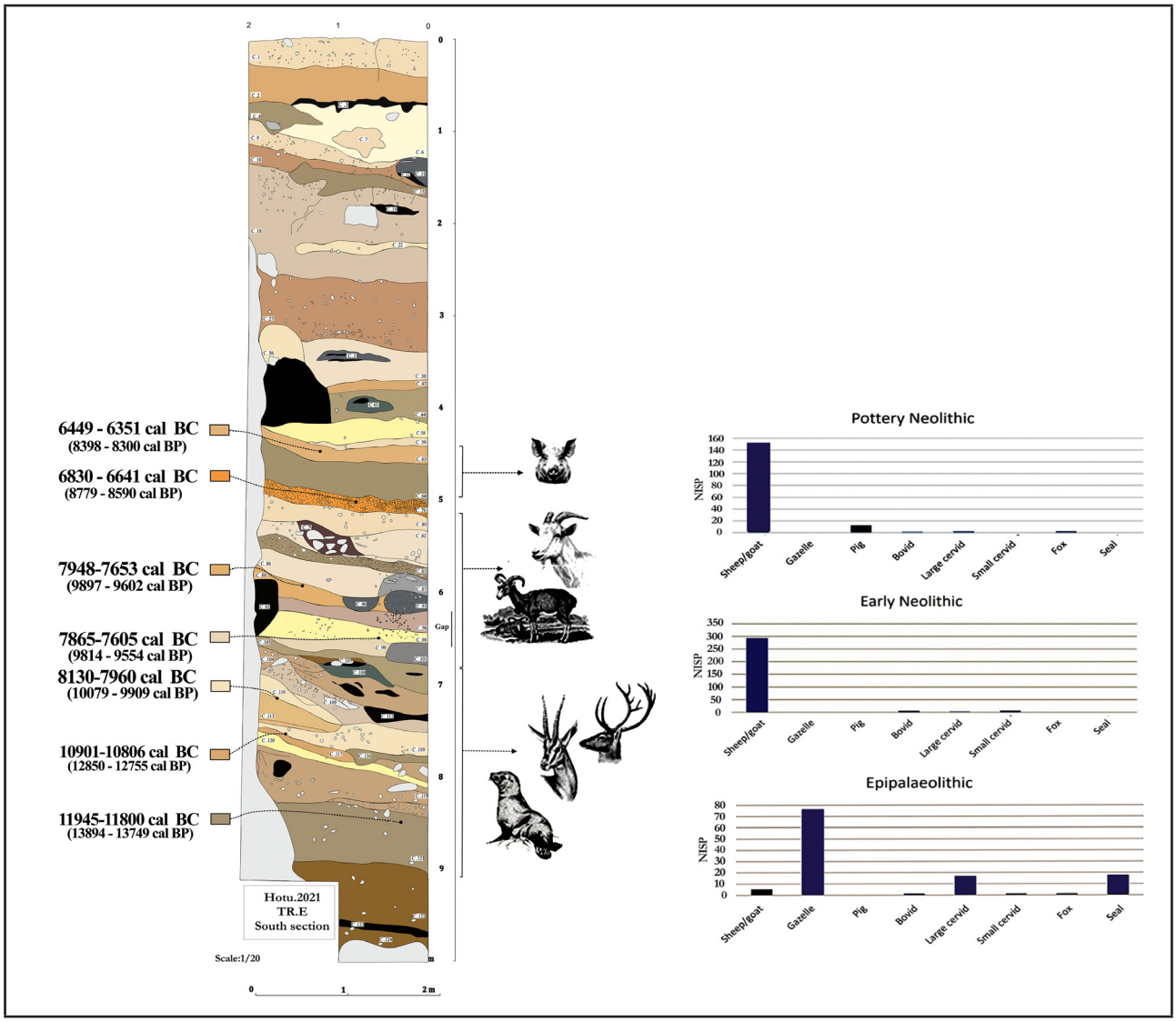


Figure.9: *Right: Stratification section of the Hotu cave and change diet in this cave (photo by Authors); Left: Chart of the frequency of animal use in Hotu Cave in three periods: Epipalaeolithic; Pre-Pottery Neolithic and Pottery Neolithic (After: Chatrs by Groene et al. 2023)*

Conclusion

The eastern Caspian region, characterized by diverse environments and cultures, harbors significant prehistoric sites. Yet, our understanding of Mesolithic, Transitional Neolithic, and Neolithic settlement patterns in this area remains limited. Subsistence during these periods was heavily influenced by the ecosystem, necessitating adaptability and resourcefulness from human populations.

Climatic changes and Caspian Sea fluctuations were pivotal external factors shaping human movements. Archaeological evidence from Hotu, Kamarband, Ali Tepe, Komishan Cave, and Komishani Tepe reveals a flexible diet adapted to environmental conditions. As the Caspian Sea advanced, hunter-gatherers exploited marine resources like Caspian jaw, fish, and water birds, alongside terrestrial animals like gazelles. Following shoreline expansion, populations transitioned to domesticating goats, sheep, and pigs.

The interplay between climatic-environmental changes and cultural factors was crucial in shaping settlement dynamics. Despite advancements, significant gaps in our knowledge persist, particularly regarding the Mesolithic-to-Neolithic transition and cultural niche construction in this region. Future research should focus on filling these gaps to enhance our understanding of prehistoric life in the southeastern Caspian region.

Acknowledgment

We are deeply indebted to Dr. Christopher P. Thornton for his generous contributions to this article. His comments and suggestions were invaluable. Additionally, we are grateful to the anonymous reviewers for their thoughtful input.

References

Abbasnejad Seresti, R., S.K. Asadi Ojaie & H. Nemati Loujandi. 2022. Tepe Veliki: A Pottery Neolithic Site in the Neka Plain, Mazandaran, Iran, *Iranian Journal of Archaeological Studies* 12 (1): 29-40. https://doi.org/10.22111/ijas.2022.7492

Arranz-Otaegui, A., J. Juan, J. Ibáñez & L. Zapata. 2016. Hunter-Gatherer Plant Use in Southwest Asia: The Path to Agriculture, In K.Hardy & L. Kubiak-Martens, (eds.), *Wild Harvest: Plants in the Hominin and Pre-Agrarian Human Worlds* 2: 91-110. https://doi.org/10.2307/j.ctvh1dmjj.10

Arranz-Otaegui, A., L. González-Carretero, M.N Ramsey & T. Richter . 2018. Archaeobotanical Evidence Reveals the Origins of Bread 14,400 years ago in Northeastern Jordan, *Proceedings of the National Academy of Sciences of the United States of America* 115(31) :7925 - 7930. https://doi.org/10.1073/pnas.1801071115

Bashari, H. & M. Hemami . 2013. A Predictive Diagnostic Model for Wild Sheep (Ovis Orientalis) Habitat Suitability in Iran, *Journal for Nature Conservation* 21(5): 319-325. https://doi.org/10.1016/j.jnc.2013.03.005

Coon, C.S. 1951. *Cave Explorations in Iran 1949,* Philadelphia: University of Pennsylvania Museum.

Coon, C.S. 1952. Excavations at Hotu Cave, Iran, A Preliminary Report, *Proceedings of the American Philosophical Society* 96/3: 231-249.

Coon, C.S. 1957. *The Seven Caves, Archaeological Exploration in the Middle East*. New York: Greenwood Press.

Darabi, H . 2022. The Creative Millennia: Highlighting the Transitional Neolithic (ca. 9800-8000 BCE) in the Central Zagros, Iran, *Journal of Archaeological Studies* 14(2):37-58.https://doi.org/10.22059/jarcs.2022.343781.143122

Dupree, L. 1952. The Pleistocene Artifacts of Hotu Cave, Iran, *Proceedings of the American Philosophical Society* 96(3): 249-257.

Fazeli Nashli, H . 2017. *Excavation Report on the Probing Project for Determination of the Land and Proposal of the Privacy of the Komishani Open Site,* [In Persian],Tehran: Iranian Center for Archaeological Research, Unpublished Report.

Fazeli Nashli, H., E. Marinova-Wolff, R. Bendrey, M. Gregg, W. Marinova, S.Balescu, L.F. Brisson, M. Lamothe, J. Thomalsky, H. Nazari & S. Maleki .2024. Pre-Agricultural Plant and Animal Management and the Emergence of a low-level, Food-producing Society in the Southern Caspian Basin During the early Holocene, In J. Thomalsky, H. Fazeli Nashli, M. Reindel, P. Kaulicke, M. Kunst & A.C. Sousa,(eds.), *From Sedentaisation to Complex Society: Settlement, Economy, Environment*. Berlin:Reichert Verlag, 351-381. https://doi.org/10.34780/1wb6-0caf

Fazeli Nashli, H . 2021. *Excavation Report to Determine the Site and Privacy of Hotu and Kamarband Caves and Excavation of the Stratification of Hotu Cave, Behshahr City, Mazandaran Province*,[In Persian] ,Tehran: Iranian Center for Archaeological Research, Unpublished Report.

Fazeli Nashli, H . 2022. *The Report of the Stratigraphic Excavation of the Kamarband Cave, Behshahr City, Mazandaran Province*,[In Persian], Tehran: Iranian Center for Archaeological Research, Unpublished Report.

Fazeli Nashli, H . 2023. *Report of the Second Season of Stratigraphic Excavation of Komishani Tepe, Neka City, Mazandaran Province*,[In Persian], Tehran:Iranian Center for Archaeological Research, Unpublished Report.

Flannery, K. V. & J .Marcus . 2012. *The Creation of Inequality: How Our Prehistoric Ancestors Set the Stage for Monarchy, Slavery, and Empire.* Cambridge: Harward University Press.

Graeber, D. & D .Wengrow . 2023. *The Dawn of Everything, A New History of Humanity*. New York: Farrar.

Goodin, J.R. & D. K. Northington . 2013. *Plant Resources of Arid and Semiarid Lands: A Global Perspective*. London: Academic Press Inc.

Gregg, M.W. & C.P Thornton . 2012. A Preliminary Analysis of the Prehistoric Pottery from Carleton Coon's Excavations of Hotu and Belt Caves in Northern Iran: Implications for Future Research into the Emergence of Village Life in Western Central Asia, *International Journal of the Humanities*19(3):56-94

Groene, D., H. Fazeli Nashli & R. Matthews . 2023. The Epipalaeolithic–Neolithic Transition in North-Eastern Iran: Zooarchaeological Evidence from the Southern Shores of the Caspian Sea, *Antiquity* 97(393):541-556. https://doi.org/10.15184/aqy.2023.37

Harris, D. & J .Coolidge . 2010. The Mesolithic and Neolithic periods: Sites, Sequences, and Subsistence, In D. Harris ,(ed.), *Origins of Agriculture in Western Central Asia: An Environmental - Archaeological Study* .Philadelphia : University of Pennsylvania Press,43-53.https://doi.org/10.2307/j.ctt3fj6gz.13

Hashemi, S.M. & H . Vahdati Nasab . 2014. Study of Reduction Intensity on the Side-Scrapers of Komishan Cave, Mazandran, [In Persian], *Archaeological Researches of Iran* 4(6) : 27-46.

Heydari, N., R. Abbasnejad Seresti & M. Safari . 2022. The Effect of Caspian Sea Water Level Fluctuations in the Late Pleistocene and Holocene Periods on the Dispersion of Prehistoric Settlements in Mazandaran, [In Persian], *Quaternary Journal of Iran* 9(1/2): 158-183.

Henry, D.O .1989. *From Foraging to Agriculture: The Levant at the End of the Ice Age*. Philadelphia: University of Pennsylvania Press.

Hillman, G.C . 2000. Plant Food Economy of Abu Hureyra: Abu Hureyra 1: The Epipalaeolithic, In A. M. T. Moore, G.C. Hillman & A.J. Legge ,(eds.), *Village on the Euphrates, From Foraging to Farming at Abu Hureyra*. London: Routledge,327–399.

Jayez, M . 2012. *Techno-typological Analysis of Komishan Lithic Industries and its Compatibility with the Epipaleolithic Industries from Zagros Region*, [In Persian] ,Unpublished Ph.D. Thesis. Tehran: Tarbiat Modares University (TMU).

Jayez, M., M. Safari & S. Ghasemi. 2024. Typo-Technological Classification of the Chipped Stone Assemblages of Hotu Cave from the Mesolithic to the Transitional Chalcolithic: Reflections on Local Raw Material Procurement in the Caspian Sea Littoral Ecozone, [In Persian], *Journal of Archaeological Studies* 16(1) :53-86. https://doi.org/10.22059/jarcs.2023.357605.143194

Jayez, M. & H. Vahdati Nasab .2016. A Separation: Caspian Mesolithic vs. Triacetin Lithic Industry. A Research on the Eexcavated Site of Komishan, Southeast of the Caspian Sea, Iran, *Paleorient* 42(1): 75-94. https://doi.org/10.3406/paleo.2016.5694

Jayez, M. & H . Vahdati Nasab .2020. Assessing Relative Chronology Via Identification of Knapping Techniques: The Case Study of Blade and Bladelet Production in Komishan Cave, Mazandaran, Iran, [In Persian], *Journal of Archaeological Studies* 12(1):59-80. https://doi.org/10.22059/jarcs.2020.257826.142566

Jayez, M. 2021. A Typo-Technological Analysis of Chipped Stone Assemblage from the Mesolithic Site of Al Tepe, Mazandaran, Iran (the Archive of the National Museum of Iran) ,[In Russia], *Universum Humanitarium* 2:49-57.https://doi.org/10.25205/2499-9997-2021-2-49-57.

Korshunov, V.M . 1994. Ecology of the Bearded Goat (Capra Aegagrus and Ersleben 1777) in Turkmenistan, In M. Biol , (ed.), *Biogeography and Ecology of Turkmenistan*. Netherlands: Springer, 231-246.

Kozlowski, S.K .1999. The Eastern Wing of the Fertile Crescent: Late Prehistory of Greater Mesopotamian Lithic Industries, *BAR International Series 760*.

Leroy, S, A. Amini, M. W. Gregg, E. Marinova, R. Bendrey, Y. Zha, A. Naderi Beni & H. Fazeli Nashli. 2019. Human Responses to Environmental Change on the Southern Coastal Plain of the Caspian Sea During the Mesolithic and Neolithic Periods, *Quaternary Science Reviews*218(1):343-364.https://doi.org/10.1016/j.quascirev.2019.06.038

Mahfrouzi, A . 2003. *A Preliminary Report on Archaeological Surveys and Excavations in East of Mazandaran Province,* [In Persian], Archaeological Reports No2: 263-278, Tehran:Iranian Center for Archaeological Research,Unpublished Report.

Mashkour, M., J. Chahoud & A. Mahforouzi. 2010. Faunal Remains from the Epipaleolithic Site of Komishan Cave, *Iranian Archaeology* 1: 32-38.

Matthews,W.2013. Investigating Early Neolithic Materials, Ecology and Sedentism: Micromorphology and Microstratigraphy, In R. Matthews, W. Matthews & Y.Mohammadifar, (eds.), *The Earliest Neolithic of Iran: 2008 Excavations at Sheikh-e Abad and Jani: Central Zagros Archaeological Project*. Oxford: Oxbow Books, 67-104

Matthews, R. & H. Fazeli Nashli . 2013. The Neolithisation of Iran: Patterns of Change and Continuity, In R. Matthews & H. Fazeli Nashli, (eds.), *The Neolithisation of Iran: The Formation of New Societies*. Oxford: British Association for Near Eastern Archaeology and Oxbow Books, 1–13. https://doi.org/10.2307/j.ctvh1dp0q.5

Matthews, R.J. & H. Fazeli Nashli . 2022. *The Archaeology of Iran from the Palaeolithic to the Achaemenid Empire*, London and New York: Routledge,Taylor and Francis Group.

McAuley, J . 2013. S*keletal Study of the Hominins from Hotu and Belt Caves, Iran*. An Example. of Conservation Gone Wrong. Unpublished MA Dissertation. Philadelphia: University of Pennsylvania.

McBurney, C. B . 1968. The Cave of Ali Tepe and the Epi-Palaeolithic in N. E. Iran, *Proceedings of the Prehistoric Society* 12: 385-413. https://doi.org/10.1017/S0079497X00013955

Nikzad, M . 2017. *Human Evolution Through the Transition from the Mesolithic to the Neolithic Period at the Southeast of the Caspian Sea, Based on the Excavation of Komishan Cave*, [In Persian], Unpublished Ph.D. Thesis. Tehran: Tarbiat Modares University (TMU).

Riehl S., M. Benz, N.J. Conard, H. Darabi, K. Deckers, H. Fazeli Nashli & M. Zeidi-Kulehparcheh.2012. Plant Use in Three Pre-Pottery Neolithic Sites of the Northern and Eastern Fertile Crescent: A Preliminary Report, *Vegetation History and Archaeobotany* 21(2): 95-106. https://doi.org/10.1007/s00334-011-0318-y

Roustaei, K. & B. Gratuze . 2020. Eastward Expansion of the Neolithic from the Zagros: Obsidian Provenience from Sang-e Chakhmaq, a Late 8th–Early 7th Millennia BCE Neolithic Site in North-East Iran, *Journal of Archaeological Science Reports* 29: 101-969. https://doi.org/10.1016/j.jasrep.2019.101969.

Shams, B.S., M. Karami, M.R. Hemami, B. Riazi & M.B Sadough . 2010. Habitat Associations of Wild Goat in Central Iran: Implications for Conservation , *European Journal of Wildlife Research* 56 (6): 883-894. https://doi.org/10.1007/s10344-010-0386-9

Shirazi, Z . 2018. Charcoal Studies at Ali Tepe Cave (Mazandaran): An Introduction to the Herbal Sources in the Epipaleolithic Period in the Eastern Alborz, [In Persian], *Pazhohesh-ha-ye Bastanshenasi Iran* 8(18):7-24. https://doi.org/10.22084/nbsh.2018.13417.1586

Tavakoli Zaniani, A., R. Abbasnejad Seresti & M. Jayez . 2022. Introduction and Analysis of Technology and Typology of Lithic Artifacts Discovered from the Excavations of 2020 in Touq Tepe Neka, Mazandaran, [In Persian], *Parseh Journal of Archaeological Studies* 7(23):39-60.https://doi.org/10.30699/PJAS.7.23.39.

Uerpmann, H. P. & W. Frey. 1981. The Surroundings of Kamarband Cave (Belt-Cave) and Ali Tepe Cave (BehShahr, Mazandaran, and N-Iran) Today and in the Late Pleistocene, [In German], In W. Frey & H. P. Uerpmann ,(eds.), *Beitrage Zur Umweltgeschichte des Vorden Orients, Tubinger Atlas des Vorden Orients*, No 8.Wiesbaden: Dr Ludwig Reichert Verlag ,134-190

Vahdati Nasab, H. & M. Jayez . 2011. Technology and Typolpgy of the Lithic Artifacts from Komishan Cave, Mazandran (Observations on the Industry of Trialeti), [In Persian], *Iranian Journal of Archaeology and History* 25 (2): 56-78.

Vahdati Nasab, H & M. Nikzad .2016. A New Look at the Neolithization of the Southeastern of the Caspian Sea, [In Persian], *Pazhohesh-ha-ye Bastanshenasi Iran* 6(11): 7-24.https://doi.org/10.22084/nbsh.2016.1736

Vahdati Nasab, H., M. Nikzad, M. Jayez, M. Hashamei, Z. knapp, N. Sykes, M.Z. Khalili, H.H. Moghassam, F Bakhtiari Nasab & D. I Olszewski . 2020. Komishan Cave: A Mesolithic and Later Settlement of the Southeastern Shore of the Caspian Sea, Iran, *Ancient Near Eastern Studies* 57(1): 97-125. https://doi.org/10.2143/ANES.57.0.3288614

Vahdati Nasab, H .2020. Carton Coon's Riddle: Anthropologist, Archaeologist, or CIA Agent? (Critical Review of Carlton Stevens Coon's Methodology and Publications in the Iranian Paleolithic Archaeology),[In Persian], *Critical Studies in Texts and Programs of Human Sciences, Institute for Humanities and Cultural Studies (IHCS)* 20(6):349-373.https://doi.org/10.30465/crtls.2020.30011.1767

Vié, J, C. Hilton-Taylor & S.N. Stuart. 2008. *Wildlife in a Changing World – An Analysis of the 2008 IUCN Red List of Threatened Species*™. Switzerland : Nternational Union for Conservation of Nature and Natural Resources.

Van Zeist, W., P.E. Smith, R.M. Palfenier-Vegter, M. Suwijn & W. Casparie . 1984. An Archaeobotanical Study of Ganj Dareh Tepe, Iran, *Palaeohist* 26(1):201–224.

Watkins, T. 2024, *Becoming Neolithic, The Pivot of Human History*. London and New York: Routledge.

Weide,A., S. Riehl, M. Zeidi & J.N Conard . 2017. Reconstructing Subsistence Practices: Taphonomic Constraints and the Interpretation of Wild Plant Remains at Aceramic Neolithic Chogha Golan, Iran , *Vegetation History and Archaeobotany* 26(5): 487-504. https://doi.org/10.1007/s00334-017-0607-1

Weinberg, P . 2001. On the Status and Biology of the Wild Goat in Daghestan, [In Russia], *Journal of Archaeological Research* 6: 31–40.

Whitlam, J., A. Bogaard, R. Matthews, W. Matthews, Y. Mohammadifar, H. Ilkhani & M. Charles. 2018. Pre-Agricultural Plant Management in the Uplands of the Central Zagros: The Archaeobotanical Evidence from Sheikh-e Abad, *Vegetation History and Archaeobotany* 27(6): 817-831. https://doi.org/10.1007/s00334-018-0675-x

Zeder, M.A . 2024. Out of the Shadows: Reestablishing the Eastern Fertile Crescent as a Center of Agricultural Origins. Part 1. *Journal of Archaeological Research* 32: 1–56.https://doi.org/10.1007/s10814-024-09195-5