University of Tehran Press

Journal of Archaeological Studies

P. ISSN: 2251-9297 - **E. ISSN:** 2676-4288

Vol. 18, No. 2, Serial No. 39 / Summer-Autumn, 2026

https://jarcs.ut.ac.ir/



A new narrative of the Bronze Age along the Caspian Sea Based on Excavation of Ghale–Ben, Iran

Hassan Fazeli Nashli[1], **Mojtaba Safari**[2]

1. Department of Archaeology, Faculty of Literature and Humanities, University of Tehran, Tehran, Iran.
Email: hfazelin@ut.ac.ir
2. Department of Archeology, Faculty of Cultural Heritage, Handicrafts and Tourism, University of Mazandaran, Babolsar, Iran (Corresponding Author). ***Email:*** m.safari@umz.ac.ir

Article Info

Pp: 99-135

Article Type:
Research Article

Article History:

Received:
2026/04/20

Revised:
2026/06/06

Accepted:
2026/06/16

Published online:
2026/10/23

Keywords:
Caspian Sea, Bronze Age, Society Structures, Economy Structures, Ghal e–Ben site, Grey Ware, Caspian Black on Red Ware.

Abstract

The central part of the southern Caspian Sea region was densely inhabited during the third millennium BCE. From an archaeological perspective, it is important to understand when and how such lush environments supported large populations during the Bronze Age, and, how these communities developed new socio-economic structures during the third and second millennia BCE. Ghal e-Ben is one of the key Bronze Age sites in the central part of Mazandaran Province, excavated in 2019. The site's occupation dates back to the Late Chalcolithic period (around 3200 BCE) and continued until the second half of the second millennium BCE (around 1500 BCE). Archaeological evidence from Ghal-e Ben indicates that during the Bronze Age, it was a fully sedentary agricultural settlement, inhabited by a large population whose economy was based on a combination of animal husbandry, including sheep, goat, pigs, and cattle, and large-scale farming. In a regional context, communities in the area became more complex during the second millennium BCE., as evidenced by the emergence of large cemeteries containing high-status burial goods, the development of new farming systems, and the establishment of long-distance trade networks. The cultivation of Chinese broomcorn and foxtail millet suggests the introduction of new crops and an evolving agricultural economy during this period. Our research program at the site of Ghal-e Ben not only provides a comprehensive chronological framework for the Bronze Age on both the southern and northern slopes of the Alborz Mountains, but also allows us to revise the chronology of several other sites that were previously dated using relative methods.

Cite this The Author(s): Fazeli Nashli, H. & Safari, M. (2026). A new narrative of the Bronze Age along the Caspian Sea Based on Excavation of Ghale–Ben, Iran. *Journal of Archaeological Studies,* 18(2), 99–135. https://doi.org/10.22059/jarcs.2026.421419.143439

Publisher: University of Tehran.
Copyright © 2026 The Authors. Published by University of Tehran.
This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license (https://creativecommons.org/licenses/by-nc/4.0/). Non-commercial uses of the work are permitted, provided the original work is properly cited.

Homepage of this Article: https://jarcs.ut.ac.ir/article_108655.html?lang=en

1. Introduction

Iran served as the heartland of diverse cultural zones and identities during the third millennium BCE, encompassing the Jiroft civilization in Kerman Province, the Helmand civilization in the east, the Great Khorasan civilization (BMAC), the Elamite civilization in southwestern Iran, the Transcaucasian cultural sphere across much of western Iran and the central plateau, and the "Burnished Gray Ware culture" in northeastern Iran—recognized as a hallmark of the Bronze Age in Mazandaran (Cleuziou, 1986; 1991; Bessenay-Prolonge and Vallet, 2019; Olson and Thornton, 2019). The 2019 excavation at Ghal-e Ben provided a detailed overview of the distribution of the "Burnished Gray Ware Culture" in the south-central regions of the southern Alborz Mountains. Secure chronological data from Ghal-e Ben has also proven valuable for comparative studies with two other major sites of the region: Tureng Tepe and Gohar Tepe (Olson and Thornton, 2019; Piller and Mahforozi, 2009). In this paper, we briefly present the 2019 excavation results from Ghal e-Ben to propose a model for the long-term socio-economic development of Mazandaran during the Bronze Age. The material culture of Early Bronze Age Mazandaran shows strong affinities with that of northeastern Iran and the Gorgan Plain. However, over time, the ceramic assemblages begin to reflect increasing regional distinctiveness and inter-regional cultural identities. We position Mazandaran Province within the broader cultural sphere of northeastern Iran, which stretches northward to the Sumbar Valley in western Turkmenistan and southward to Tepe Hissar in the Damghan region. Prominent excavated sites across northeastern Iran, such as Tepe Hissar, Tureng Tepe, Narges Tepe, Hoseyn Abad, Shah Tepe, Yarim Tepe, Gohar Tepe, Ghal e-Kesh, Tepe Kelar, and Ghal e-Ben, together outline the settlement history of the third millennium BCE., a pattern that gradually declined between 1900/1800 and 1500 BCE. (Abbasi, 2011; Afshar *et al.,* 2019; Olson and Thornton, 2019; Tadahiko, 2010; Vallet, 2019; Thornton *et al.,* 2013). A particularly significant development is the appearance of Transcaucasian cultural elements in Mazandaran and the Gorgan Plain around 2500–2400 BCE. This reflects a phase of hybrid cultural interaction with northwestern Iran. However, the Bronze Age culture of Mazandaran should not be seen merely as a prehistoric local identity. It coexisted with and was influenced by the broader Transcaucasian cultural tradition, which, during the late fourth and third millennia BCE., emerged without evolving into complex urban or state-level societies.

The agricultural intensification in Mazandaran and the Gorgan Plain during the Bronze Age demonstrates the presence of fully sedentary agrarian societies. These communities ranged from small villages to large settlements, organized within a hierarchical site structure. Their economies relied primarily on a combination of large-scale agriculture and animal husbandry, including sheep, goats, pigs, and cattle, while showing decreasing reliance on wild resources (Heydari, 2017; Heydari et al., 2021; Olson, 2024). Although interregional interactions were substantial during the third millennium BCE., a particularly intriguing discovery is the cultivation of Chinese broomcorn and foxtail millet, which points to a distinct agricultural economy that had emerged around 4000 years ago. Mortuary practices, the investment in burial goods, the construction of monumental architecture, and iconographic evidence all attest to the presence of a socially complex, possibly urbanized landscape in Mazandaran during the Bronze Age.

2. The site of Ghal e-Ben (Excavated Trenches and the Absolute Chronology)

The archaeological site of Ghal-e Ben, located near the Caspian Fault and the Khoshroud-Pey River, has been significantly shaped by its surrounding environmental conditions. Situated approximately 20 kilometers south of the city of Babol and near the modern town of Khoshroud Pey (36º23'18''N, 52º34'13''E, at 67 meters above sea level), the site currently covers an area of less than 3 hectares. However, its original extent was likely much larger before modern development, including road construction, agricultural expansion, and residential buildings, reduced its size. Archaeological excavations were carried out between January and March 2019 to establish a secure chronological framework through the study of three stratigraphic trenches: TR Q-31, TR AB-27, and STR X-35 (Figs. 1, 2, and 3), all situated in the northern and western parts of the site. In addition, a horizontal trench (TR W-32), measuring 5 by 5 meters, was opened to document more detailed evidence of site occupation. Unfortunately, this area appears to have been disturbed by local activity in recent years, limiting its interpretive value. Nevertheless, the three stratigraphic trenches yielded secure archaeological data spanning from the late fourth millennium BCE to the middle of the second millennium BCE. In the following sections, we summarize the stratigraphy of trenches Q-31, AB-27, and X-35 to gain insight into the cultural phases and occupational history of the site. Table 1 indicates the cultural sequences of the site from 3101 BCE to 2925 BCE (93.2%) to 1613 BCE -1508 BCE (95.4%), while after a long interval, the site was reoccupied from 940 A.D to 1023 CE.

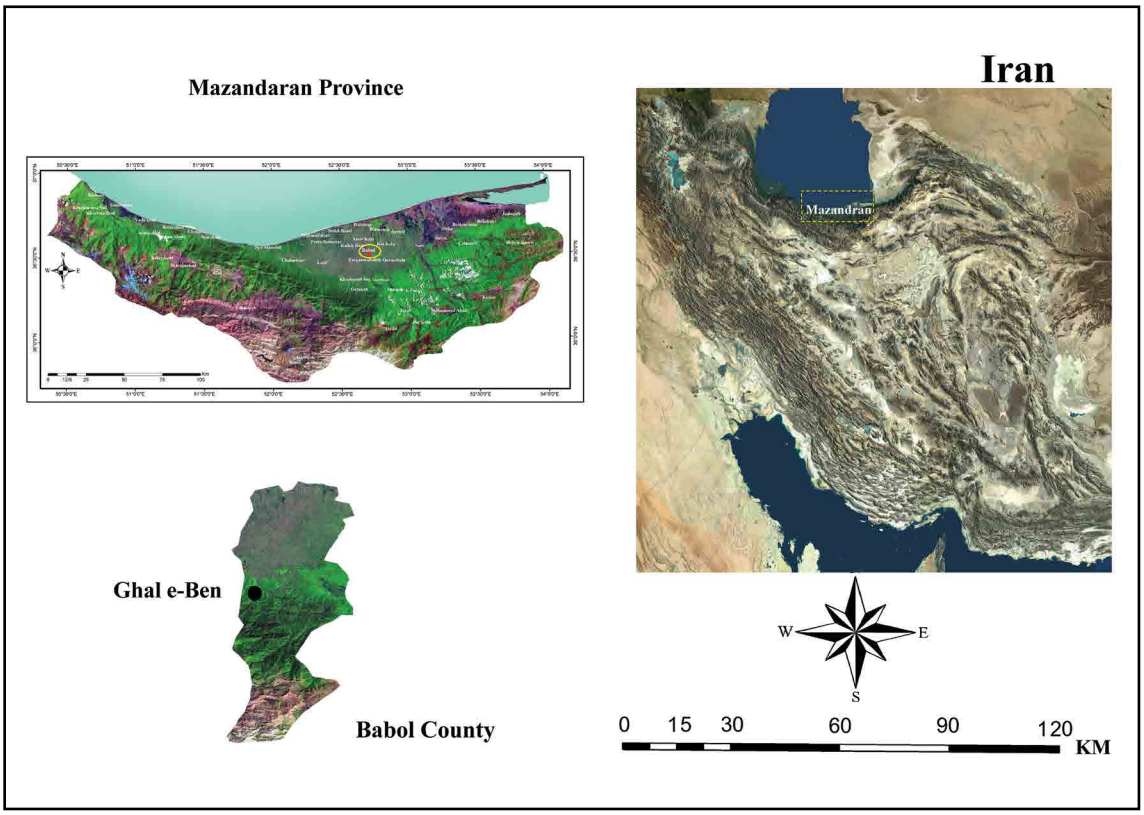


Fig. 1: Location of Ghal e-Ben, south of the Caspian Sea.



Fig. 2: Aerial image of the site and the location of the trenches Q31- X35.

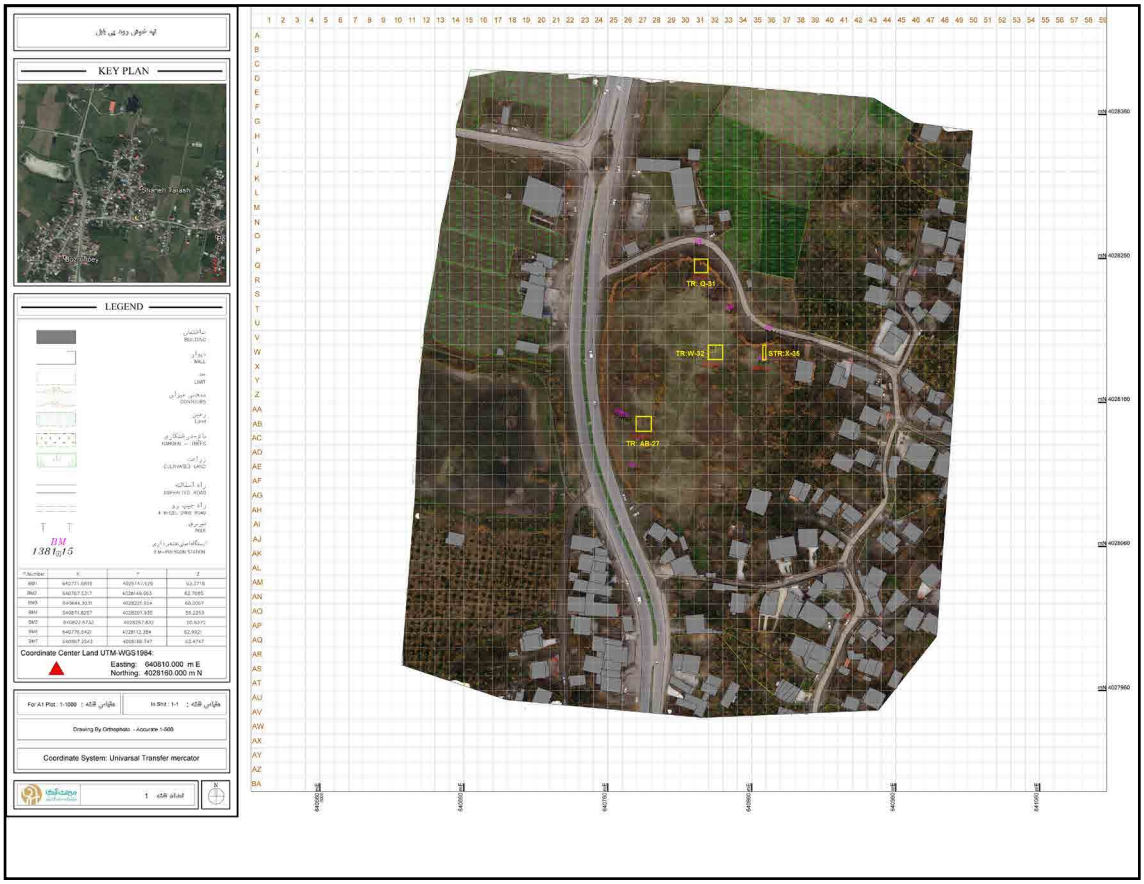


Fig. 3: Topographic map of the area and location of excavated trenches at Ghal e-Ben.

2-1.Step trench (STR)

X-35: The step Trench of X-35 (Fig. 4) is in the northern part of the site and with a 10.50m depth of archaeological 37 contexts, including primary and secondary deposits such as house walls, pits, burial contexts, and pavement. The first two meters of the top layers date back to the 10th century; afterwards is a combination of in situ and disturbed context, and after this period, one meter of oxbow lake deposits completely separates the 10th century occupation from the Bronze Age contexts. After the Oxbow Lake deposit, a secure 7.50 m of Bronze Age layers were exposed, addressing the start of the site's occupation from 3200 BCE. and ending 1500 BCE. Contexts from 101 to 109 (besides Context 107) belong to the 10th century. Context 109 is a large pit in which Context 107 was cut and is a mixed material culture of the 10th century CE (Seljuk period) onwards, such as seeds, pottery, glass, coins, etc. Contexts 103 and 105 consist of the parts of a wall and stone pavement. Context 106 includes several broken mudbricks as part of a collapsed wall. At a depth of two meters below the top layer, Context 107 consists of oxbow lake sediment deposit, and we assume environmental instabilities, such as flooding, caused such sedimentation and abandonment of the site around 1600-1500 BCE. There is no evidence of material culture in the one meter of oxbow lake sediment deposit.

Just below this context, archaeological evidence of the Late Bronze Age has appeared (Contexts 110-117) with a 2.50 m thickness starting from a depth of 3 m to 5.50 m. The Late Bronze Age cultural layers of Trench X-35 can be subdivided into the four architectural phases. The first phase includes a compact fired clay (Context 110) with the evidence of charcoal, fired broken bricks starting from a depth of 300 cm and continuing to a depth of 360 cm. The 14C sample from Context 110 dates back to 1613-1508 BCE, and according to the other 14C dates from the Trench Q-31 (see below), the site of Ghal e-Ben was abandoned around 1500 BCE. The second phase (context 111) is a collapsed, irregular, disturbed brick, in which parts of the bricks were fired while parts of the walls were in situ. The size of the bricks is 10×30×60 cm. In this architectural phase, around 20 kilograms of seeds (context 113) were found, dating back to 1691- 1532 BCE. Two other dates belong to context 111, dating back to 1621-1518 BCE (95.4%) and 1589- 1476 BCE (95.4%).

The three architectural phases consist of Contexts 114, 115 (pit) and 116 (pit), starting from 430 cm and ending 540 cm. Considering the thickness of Context 114, the whole depth has been divided into three levels: A, B and C. In this context, large-sized carbonized branches were found, and this evidence strongly suggests their origin as belonging to timbers used for roofing. Stone mortars, spindle whorls, and potsherds were found in Context 114. The 14C dates of the three depths of level A, B, and C indicate the following dates of 1689-1537 BCE (92.6%), 1641-1550 BCE (81.3%), and 2141-1951 BCE (95.4%). Phase 4 includes the floor, oven, and some small pits, which seem to be part of the residential section. This context starts from 550 cm and continues to 520 cm. Although we do not have 14C data from this layer, its depth is parallel with level C of Context 114, dating back to 2141-1951 BCE (95.4%). Therefore, we propose that it is probably the site was abandoned after the 4.2ka events, and around 400 years later was occupied for a short period of time, 100 to 150 years, and then abandoned again.

From Context 118, the Middle Bronze Age starts in trench STR-X35 with three meters of archaeological layers. Contexts 118 and 119 are part of a residential space which starts from 550 cm and continues to 573 cm with limestone floor evidence. The 14C of this context is 2300-2150 BCE (84.6%). Contexts 120,121, 122, and 123 start from a depth of 600 cm and continue to a depth of 705 cm, which indicates a domestic activity of the Middle Bronze Age. These consist of considerable debris from a residential house, which is located on the floor of Context 122, and a burial belongs to a young child (Context 121). The 14C date of context 121 is 2864-2495 BCE. Contexts 124-129 all suggest domestic activities, which start from a depth of 700 cm and continue to a depth of 840 cm. The 14C date of Context 124 is 2409-2234 BCE (93.3%). The considerable point is that the traces of several ovens, which are all located close to each other, were found in this deposit. The 14C date of Context 129 is 2877-2633 BCE belongs to the Early Bronze Age. The skeleton was buried in a flex position close to an oven without any gifts, and it seems that one of the traditions of the Middle Bronze Age was that the dead were buried close to an oven. Unfortunately, parts of the oven are located outside the trench and do not allow us to present a better picture of burial practices. Context 127 is located under Contexts 122 and 123, between a depth of 820-872 cm. In this context, we have recovered some pieces of Transcaucasian ceramics with an associated 14C date of 2530-2427 BCE (93.5%) (Fazeli Nashli *et al.*, 2022a) (Table 1).

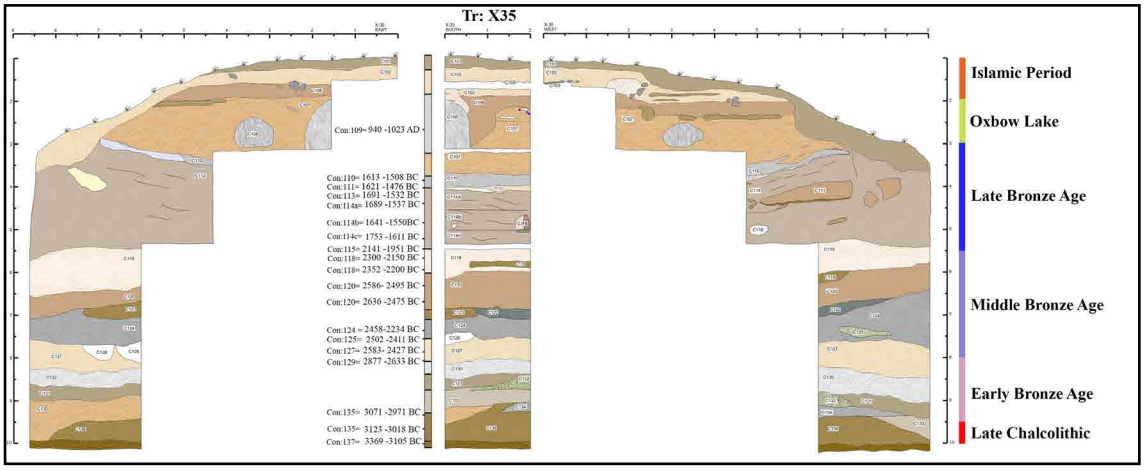


Fig. 4: Trench X-35, stratigraphic section and location of dated samples.

Table 1: The absolute chronology of Ghal e-Ben, Tr X-35).

Period	Context	Depth	Radiocarbon date (charcoal)	Radiocarbon Date (seeds)	Comment
10 century A.D.	109	-100 cm		940-1023 BCE (65.3%) (Oryza sativa)	pit
Gap	107	-200-300 cm			oxbow lake
	110	-390 cm		1613-1508 BCE (95.4%) (Triticum aestivum)	flotation

Late Bronze Age 2000-1500 BCE	111	-391 cm	1589-1476 BCE (95.4%)		collapse layer
	111	-395 cm		1621-1518 BCE (95.4%)	flotation
	113	-390 cm		1691-1532 BCE (91.7%) (Triticum aestivum)	flotation
	114_a	-400 cm		1689-1537 BCE (92.6%)	flotation
	114_b	-455 cm	1641-1550 BCE (81.3%)		collapse layer
	114_c	-530 cm		2141-1951 BCE (95.4%) (Panicum miliaceum)	flotation
	115	-470 cm		1753-1611 BCE (93.1%) (Hordeum vulgare)	flotation
Middle Bronze Age 2500-2000 BCE	118	-560 cm	2300-2150 BCE (84.6%)		soil layer
	118	-570 cm		2352-2200 BCE (84.2%)	flotation
	120	-675 cm		2586-2495 BCE (56.7%)	soil layer
	120	-685 cm		2636-2475 BCE (89.1%)	flotation
	124	-715 cm	2409-2234 BCE (93.3%)		soil layer
	124	-690 cm		2458-2283 BCE (90.2%)	flotation
	125	-750 cm	2448-2411 BCE (53.9%)		kiln
	125	-750 cm		2502-2456 BCE (49.7%)	flotation
Early Bronze Age 3000-2500 BCE	127	-835 cm	2530-2427 BCE (93.5%)		soil layer
	127	-840 cm		2583-2472 BC E (92.1%)	flotation
	129	-900 cm	2877-2633 BCE*		burial
Late Chalcolithic/ Caspian Black of Red Ware 3200-3000 BCE	135	-1015 cm	3071-2971 BCE (50.9%)		pit
	135	-1020 cm		3123 BCE-3018 BCE (44.2%)	flotation
	137	-1035 cm	3369-3105 BCE*		burial

2-2.Trench Q-31

This trench was excavated in the northwestern section of the site to investigate geological transformations and the presence of a fault through stratigraphic methods. The trench measured 2×2 meters, within which 37 contexts were identified, and the excavation reached a depth of 10 meters. Contexts 301 to 307, with a thickness of approximately two meters, are attributed to the Islamic period. The burial matrix of Context 305, located at a depth of around 160 cm, was found within a cavity created by animals. This cavity, probably a rodent burrow, caused mixing and disturbance of the underlying soil layers with the upper layers (Fig. 6). A radiocarbon (14C) test

conducted from the seed sample obtained through flotation yielded a calibrated date of 1508-1434 BCE (95.4%), indicating that this layer has been disturbed and mixed with earlier prehistoric strata (Table 2).

Meander Flow and Formation of Oxbow Lake: At a depth of 2 meters in Trench Q-31, Context 307, like Context 107 in Trench X-35, revealed a one-meter-thick natural silty fine-grained sediment deposit containing abundant remains of small freshwater snails, but no pottery fragments or cultural materials were found. Based on geological and sediment logical analyses, this context represents the remnants of a gradually abandoned channel of an ancient meandering river that eventually transformed into an oxbow lake or stagnant water body. This environmental transformation caused a cultural hiatus across the entire site.

The sub-fault event: The subsidience faultline (Context 309) extends from the western and southern edges of the trench to its northern boundary. This significant geological feature likely results from subsidence or seismic stress along two fissures or fractures caused by a secondary fault. This natural fault has affected more than 1×1 meters of the trench's western and southern sides. It originates at a depth of 2 meters, coinciding with the cultural hiatus layer (Context 307), and has caused a vertical displacement of approximately 40 cm across all sedimentary and cultural layers in this section of the trench (Fig. 5).

Due to the considerable width of the fault fissure, cultural materials such as Islamic, historic, and even prehistoric pottery were displaced from upper layers to deeper contexts, reaching depths of up to 8 meters. This downward movement and the resulting layer disturbances have significantly complicated stratigraphic analysis. To mitigate this issue, from a depth of 8 meters onward, a narrower probe extended northward from the southern wall of the trench. Consequently, excavation continued smaller scale with dimensions of 1.5 by 2 meters.

The Late Bronze Age layers, represented by Contexts 311 to 321, begin at a depth of 4 meters and continue down to approximately 6 meters, with an estimated thickness of about 2 meters. This period includes two architectural phases. The first layer following the cultural hiatus is indicated by the sedimentary deposits of contexts 308 and 310, which extend from a depth of 3 to 4 meters.

Phase I: Radiocarbon (14C) analysis performed on a charcoal sample taken from the hearth in Context 317 at a depth of 430 cm yielded a date of 1512-1440 BCE (66.4%). A separate 14C test on a charcoal sample retrieved through flotation from the same context produced a calibrated date range of 1539-1446 BCE (95.4%). Phase II: This phase likely pertains to a domestic space, starting at a depth of 560 cm and extending to 6 meters. Its primary feature is a hearth (Context 320), situated adjacent to a pit (Context 319). Radiocarbon analysis of a charcoal sample obtained via flotation from Context 319 yielded a calibrated date of 1620-1498 BCE (93.7%).

The Middle Bronze Age is represented by Contexts 322 to 324, beginning at a depth of 600 cm and extending to 700 cm. It includes the remains of an architectural structure featuring a preserved residential floor, mud brick walls, and a hearth. Radiocarbon dating of charcoal from Context 322 yielded a calibrated date of 2299-2142 BCE (84.9%). A separate 14C test on charcoal obtained via flotation from the same context produced a date of 2350-2193 BCE (82.5%).



Fig. 5: Earthquake activity during the Bronze Age in Ghal e-Ben.

The Early Bronze Age includes Contexts 324-335, starting at a depth of 7 meters and reaching 9 meters, with a layer thickness of approximately 2 meters. It comprises two architectural phases:

Phase I: A collapsed wall (Context 325) with scattered mud bricks was observed at 7 meters. Radiocarbon analysis of charcoal from this context yielded a date of 2525-2422 BCE (95.4%),

while the charcoal sample from flotation resulted in 2576-2469 BCE (95.4%). Phase II: The residential floor from Phase I (Context 325) continues from 8 meters depth and is adjacent to a hearth (Context 333). Human remains recovered from this level include an adult (Context 330) and a small child (Context 331). Apart from a single lapis lazuli bead, no additional burial goods or artifacts were found. Radiocarbon dating of charcoal near the hearth (Context 333) yielded a date of 2893-2843 BCE (72.6%).

The Late Chalcolithic layer corresponds to Contexts 335 to 337, beginning at a depth of 9 meters and extending to 10 meters. It primarily consists of cultural and occupational deposits with no preserved architectural features. A 14C test on charcoal from Context 337 produced a date of 3048-2951 BCE (73.9%), while the flotation sample yielded a date of 3101-2925 BCE (93.2%) (Table 2. See charts 1 and 2) (Fig. 6).

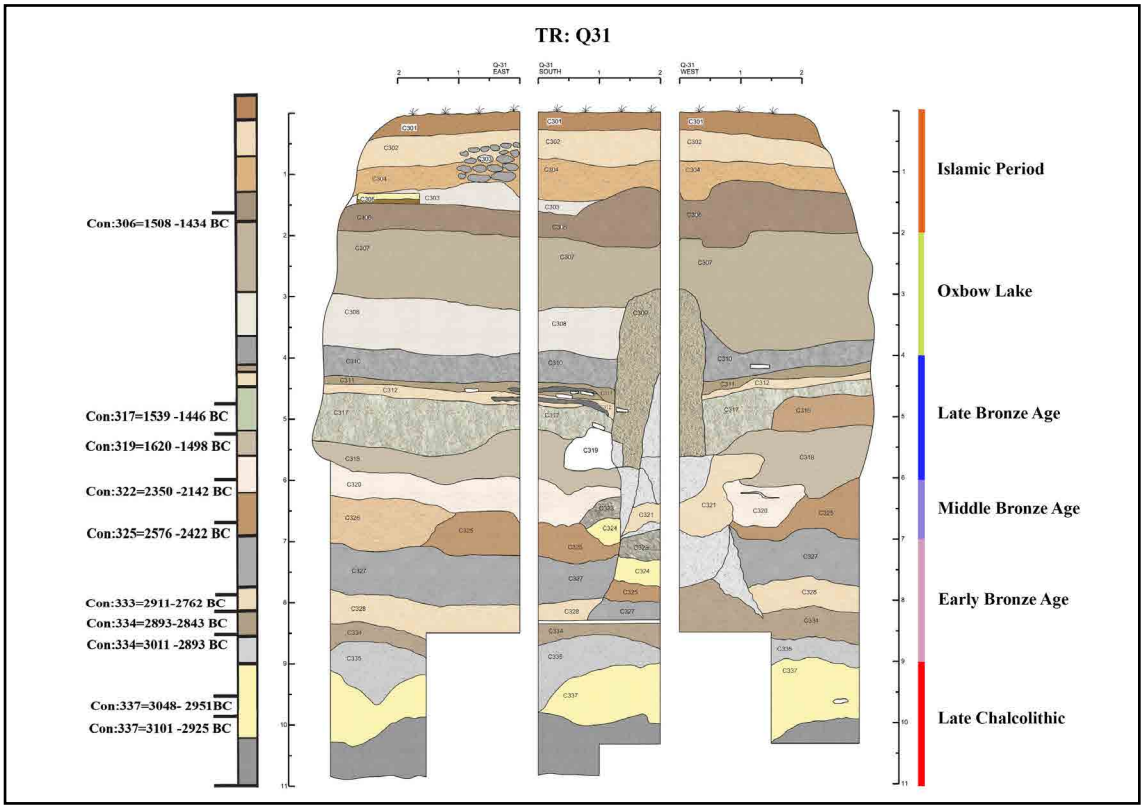


Fig. 6: Trench Q-31 stratigraphic section and location of dated samples.

Table 2: The absolute chronology of Ghal e-Ben, Trench Q-31.

Period	Context	Depth	Radiocarbon date(charcoal)	Radiocarbon Date (seeds)	Comment
10 century A.D.	306	-150 cm		1508-1434 BCE (Lentil)	Context 301-306 is a 10th contrary layer, but the hedgehog removes the soil from context 317 to 306
Gap	307	-200-300 cm			oxbow lake

Late Bronze Age 2000-1500 BCE	317	-420 cm	1512-1440 BCE (66.4%)		kiln
	317	-430 cm		1539-1446 BCE (95.4%)	flotation
	319	-570 cm		1620-1498 BCE (93.7%) (Triticum aestivum)	flotation
Middle Bronze Age 2500-2000 BCE	322	-630 cm	2299-2142 BCE (84.9%)		collapsed wall
	322	-650 cm		2350-2193 BCE (82.5%)	flotation
Early Bronze Age 3000-2500 BCE	325	-680 cm		2576-2469 BCE (95.4%)	flotation
	325	-680 cm	2525-2422 BCE (95.4%)		kiln
	333	-810 cm	2911-2762 BCE *		burial
	334	-855 cm	2893-2843 BCE (72.6%)		kiln
	334	-910 cm		3011-2893 BCE (95.4%)	flotation
Late Chalcolithic 3300-3000 Caspian Black of Red Ware (3200-3000 BCE)	337	-990 cm	3048-2951 BCE (73.9%)		soil layer
	337	-990 cm		3101-2925 BCE (93.2%)	flotation

*** Dated in Mannheim, Germany, other dates analyzed in the School of Archaeology, Peking University.**

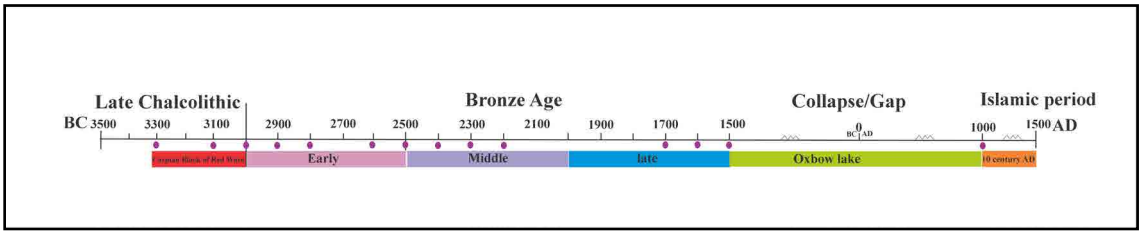


Chart 1: The sequence of settlement at Ghal e-Ben.

3. Findings and Cultural Significance

As previously mentioned, a distinctive decorative bead made of lapis lazuli (Fig. 7) was found next to the remains of a small child within the Bronze Age layers, on the floor of a domestic space in association with a hearth. This finding is of particular significance, as there are no known sources or deposits of lapis lazuli in northern Iran or the Iranian Plateau. The presence of this ornament, therefore, strongly indicates that it was a cultural import. Another notable artifact from the site is a human figurine (Fig. 8) comparable to similar examples previously documented in the Gorgan Plain and at Tureng Tepe (Olson and Thornton, 2019). These items, along with a variety of human-made bone tools of undetermined function and spindle whorls, recovered from the

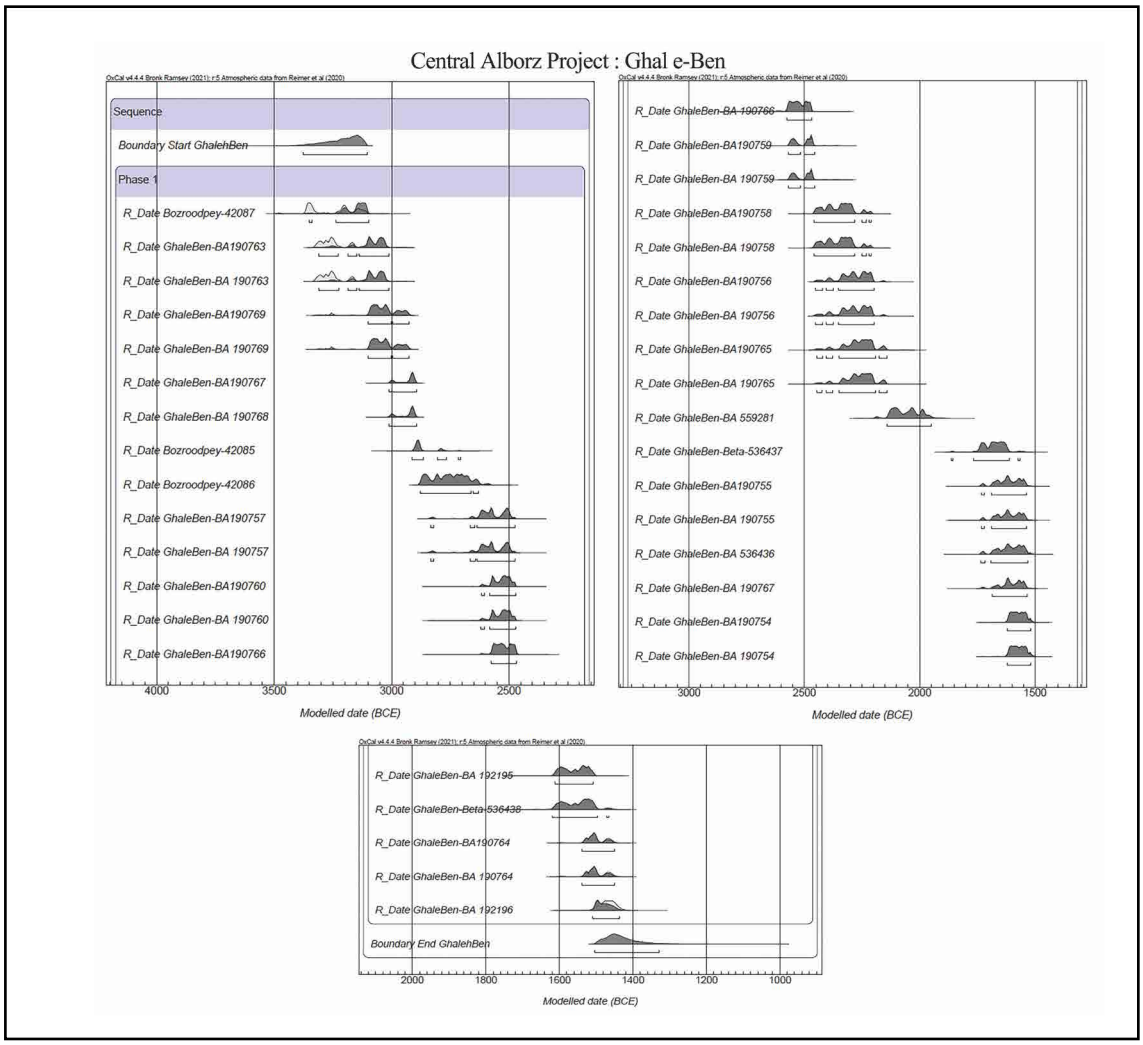


Chart 2: The sequence of settlement at Ghal e-Ben.

Bronze Age horizons, collectively reflect a rural settlement at the Ghal e-Ben. Material culture suggests a community with a subsistence economy based on agriculture and animal husbandry.



Fig. 7: Burial objects recovered from two trenches, X-35, Q-31 (from left to right: lapis lazuli bead, vessel-glass paste pendant, bone tools.



Fig. 8: Human figure found in Ghal e-Ben.

4. The Relative Chronology Based on Typology of Pottery at Ghal e-Ben

4-1. Late Chalcolithic: Caspian Black of Red Ware (3300-3000 BCE)

Although the eastern part of Mazandaran province has a relatively good background related to the fourth millennium BCE. But archaeological visibility of the fourth millennium BCE. in the central and western parts is much weaker than that of the fifth and early fourth millennia BCE. The traces of Sialk III ceramics, both Sialk III4-5 and Sialk III6-7, can be found in sites such as Terkam, Komishani in Neka, and Sad Tepe in Sari, further to the eastern part of Mazandaran, and doubtfully in Astangroad in Nowshahr, in the western part of Mazandaran, who dates back before 3400 BCE (Heydari, 2017; Khazaie Kouhpar, 2012). It seems that during the Early Hissar II (3650-3400), Sialk III3-7 culture penetrated the eastern Mazandaran through the Damghan region. However, both Barbara Helwing and Christopher Thornton (Helwing, 2006; Thornton *et al.,* 2013) accurately address Hissar's "cultural orientation" changes from the west (i.e., the north central plateau) to the north/northeast of Iran, especially turning to the Gorgan plain, which fluoresced around this time. The second half of the fourth millennium BCE is a crucial time concerning highly refined craft production, such as metallurgy and lapidary work, all of which support the inference an elite societal context in the Damghan region. Indeed, during the second half of the fourth millennium that Hissar became a centralized production center, with metallurgical production and lapidary work (particularly with lapis lazuli) on a large scale, with a centrally organized system. And the Gorgan plain could be seen as the consumers of such status goods.

The phenomenon of "Caspian Black on Red Ceramic" at Tepe Hissar also supports such changes of orientation to the north of Alburz Mountain (the Gorgan plain). We can see "Caspian Black of Red Ceramic" emerged in the stronger layers in the Gorgan plain and sites such as Tureng Tepe, Narges Tepe, and Hoseyn Abad support our hypothesis that the Grogan plain was probably the centre or the corridor of "Caspian Black on Red Ceramic" which gradually diffused into the site Tepe Chalow (Vahdati *et al.,* 2019). The absolute dating of Chalcolithic ceramics of Tepe Chalow dates back to 3337-3208 BCE (95.4%) cal BCE (Vahdati *et al.,* 2019: 186). The Chalcolithic pottery can be grouped into distinct types of Black-on-Red and Black-on-Buff painted pottery, which mostly appear at Shah Tepe III and Narges Tepe IV (Abbasi, 2011). In

Mazandaran province, sites such as Gohar Tepe and Ghal e-Ben also address the Caspian Black on Red Ceramic (Fig. 9, N:1-9).

At Gohar Tepe, lower layers introduce both the "Caspian Black on Red Ceramic" and "Burnished Grey Ware", dating back 3511-3426 cal BCE (70.3%) and 3383-3351 cal BCE (25.1%) (Ghasemi Gorji, 2017). Around 30 cm of Ghal e-Ben contains the Black of Red Ceramic, which is handmade, with the surface is covered by red slip. All the paints on the surface due to the high moisture of the lower layers of the site disappear. The 14C date of Context 135 of trench X35 from the 14C labs of Peking University shows 3071 -2971 BCE (50.9%). In Context 137, a burial skeleton was found, which is located on virgin soil. The body was buried in the flex position on the left-hand and the face turned to the southwest. Numbers of beads with a bronze pin, which was fixed in an awl, was found with the skeleton (Safari *et al.,* 2021). The radiocarbon date from this context shows 3363-3129 BCE (Fazeli Nashli *et al.,* 2022a).

An important point is that the "Caspian Black on Red Chalcolithic Ceramic" gradually intermixes with the "Gorgan Grey Ware," which supports gradual developments from the late fourth millennium BCE. of the two above ceramic traditions. We also should consider that the central parts of the southern Alborz do not have strong evidence of fourth-millennium cultural tradition, and large tell sites which emerged during the third millennium BCE. onwards. The limitation of excavated areas from the site of Ghal e-Ben does not allow us to have more cultural data, but sites such as Tepe Chalow and Hoseyn Abad support the relationship between the Namazga III, Kara Depe, Geoksyur I, and Chong-depe (Vahdati *et al.,* 2019; Tadahiko *et al.,* 2010).

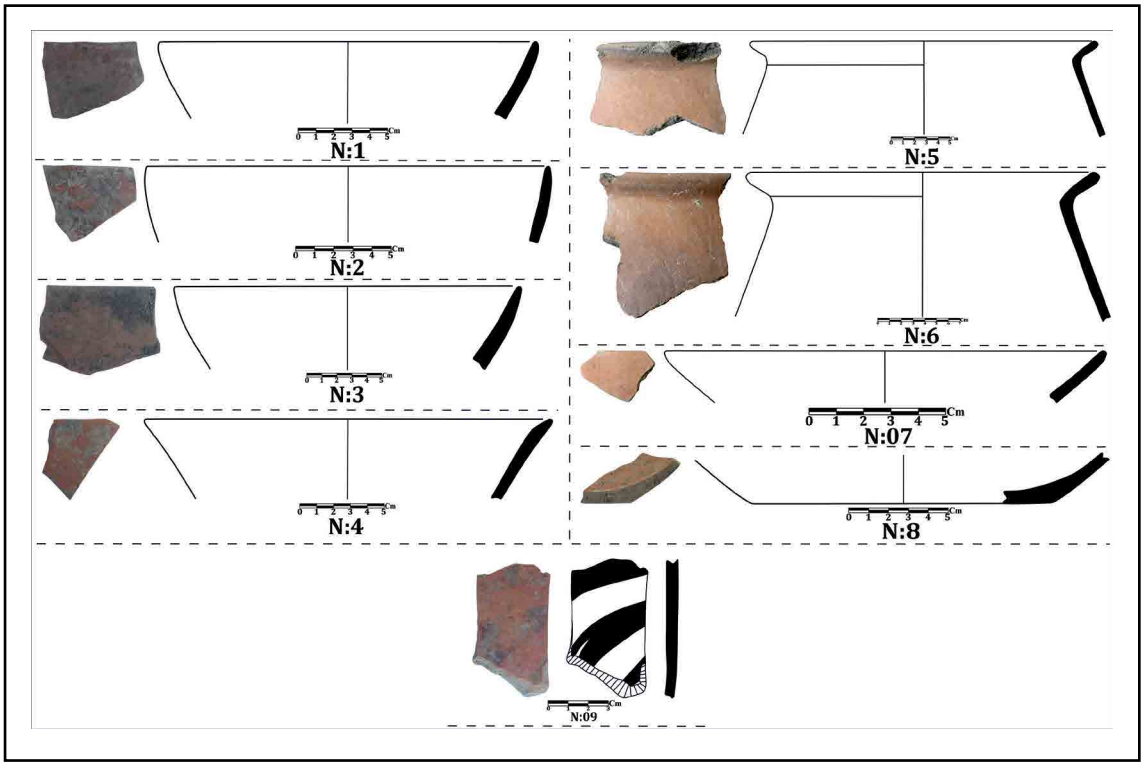


Fig. 9: Late Chalcolithic pottery design of Ghal e-Ben (Kalvari Janaki, Hedayat Allah).

4-2. Early Bronze Age, 3000-2500 BCE.

The population of Mazandaran province flourished during the Bronze Age with the emergence of large centers such as Gohar Tepe, with more than 30 hectares. The same situation took place in the Gorgan plain with large centers such as Tureng Tepe, with its large monumental buildings, etc (Bessenay-Prolonge & Vallet, 2019). Against this background, the Early Bronze Age of Ghal e-Ben starts from ca. 3000 BCE., & ends at ca. 2500 BCE. With the beginning of the Bronze Age, the technology and style of pottery changed with the appearance of "Gray Wares" from light to dark colours. During this period, we see seven types of spout containers, such as open, vertical, shoulder, closed, and congressional. Eight types of vessel forms, including varieties of bowls, jugs, cauldrons, cups, jars, glasses, plates, and small cups (Fig. 10, N:1-17). Most of the ceramics are wheel-made with the inorganic temper and fired in the closed kilns; the surface is burnished, engraved, and polished. Patterns are a combination of geometric lines decorated with thin, wide strips or horizontal, vertical, and diagonal lines. The most important types of these designs are in the form of wide horizontal, vertical, and diagonal strips or a combination of these several items, in the form of spiral patterns, zigzag patterns, square and lozenge-shaped patterns, circular and pin-shaped patterns. The location of these designs is on the exterior surface and in the upper and middle segments of the vessels. Polished patterns are in the form of wide horizontal strips, narrow irregular horizontal lines, and irregular square grids that have been used in the upper part of the vessels and the parts of the shoulder and body. Also, carved designs have been used in two ways on the surface near the rim of vessels, looking like mouse teeth and with several horizontal lines (Safari et al., 2021). The dark and light grey ceramics of Ghal e-Ben Early Bronze Age are comparable with Gohar Tepe (Mahforozi, 2007), Yaghout Tepe (Mahforozi, 2006), Kelar Tepe, Kelardasht (Mousavi Kouhpar and Abbasnejad Seresti, 2007), Ghal e-Kesh (Amir Kolaei, 2009), Ghal e-Pey in Sari (Mahforozi, 2009), Terkam (Mahforozi, 2010), Komishani (Fazeli Nashli, 2017) and Tepe Abbasi in Neka (Abbasnejad Seresti, 2009) these ceramics is also comparable with the north-eastern regions such as Shah Tepe, Tureng Tepe IIIA, Narges Tepe IIIC, and Hissar IIB-IIIA. Related to the pottery forms, the most connection can be found with the sites of Shah Tepe, Tureng Tepe and Yarim Tepe (Arne, 1945; Deshayes, 1968a, 1976b; Stronach, 1972) and Narges Tepe in Gorgan (Abbasi, 2011) Gorgan plain and Hissar (Schmidt, 1937; Dyson and Howard, 1989).

Along with the grey wares, several pieces of Kura-Araxes pottery types were identified in Ghal e-Ben. With the polished surface and engraved decoration, and with the typical handles of Kura-Araxes type (Fig. 10, N. 8 and 13). Delicate logs consist of zigzag and triangular strips, geometric carving lines with combed and wavy ornaments, and nail-shaped lines carved on the outer or inner edge of the dishes, which are comparable to specimens. The type of ceramics is also found at Kelar Tepe (Heydarian, 2011: 247). It is also comparable to the Astankrood site of Nowshahr (Khazaei, 2011: 194-195). This pottery is a sign of cultural connection with the western and northwestern areas, and in a way, the area of Ghal e-Ben can be considered as the easternmost area of influence of Kora-Arax culture.

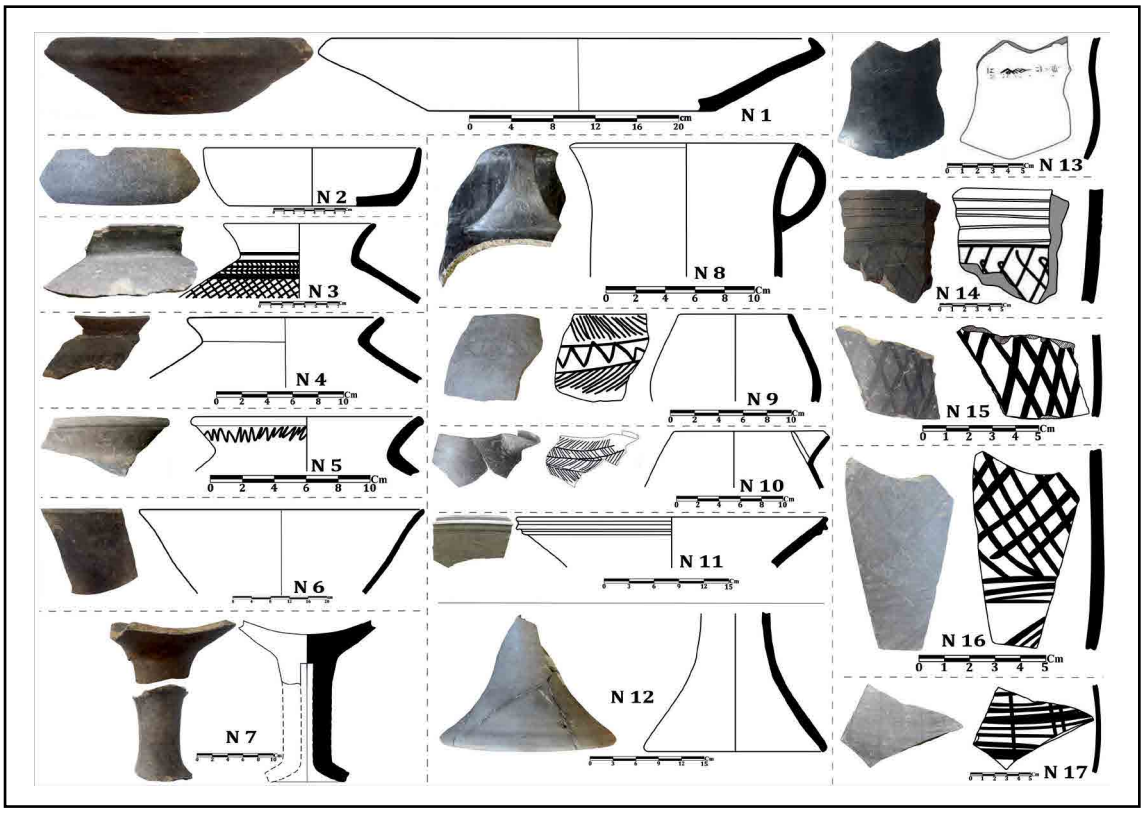


Fig. 10: Early Bronze Age pottery of Ghal e-Ben (Kalvari Janaki, Hedayat Allah).

4-3. Middle Bronze Age 2500-2000 BCE.

During the Middle Bronze Age, we see innovations such as new shapes of vessel mouth forms, and new forms, including tubular, ventral, handle, and chamfered rim. The bowls form disappeared, but new forms such as pitchers, pots, and jars were used during the Middle Bronze Age. Ceramics were fired in closed kilns and wheel-made, while the surface treatments of the Early Bronze Age were continued, but horizontal lines were applied on the surface of the vessels. Regarding the placement of the designs, it can be said that the burnished and polished patterns were used on the whole surface of the vessels. The polished patterns of this period were created with less depth than the previous period, and the burnished patterns were created on both the inner and outer surfaces of the vessels. A variety of thin patterns of motifs in the form of horizontal and vertical lines have been used. The embossed designs of this period have a different variety than the previous period and are seen in the form of horizontal lines and rope embossed designs. Some of the motifs of the previous period were also not used in this period. The new designs of this period can be in the form of regular and irregular squares with narrow burnished lines, combined geometric designs in the form of horizontal, vertical, diagonal, and tangled lines, cross lines, truncated patterns, and vertical toothed patterns lines (Safari *et al.,* 2021) (Fig. 11, N:1-20).

Middle Bronze Age pottery of Ghal e-Ben is comparable with Gohar Tepe (Mahforozi, 2007), Yaghout Tepe (Mahforozi, 2006), Tepe Kelardasht (Mousavi Kouhpar and Abbasnejad Seresti, 2007), Ghal e-Kesh in Amol (Amir Kolaei, 2009), Ghal e-Pay in Sari (Mahforozi, 2009), Terkam in Sari (Mahforozi, 2010), Komishani Tepe (Fazeli Nashli, 2017), and Abbasi in Neka (Abbasnejad

Seresti, 2009). Also, based on the pottery typology, there is obvious high resemblance of pottery types with the northeastern sites such as Hissar IIIB (Schmidt, 1937), Yarim Tepe III (Stronach, 1972), Shah Tepe II (Arne, 1945), Tureng Tepe IIIB (Deshayes, 1968-1976), and Narges Tepe IIIB (Abbasi, 2011). In general, it seems from this period, the connections with north-western Iran ended, and there is a gradual decrease of ceramic style and form in the Gorgan plain, which indicates a new cultural boundary.

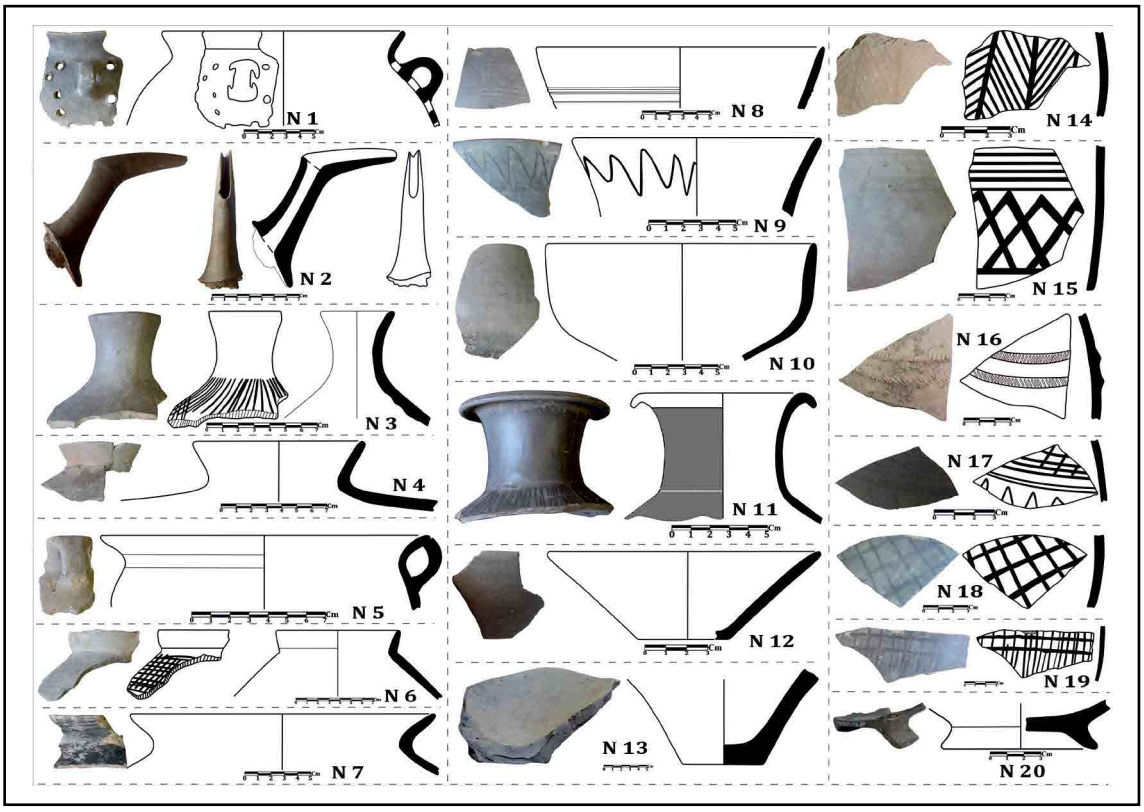


Fig. 11: Middle Bronze Age pottery of Ghal e-Ben (Kalvari Janaki, Hedayat Allah).

4-4. Late Bronze Age 2000-1500 BCE.

Here in this paper, we will discuss more about the cultural gaps during the third and second millennia BCE. but, the site of Ghal e-Ben experienced two cultural gaps at the end of the third millennium BCE. and beginning of the second millennium BCE. Then the site was re-occupied from ca. 1700 BCE. and finally abandoned during the first half of second millennium BCE. During the Late Bronze Age, although the shape of the rim increased, in general, the forms are the continuation of the previous period with less innovation to come. The most important types of rims are open, vertical, concave, closed mouth, necked, funnel-shaped, tubular, and rim with handle. During this period, bowls that were not used during the Middle Bronze Age began to be made again. Jars continued in three types: shoulder, shoulderless, and handled, and cups of the handleless type with a cylindrical shape. The jars are in one category with handle type, and food storage vessels and cooking containers, also the continuation of the Middle and Early Bronze Age. Pitchers that became popular from the Middle Bronze Age continued in this period with

the two types of simple and handle forms, and cups, which were simple in the Early Bronze Age, in this period is in two simple forms with a low rim. As in the two previous periods, the pottery was fired more adequately in closed kilns which most of which are wheel-made. The engraved decoration ended during the Late Bronze Age. Another important aspect regarding the motifs is their placement, which appears on various parts such as the base, rim, shoulder, neck, stem, outer edge, and interior surface lines (Safari *et al.,* 2021).

The burnished designs of this period do not have a special order and were used only in certain parts of vessels, such as under the pipe and inside the pipes. Burnished pattern of this period can be a combination of helical and horizontal motifs in the form of wide strips, vertical zigzags with thin and wide horizontal and vertical bands, irregular horizontal and vertical bands, zigzag motifs that evoke the ladder form, and helical motifs. Horizontal and horizontal and vertical strips are deformed. Among the designs that appeared for the first time in this period, we can mention the designs of empty circles on the inside of ceramics. Another type is diagonal lines that were used with less depth than in previous periods. Another issue is that paints are in the base, rim, shoulder, on the rim inner parts of the rim (Fig. 12, N: 1-18).

The Late Bronze Age pottery of Ghal e-Ben is comparable to Gohar Tepe in Behshahr (Mahforozi, 2007), Yaghout Tepe (Mahforozi, 2006), Ghal e-Kesh in Amol (Amir Kolaei, 2009), Ghal e-Pay in Sari (Mahforozi, 2009), Tepe Kelar (Mousavi and Abbasnejad Sereshti, 2007; Mousavi Kouhpar, 2009), Hissar IIIC (Schmidt, 1937), Shah Tepe IIA (Arne, 1945), Tureng Tepe IIIC (Deshayes, 1968; 1976) and Narges Tepe IIIA (Abbasi, 2011).

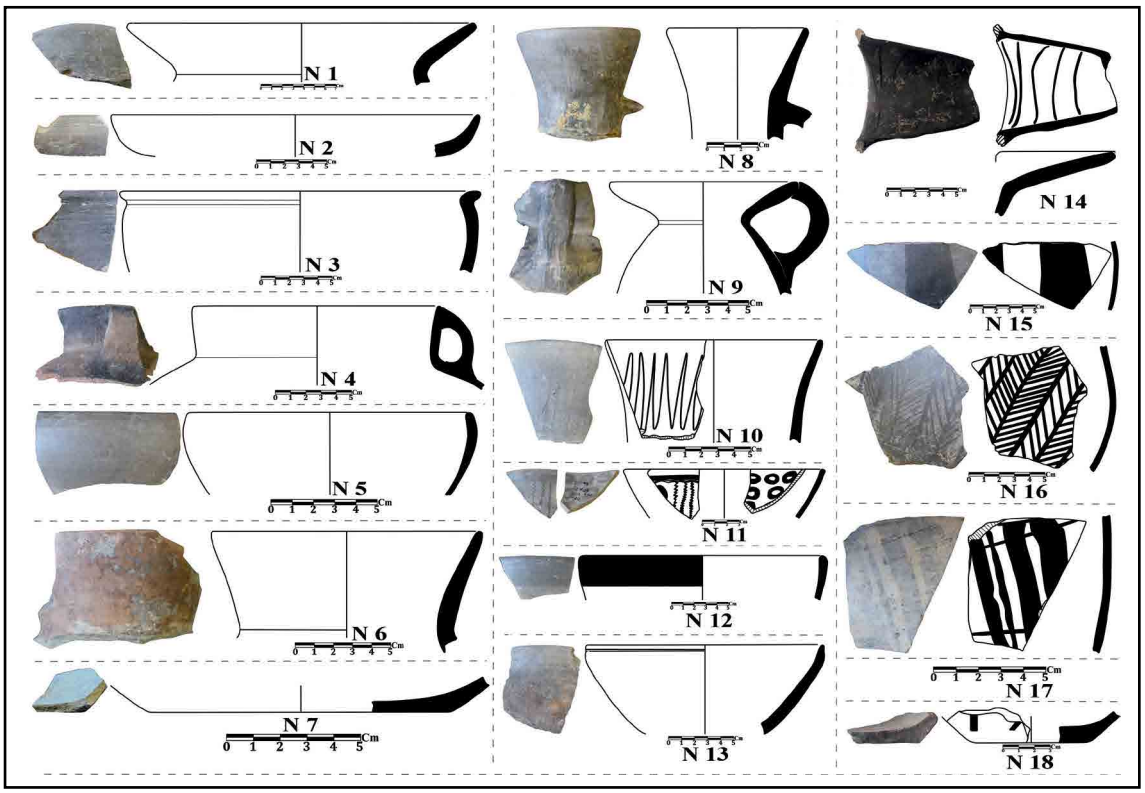


Fig. 12: Late Bronze Age pottery of Ghal e-Ben (Kalvari Janaki, Hedayat Allah).

5. Faunal remains from Ghal e-Ben

A total of 745 animal bones were recovered from very well-preserved conditions during the excavations of the three stratigraphic trenches at Ghal e-Ben. The archaeozoological studies of this collection could shed light on the exploitation of animals and herding strategies of Bronze Age occupants in the southern Caspian Sea shore. Within the collection, 333 bones belong to the Early Bronze Age, 204 bones to the Middle Bronze Age, 182 bones to the Late Bronze Age, and 14 bones only to the Early Iron Age. 73% of the collection (533 bones) was identified to the level of genera and species. Faunal spectra are not very diverse, which include cattle, sheep, goat, pig, red deer, dog, fox, beech marten, and waterfowl (Table 3).

Table 3. Taxonomic distribution of animal remains in number (NR) and weight (WR) of remains.

Ghal e-Ben 2019	Early Bronze Age		Middle Bronze Age		Late Bronze Age		Early Iron Age		Total of NR	Total of WR (G)
Species	**NR**	**WR**	**NR**	**WR**	**NR**	**WR**	**NR**	**WR**		
Bos taurus	84	6190.2	35	1861.3	29	2340			148	10391.5
Ovis aries	9	242	8	171.3	14	237.7	1	1.4	32	652.4
Capra hircus	9	101.2	2	53.4	5	77.6			16	232.2
Caprinae	47	541.8	76	483.9	55	425.1	7	55.6	185	1506.4
Sus scrofa	82	2302	33	875.1	18	435.6			133	3612.7
Cervus elaphus	1	296.8	1	34.5					2	331.3
Canis familiaris	2	6.3			6	30.4			8	36.7
Vulpes vulpes	2	11.3							2	11.3
Canidae	1	1.7							1	1.7
Martes foina	1	2.4							1	2.4
Carnivorae			1	8.3					1	8.3
cf. Pelecanidae			1	42					1	42
Anas sp.	2	1.9							2	1.9
Mollusc							1	0.2	1	0.2
Large mammal	34	661.3	16	299.2	14	193.6			64	1154.1
Medium mammal	7	63.3	4	62.1	1	7.9			12	133.3
Small ruminant	52	175.4	27	101.6	40	108.6	5	10.3	124	395.9
Grand Total	**333**	**10597.6**	**204**	**3992.7**	**182**	**3856.5**	**14**	**67.5**	**733**	**18514.3**

The main animal species exploitated are domesticates, including Bos taurus, Ovis aries, Capra hircus, and subsequently, Sus scrofa domesticus. The standards introduced by Von den Driesch (1976) were used for bone measurement. The size of sheep and goat compared with the reference collection by using the Log Size Index method. Sheep measurements were compared with wild sheep (Ovis orientalis) and goat (Capra aegagrus) published by Uerpmann and Uerpmann (1994), and of domestic cattle (Bos taurus) by Helmer (1992). The average size of sheep and goat populations at Ghal e-Ben, with a value of -0.033 and -0.075, respectively, is smaller than the reference species. The average size for the cattle, with a value of 0.042, is a little bit larger than the reference. The size variations in sheep, goats, and cattle could be explained by exploitation strategies in various ages and sexes during the Bronze Age. Comparison of pig measurement with wild boar reference species (Payne and Bull, 1988) showed the smaller size in most of the Ghal

e-Ben collection. The age of the animal at death was estimated by tooth wear and epiphyseal fusion of bones. These analyses indicate that two-thirds of cattle and sheep/goat populations had been slaughtered between 2 to 6 years after the age of puberty. The equal status for immature and mature animals was observed for porcines. It seems Ghal e-Ben habitants kept females for the years after puberty.

Hunting played a very marginal role in the subsistence economy of Ghal e-Ben, with 3% of identified species. The northern slope of the Alborz Mountains is among the main habitats of red deer; however, represented only by two bones in the collection. The presence of beech marten bone with cut-marks is interesting, probably hunted for their coat or fine fur. The inhabitants also hunted migratory waterfowl from nearby wetlands. The presence of a red fox might be intrusive. It is noteworthy that fish bones are absent in the collection of this season of excavation. Cut marks of the butchering process were the most common traces identified on 56 bones. Cooking and grilling caused very dark brown and black colours on bones, and tool making are among the other human activities traces at the site. Canid and rodent gnawing traces were also observed on various bones. Most of the human and animal traces appeared on domestic animal bones (Fig. 13).

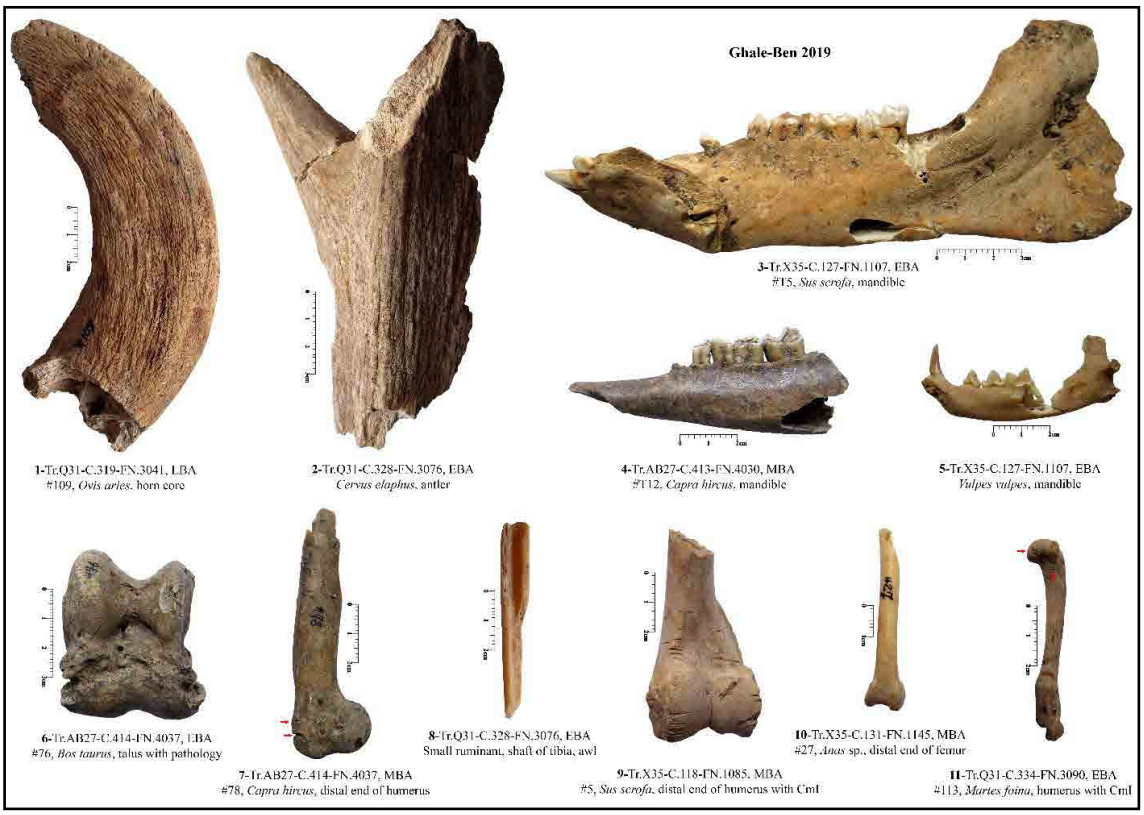


Fig. 13: Selection of some bones, 1: Sheep horn core; 2: Red deer antler; 3: Pig mandible; 4: Goat mandible; 5: Red fox mandible; 6: Cattle talus with pathology; 7: Goat humerus with cut-mark; 8: Awl made from small ruminant tibia; 9: Pig humerus with cut-mark; 10: waterfowl femur; 11: Beech marten humerus with cut-mark.

There was a diachronic ascending tendency towards breeding and exploiting sheep/goats and cattle versus pigs from the EBA to the LBA. During the EBA, 36% of identified specimens were allocated to pigs, while cattle and sheep/goats accounted for 31% and 29%, respectively. Unlike

the prior period, this ratio changed during the MBA with increasing sheep / goats to 49% and decreasing cattle and pig portions to 25% and 24%, respectively. The preference for sheep / goats had continued into the LBA, accounting for 59% of the collection, while cattle and pigs comprised 23% and 15%, respectively. The distribution of bone weight of each species also approximately confirmed this tendency (Fig. 14).

Although there is some difficulty in distinguishing between all bones of Caprine, sheep are more common than goats, with an average ratio of 2.5:1. The faunal remains, with the importance of cattle and sheep, are characteristic of residential sites and an indicator of developed animal husbandry. The same pattern in animal exploitation was identified in the nearby Iron Age site in Gillan, Pila Qaleh, with emphasis on the exploitation of cattle. Noteworthy that wild animals were used as a supplementary source in the subsistence economy of Pila Qaleh and Jalaliye (Davoudi *et al.,* 2019), when hunted animals played a very marginal role in Ghal e-Ben.

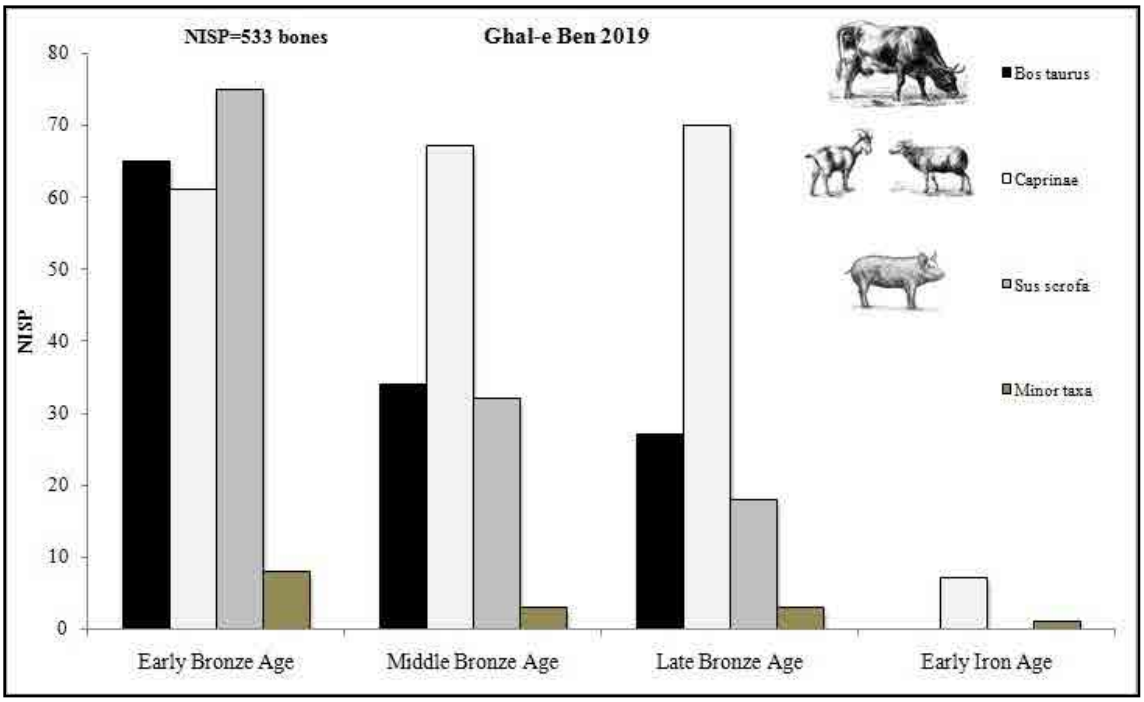


Fig. 14: Faunal spectra in percent of Number of Identified Specimens (NISP).

The high proportion of pig is interesting, while there are not enough data about the domestication of boar in northern Iran. If we just consider the least portion of pig in Ghal e-Ben during LBA by 15% of NISP, it is five times more than the average (approximately 3% of collections) of other sites in Iran (Mashkour, 2006). Ghal e-Ben could be a key case study for evaluating the domestication of pig in Iran: It depends on the nature of the northern slopes of the Alborz Mountains. The nearly same strategy is documented in the Bronze Age sites of south-eastern Turkey, such as Kenan Tepe, Musluman Tepe, Hirbemerdon Tepe, Türbe Höyük, etc (Berthon, 2013). In this context, it is very important to define the role of herding versus agriculture in the region. In the extraordinarily lush environment of Mazandaran, the interaction between these two economic activities may appear simple, but must nevertheless have been relatively complex. These studies highlight the complexity of the herding strategies on a micro-regional scale.

6. Agricultural Economy and Plant Exploitation in the Bronze Age Society of Ghal e-Ben

The earliest evidence of the agricultural economy of the southern Alborz Mountain dates back to nine millennia BCE, when the last hunter-gatherer of the Caspian Sea independently started to cultivate the agricultural lands mostly in front of caves and finally fully became agricultural sedentary villagers during the second half of the seventh millennium BCE (c.a. 6500 BCE) (Leroy *et al.,* 2017, Fazeli Nashli *et al.,* 2024a; Fazeli Nashli, 2024b, Fazeli Nashli, 2024c, Abbasnejad Seresti, 2024a, Abbasnejad Seresti *et al.,* 2024b). As we mentioned here, the eastern Mazandaran province was populated as "Eastern Gray Ware Culture," while the pathway of the two "steppe societies" (Lunea, 2017) and farming societies in the Gorgan plain and Mazandaran was completely different. In Central Eurasia transformation from hunting to mobile herding without agriculture started during the fourth millennium BCE, and the agricultural economy started during the third millennium BCE. (Spengler *et al.,* 2014; Billings *et al.,* 2022). Archaeological evidence from Ghal e-Ben indicates that the economy of Bronze Age communities in Mazandaran was primarily based on animal husbandry and agriculture. In this rainfed region, Bronze Age farmers practiced dryland farming rather than irrigation (Huang *et al.,* 2023). Ehlers (2001a, 2011b) writes, the natural water potential in the Caspian lowlands, including Gillan and western and central Mazandaran, provided sufficient precipitation for rain-fed agriculture. The region's topography, characterized by a dense network of brooks, ravines, and rivers with large delta fans, has facilitated dry-land farming from prehistoric times to the present.

Archaeological findings suggest that the settlers of Ghal e-Ben extensively cultivated vast areas surrounding their villages. The abundance of botanical remains across all excavation contexts points to a well-developed agricultural system that likely contributed to social inequality during the Bronze Age. Initial surveys conducted by Fazeli Nashli and Mojtaba Safari in the Babol and Qaem Shahr regions indicate that all Bronze Age sites in this area emerged as large settlements. These sites contain extensive cultural layers rich in ash, bones, and seeds, signifying intensive settlement activity. The presence of large populations in these tell-centered landscapes suggests that food production on an extensive scale was essential, leading to social stratification and labor division. The globalization of the economy in the late third millennium BCE. played a significant role in surplus accumulation and diversification of food resources in Mazandaran, particularly through millet cultivation at Ghal e-Ben.

The archaeobotanical analysis of Ghal e-Ben provides crucial insights into past agricultural practices and plant utilization. The study of carbonized plant remains from different contexts has revealed a diverse assemblage of cultivated cereals, pulses, and gathered plants. These findings enhance our understanding of ancient subsistence strategies, crop choices, and potential trade or cultural exchanges in the region. The cereal assemblage from Ghal e-Ben predominantly consists of Triticum aestivum (bread wheat) and Hordeum vulgare (barley). The presence of grain and rachis fragments in context 113 suggests that processing activities such as threshing and winnowing were conducted on-site. The identification of naked Hordeum vulgare indicates a preference for free-threshing barley, which may have been used for human consumption or brewing purposes.

Additionally, Triticum spelt (spelt wheat) was found in multiple contexts, including grain and glume base remains, highlighting its significance in local agriculture.

Beyond cereals, the archaeobotanical assemblage includes several pulse crops, which were essential protein sources in ancient diets. Identified species include Vicia ervilia (bitter vetch), Lens culinaris (lentil), Lathyrus sativus (grass pea), and Pisum sativum (pea), recovered from contexts 113, 306, and 114. These legumes would have contributed to soil fertility through nitrogen fixation, supporting sustainable farming practices. Their widespread presence across multiple contexts suggests their integration into daily food consumption and storage strategies (Fig. 15).

In addition to staple crops, the presence of oil and fiber plants such as Linum spp. (flax) and aromatic or culinary plants like Coriandrum sativum (coriander) suggest a broader spectrum of plant use at Ghal e-Ben. Flax remains from context 114 indicate its possible role in textile production or oil extraction. The discovery of Cucumis spp. (melon or cucumber) and Vitis spp. (grape) suggests that fruit cultivation or gathering was also practiced, reflecting dietary diversity and potentially early viticulture in the region.

Overall, the archaeobotanical evidence from Ghal e-Ben underscores a complex and well-developed agricultural system during the Bronze Age. The diversity of cereals, pulses, and gathered plants highlights the adaptive strategies employed by past societies to ensure food security and economic sustainability. Further analysis, including isotopic and genetic studies, could provide deeper insights into crop management, climatic adaptations, and the broader socio-economic dynamics of ancient agricultural communities in the region (see: Huang *et al.,* 2023).

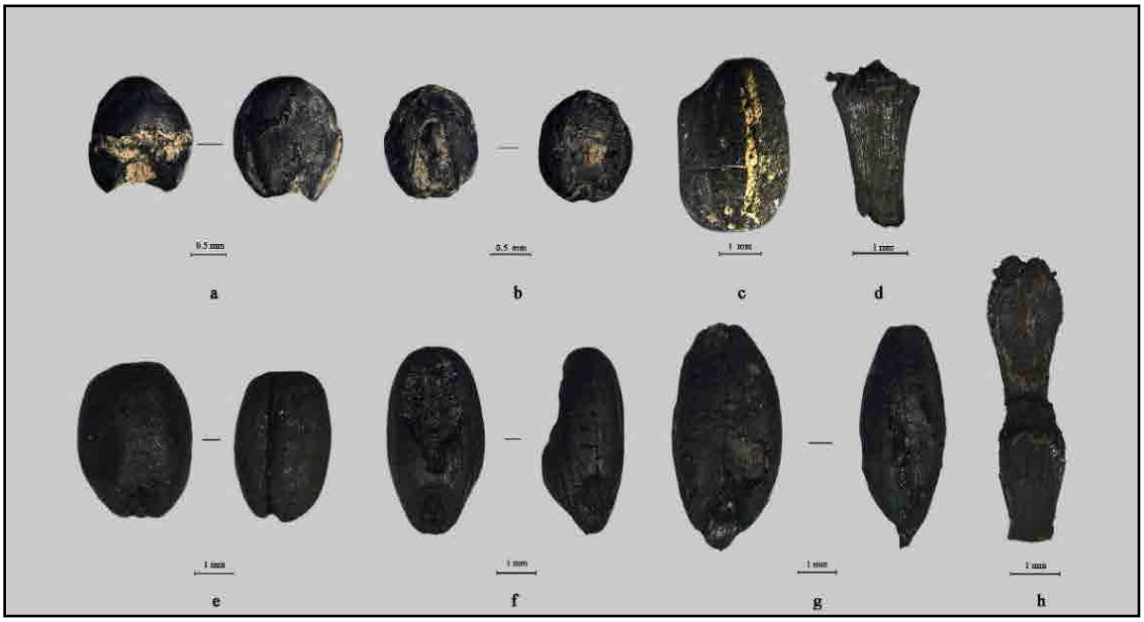


Fig. 15: Cereal grains and chaff from Ghal e-Ben: a) Panicum miliaceum; b) Setariaitalica; c) Oryza sativa; d) Hordeum vulgare rachis, six-row, hulled type; e) Triticum cf. timopheevii glume base; f) Triticum aestivum/durum; g) Triticum cf. timopheevii; h) Hordeum vulgare var. coeleste (naked, six-row); Triticum aestivum rachis (Huang *et al.,* 2023).

7. Human remains from Ghal e-Ben

During excavations at Ghal e-Ben, skeletal remains of at least nine individuals were uncovered and subsequently analyzed using a modified version of the standard osteological protocol by Buikstra and Ubelaker (1994), (Sołtysiak et al., 2019). The stature of adult individuals was estimated using the formulas proposed by Trotter and Gleser (1952) based on measurements of the upper limbs, originally developed for white males. The assemblage comprised incomplete skeletons of three adults and four subadults, along with one additional adult and one subadult represented only by a few bone fragments. The subadult individuals fell within a relatively narrow age-at-death range of 2 to 6 years, corresponding to early post-weaning children (Table 4).

The most complete skeleton (Q31-C330) belonged to a mature female individual. Sex and age-at-death were confidently determined through pelvic morphology. Most skeletal elements were present, though often incomplete; missing elements included the left scapula, mandible, and substantial parts of the cranial vault. Despite her relatively advanced age at death, no degenerative joint diseases were observed, and dental wear was moderate. Clear single hypoplastic lines appeared on the upper canines and central incisors, which likely indicate an episode of post-weaning stress (Reid and Dean, 2000). Alongside this skeleton, some right-hand bones belonging to another adult individual were found; these bones were more eroded and showed signs of degenerative joint disease.

Another adult skeleton from the same trench (Q31-C305) was identified as a mature male based on cranial morphology and long bone measurements. This skeleton was less complete than the previous one, missing both ossa coxae, as well as the left tibia, fibula, and radius.The second male skeleton (X35-C128) (Fig. 16) is relatively complete, although most epiphyses of the long bones were heavily damaged. This individual was also considered quite old. The subadult skeletons were generally more incomplete than the adults. The oldest child (5–6 years old, AB27-C415) was mainly represented by upper limb bones, with only a few fragments from the lower body and skull preserved. Another subadult individual (X35 C135) (Fig. 17), aged between 3 and 5 years as estimated from tibial length (Boccone *et al.,* 2010), is represented mostly by fragmented long bone diaphysis and small skeletal pieces, with no skull present. Red staining observed on most elements was likely caused by red ochre.

A three-year-old skeleton from trench X35-C121 included the skull and upper body, while lower limbs were mostly absent except for a fragment of the distal femoral metaphysis. Finally, an incomplete skeleton of a two-year-old child (Q31-C331) was recovered, represented by fragments of the cranial vault and sphenoid, the lower spine with some ribs, pelvis, right clavicle, and various long bones.

8. Environmental crisis during the Bronze Age and the issue of the cultural gap at Ghal e-Ben during the Bronze Age

Environmental determinism has played a fundamental and decisive role in human history from ancient times to the present. To fully understand cultural transformations and developmental trajectories of societies, it is essential to examine the environmental and geographical contexts



Fig. 16: skeleton (X35-C128).



Fig. 17: subadult individual (X35-C135).

in which these communities existed. Without such an understanding, the nature and causes of cultural, economic, and social changes of the past civilizations cannot be comprehensively grasped. Studying the geographical and environmental settings of our ancestors provides valuable

Table 4: Basic characteristics of human remains from Ghal e-Ben (Soltysiak *et al.*, 2019 b).

Trench	Context	Sex	Age-at-death	Caries	Stature	Chronology
AB27	415	-	5-6			Early Bronze Age
Q31	305	M**	mature	2/12	171 cm	Early Bronze Age
Q31	330	F	45-50	0/10	168 cm	Early Bronze Age
Q31	330	?	adult			Early Bronze Age
Q31	331	-	2			Early Bronze Age
X35	121	-	3			Early Bronze Age
X35	121	-	3			Early Bronze Age
X35	128	M*	old	0/8	180 cm	Early Bronze Age
X35	135	-	3-5			Late Chalcolithic

insights into cultural changes and the evolution of ancient civilizations (Safari *et al.*, 2024; Azizi *et al.*, 2019; Staubwasser *et al.*, 2003; Helama, 2024; Shaikh Baikloo *et al.*, 2020; Fazeli Nashli *et al.*, 2023; Bini *et al.*, 2019; Bal *et al.*, 2024).

Integrated archaeological, geoarchaeological, archaeoseismological, geomorphological, and sedimentological investigations in trenches Q-31 and X-35 of Ghal e-Ben has revealed some environmental crisis significantly influenced the establishment, persistence, and eventual abandonment of settlements in this region during the third and second millennium BCE. One of the most impactful events occurred at the end of the third millennium BCE in Ghal e-Ben and also in Gohar Tepe and was that the seismic fault activity (Nazari *et al.*, 2021), which triggered the abandonment of numerous settlements in the area during the Bronze Age. Closely following this seismic disturbance, the 4.2 ka BP climatic event during the Late Holocene—marked by abrupt aridification and prolonged drought—exerted widespread climatic stress across Iran and the broader Near East. Paleoenvironmental evidence from sediment cores and paleoenvironmental proxies across various Iranian sites—including the Persian Gulf, Lake Neor, Lake Urmia, Hamun Lake, Jazmourian, Konar Sandal (Jiroft), and Gol e-Zard Cave—attests to this extensive environmental fluctuation during the Bronze Age (Carolin *et al.*, 2019, Fazeli Nashli *et al.*, 2022b, Vaezi *et al.*, 2025).

Stratigraphic analysis and radiocarbon dating at Ghal e-Ben (approximately 2299-2142 to 1753-1611 BCE) reveal a period of site abandonment, which we assume corresponds with the 4.2 ka BP event. The interesting point is that the site of Gohar Tepe was abandoned during this time, and after 300 years, the urban site was again reoccupied (Ghasemi, 2017, Nazari *et al.*, 2021). A distinct layer of dry and warm sediments aligns temporally with this event, while the absence of cultural artifacts supports the conclusion that environmental factors drove this desertion. These observations correspond with broader regional patterns of depopulation and cultural disruption linked to climatic stress. In summary, the archaeological record of Ghal e-Ben exemplifies how

abrupt Holocene climate changes, particularly the 4.2 ka BP aridification event, played a critical role in cultural transformations and population movements in ancient Iran. Understanding these past human-environment interactions enhances our comprehension of resilience and vulnerability in the face of environmental and climatic challenges.

Ghal e-Ben was again inhabited in the late Bronze Age, around the 17th century BCE., & then was abandoned around 1500 BCE. after a short occupation during the second millennium BCE. Additionally, geomorphological processes such as the development of meandering watercourses and oxbow lakes led to sediment accumulation, which contributed to the site's eventual desertion. The presence of dense clayey soils with high lime content and freshwater mollusk remains in specific trench contexts points to sustained fluvial and sedimentary dynamics influencing human habitation patterns. Another indication of environmental impact at the site is the formation of meandering water flows and the development of oxbow lakes or stagnant waters, which contributed to the site's eventual abandonment. In trenches Q-31 (Contexts 306, 307, 309) and X-35 (Context 107), dense clayey soils with high lime content and freshwater mollusk remains (shells and river snails) were discovered, indicating sedimentary and fluvial activity. These environmental conditions likely prompted the inhabitants of Ghal e-Ben to leave the area in search of a new settlement (see: Safari *et al.,* 2021).

Our archaeological literature review addresses that the second cultural gap started not only in Ghal e-Ben but also in most of the Bronze Age settlements of Mazandaran and northeastern Iran with a ca. 300-year cultural Hiatus. We propose the time ranges between 1500 to 1200 BCE. of the final Bronze Age faces with a diverse cultural diversity not only in the north and south of central Alborz but also the settlement pattern of the northeastern Iran and central Asia (Vahdati, 2020; Luneau, 2018, 2021; Cerasetti *et al.,* 2022; Vahdati *et al.,* 2025). It is important to point out that the Greater Khorasan Civilization/BMAC collapsed 1600/1500 BCE with profound climatic upheavals, and most parts of Central Asia and the northwestern Iran entered into a new settlement pattern and economic strategies with a large-scale scale of settlement shift. This event coincided with major cultural declines in the Bronze Age, manifesting in reduced settlement activity and a shift from sedentary agriculture to pastoral nomadism in some communities. With such environmental adversities, the inhabitants of Ghal e-Ben exhibited resilience by maintaining occupation into the Iron Age (Fazeli Nashli *et al.,* 2024a).

10. Discussion

The eastern regions of Mazandaran, endowed with favourable environmental features such as an abundance of freshwater resources, fertile soils, and rich marine and forest resources, offered an ideal setting for the emergence of farming communities. Based on the current data, most of the excavated sites in Mazandaran were abandoned around 1500 BCE. afterward, and after 400 to 300 years again re-occupied during the Iron Age with fundamental changes in settlement types, mortuary practices, and quality and quantity of craft goods found in the graves, and also changes in subsistence economy and diet. As it was mentioned above, the settlement survey of Mazandaran addresses a sudden increase in population from the beginning of the third millennium

BCE (Heydari, 2017), while during this time in the north central plateau, settlements collapsed and most of the villages were depopulated (Fazeli Nashli *et al.,* 2021).

Back to Mazandaran and the southern part of the Caspian Sea, the population of some settlements such as such as Ghal e-Kesh with 15 hectares and Gohar Tepe with 50 hectares, Tepe Kelar with six hectares, and Ghal e-Ben with more than six hectares (present day is around 2.5 hectares), all support a large scale of population density during the Bronze Age in Mazandaran (Piller and Mahforozi, 2009; Heydari *et al.,* 2018). So far, the best site with secure 14C chronology in Mazandaran belongs to the excavated site of Ghal e-Ben close to Babol and Gohar Tepe close to Behshahr (Fazeli Nashli *et al.,* 2022a; Ghasemi Gorji, 2017; Piller and Mahforozi, 2009). The archaeological site of Ghal e-Ben has a long history, starting from 3200 BCE and ending around 1500 BCE. The other site in the region with a secure chronology is Gohar Tepe, initiating around 3200 BCE, which is clearly also part of the grey ware tradition. It seems the beginning of "Gray Ware Culture" started in Mazandaran from 3000 BCE, such as Tepe Kelar and Ghal e-Kesh.

The Bronze Age layers in Ghal e-Ben began with the "Burnished Gray Ware" 3000 calBCE, the same as the other mentioned sites. The Bronze Age ceramics of Mazandaran exhibit a high degree of resemblance to sites such as Hissar III, Shah Tepe IIA-B, and Tureng Tepe III, indicating a high level of interaction between Mazandaran and north-eastern Iran during the Bronze Age. Also, around 2500-2400 BCE., we see the interaction of Bronze Age socialites of central and western Mazandaran with the Transcaucasian societies in north-western Iran. Here, Transcaucasian ceramics were found in the same contexts with grey ware ceramics in the archaeological layers of Ghal e-Ben and Tepe Kelar.

11. Conclusion

In 2020, Jan-Waalke Meyer and colleagues published the conference volume The Iranian Plateau during the Bronze Age. The contributions to this volume represent an important effort to conceptualize Iranian urbanization on its own terms, rather than primarily through comparison with developments in Mesopotamia, Central Asia, or the Caucasus. Building on this approach, we propose understanding Bronze Age Iran as a heterogeneous or "multicultural" civilization characterized by considerable regional variation in settlement, economy, and social organization. In some regions, populations developed intensive agricultural economies centered on large settlements, as seen, for example, in Mazandaran Province. Southwestern Iran witnessed the development of more centralized political formations, while parts of northwestern Iran followed trajectories that retained stronger continuities with prehistoric forms of social organization. Elsewhere, particularly in Kerman and at sites such as Jiroft and Shahr-e Sukhteh, the extensive production, circulation, and consumption of prestige goods and symbolic objects point to increasingly differentiated forms of social organization and inequality during the Bronze Age.

A substantial body of scholarship has examined the influence of the Uruk and Transcaucasian cultural horizons on northwestern Iran and the central Zagros during the Bronze Age. Eastern Iran, however, followed a different trajectory, represented especially by the major centers associated with Jiroft and the Helmand region. These developments suggest an alternative

pathway toward urbanism during the third millennium BCE, closely connected to long-distance exchange, specialized craft production, and the creation and circulation of objects with elaborate mythological and symbolic imagery. In northeastern Iran, meanwhile, the so-called "Great Khorasan Civilization" emerged without a known writing system but exhibited strong cultural connections with Central Asia. Between the third and second millennia BCE, communities across this region participated in extensive networks of material exchange linking southwestern Asia and the Mediterranean with Central Asia and the Indus region, while maintaining economies grounded in agriculture and pastoralism (Lyonnet and Dubova, 2021; Billings *et al.,* 2022; Biscione and Vahdati, 2022). Taken together, these regional trajectories suggest that Bronze Age social complexity and urbanization on the Iranian Plateau cannot be adequately described through a single developmental model.

But now back to the southern coast of the Caspian Sea during the Bronze Age and debates over the context of the Mazandaran Bronze Age and its background of urban development. Certainly, we believe that the archaeological cultures of this region cannot be defined as "prehistoric identities" the same as the Transcaucasian phenomenon observed in northwestern Iran. Culturally, the eastern parts of Mazandaran Province are part of the "Eastern Grey Ware Culture" cultural zone, which is mostly connected with the Gorgan plain and northeastern Iran, Turkmenistan, and Central Asia. We address the Ashkhaneh region, which is nowadays as capital of Samalqan County, a conjunction, frontier, and a corridor of intercommunication and movement of people from the northeastern Iran into the Gorgan plain and Mazandaran, and importantly divides Iran from the steppe civilization (Vahdati 2018; Luneau 2017). Geographically, Ashkhaneh is a wide plain in which the eastern Alborz with the Hyrcanian Forest is located in the south of the plain, and the Kopeh Dagh pediment, which is now 80 percent of such landscape, is located in the Iranian part. Sites such as Qala Khan (Garazhian *et al.,* 2014) and several large Bronze Age sites represent a large population based on an extensive agricultural economy and a combination of pastoral life.

Following the Ali Mahforozi and Christian Konrad Piller, Christopher Thornton and Kyle Olson (Mahforozi and Piller 2009; Olson and Thornton 2019), we define the Bronze Age of the southern part of the Capsian Sea with the "Eastern Grey Ware" as an "urban phase." Sites such as Tureng Tepe arose as a "capital" or as a "regional centre" with its enigmatic monumental architecture, famous terracotta figurines, and craft goods with both local and interregional characteristics, addressing the high degree of complexity of the Bronze Age. Today, the Bronze Age site of Ghal e-Ben, due to modern disturbances, extends intact over fewer than three hectares, but we believe that the site may originally have resembled Gohar Tepe or Tureng Tepe in size, with more than 30ha of occupation, putting it in the class of the largest urban centres with a dependency on a large-scale farming economy during the Bronze Age. We hope that in the near future a large excavation at the site will be possible to illustrate its urban layout.

Acknowledgments

We are grateful to all the persons for scientific consulting in this paper.

Authors' Contribution

The authors contributed equally.

Conflict of Interest

Authors declared no conflict of interest.

References

- Abbasnejad Seresti, R. (2009). *Report of archaeological excavation and test trench excavation report of Abbasi Khansar: Neka County in Mazandaran province.* Document center of the cultural heritage organization. (In Persian).

- Abbasnejad Seresti, R., Asadi Ojaei, S.K., Zhou, X., & Kheiri Malakshah, H. (2024a). Caspian Neolithic Software vs. Djeitun Pottery: New Absolute Dating from the Pottery Neolithic of Eastern Mazandaran. *Journal of Archaeological Studies,* 16(2), 69-93. https://doi.org/10.22059/jarcs.2024.382716.143299

- Abbasi, G.A. (2011). *Final report of archaeological excavation at Narges Teppeh Gorgan, plain.* Tehran: Naghsh-e-Jahan treasure. (In Persian)

- Afshar, Z., Millard, A., Roberts, C., & Gröcke, D. (2019). The evolution of diet during the 5th to 2nd millennium BCE for the population buried at Tepe Hissar, north-eastern Central Iranian Plateau: The stable isotope evidence. *Journal of Archaeological Science: Reports,* 27, 1-13.

- Amirkolaei, E. (2000). *Report of archaeological excavation of Ghal e-Kesh Kelardasht at Amol County, chapter 2.* Document center of cultural heritage organization (In Persian).

- Amirkolaei, E. (2013). *Report of archaeological excavation of Ghal e-Kesh Kelardasht at Amol County, chapter 3.* Document center of cultural heritage organization (In Persian).

- Arne, T. (1945). *Excavations at Shah Tepe, Iran.* Publication 27, Stockholm.

- Azizi, G., & Davoudi, M. (2019). Iran's Climate Change in the Holocene. *Quaternary Journal of Iran,* 5(1), 1-25. https://doi.org/10.22034/irqua.2019.702214

- Bal, Ç. and Pişkin, E. (2024). The 4.2 ka BP event in western Anatolia: Tracing the impact of climatic change. *The Holocene,* 34(10), 1478-1495. https://doi.org/10.1177/09596836241259774

- Berthon, R. (2013). New data on the exploitation of animal resources in the Upper Tigris area (Turkey) during the second and first millennia BCE. In B. De Cupere, V. Linseele, and S. Hamilton-Dyer (Eds.), *Archaeozoology of the Near East X* (pp. 145-162). Peeters.

- Bessenay-Prolonge, J., & Vallet, R. (2019). Tureng Tepe and its high terrace, a reassessment. In J.-W. Meyer, E. Vila, M. Mashkour, M. Casanova, & R. Vallet (Eds.), *The Iranian Plateau during the Bronze Age.* Lyon: MOM Éditions. https://doi.org/10.4000/books.momeditions.8076

- Bini, M., Zanchetta, G., Perşoiu, A., Cartier, R., Català, A., Cacho, I., Dean, J. R., Di Rita, F., Drysdale, R. N., Finnè, M., Isola, I., Jalali, B., Lirer, F., Magri, D., Masi, A., Marks, L., Maria Mercuri, A., Peyron, O., Sadori, L., ... Brisset, E. (2019). The 4.2 ka BP Event in the Mediterranean region: An overview. *Climate of the Past,* 15(2), 555-577. https://doi.org/10.5194/cp-15-555-2019

- Billings, T. N., Cerasetti, B., Forni, L., Arciero, R., Martello, D. R., Carra, M., Rouse, L. M., Boivin, N., & Spengler, R. N. (2022). Agriculture in the Karakum: An archaeobotanical analysis

from Togolok 1, southern Turkmenistan (ca.2300–1700 BC). *Frontiers in Ecology and Evolution*, 10, 995490. https://doi.org/10.3389/fevo.2022.995490

- Boccone, S., Micheletti-Cremasco, M., Bortoluzzi, S., Moggi-Cecchi, J., & Massa, E. (2010). Age estimation in subadult Egyptian remains. *Homo,* 61, 337–358. https://doi.org/10.1016/j.jchb.2010.05.003

- Boardman, S., & Jones, G. (1990). Experiments on the effects of charring on cereal plant components. *Journal of Archaeological Science,* 17(1), 1-11.

- Buikstra, J. A., & Ubelaker, D. H. (1994). *Standards for data collection from human skeletal remains (Arkansas Archaeological Survey Research Series 44).* Fayetteville, AR: Arkansas Archaeological Survey.

- Carolin, S. A., Walker, R. T., Day, C. C., Ersek, V., Sloan, R. A., Dee, M. W., Talebian, M., & Henderson, G. M. (2019). Precise timing of abrupt increase in dust activity in the Middle East coincident with 4.2 ka social change. *Proceedings of the National Academy of Sciences,* 116(1), 67–72.

- Cerasetti, B., Arciero, R., Billings, T. N., Cattani, M., D'Ippolito, L., Forni, L., et al. (2022). The rise and decline of the desert cities: The last stages of the BMAC at Togolok 1 (Southern Turkmenistan). In: C. Baumer, M. Novák, and S. Rutishauser (Eds.), *Cultures in contact: Central Asia as focus of trade, cultural exchange and knowledge transmission.* Wiesbaden: Harrassowitz-Verlag.

- Cleuziou, S. (1986). Tureng Tepe and the burnished grey ware: A question of frontier? *Oriens Antiquus,* 25(3–4), 221–256.

- Cleuziou, S. (1991). Ceramics IX. The Bronze Age in Northeastern Persia. *Encyclopaedia Iranica,* V (3), 297–300.

- Davoudi, H., Mashkour, M., & Nokandeh, J. (2019). Animal exploitation along the southern Caspian Sea shore during the Iron Age, Iran. In Y. Hassanzadeh, A. A. Vahdati, and Z. Karimi (Eds.), *Proceedings of the International Conference on the Iron Age in Western Iran and Neighboring Regions* (Vol. 1, pp. 456–483). Tehran and Sanandaj: RICHT / National Museum of Iran / Kurdistan Province ICHHTO publications. (In Persian)

- Deshayes, J. (1968a). Tureng Tepe et la plaine de Gorgan à l'âge du Bronze. *Archaeologia Viva,* 1, 63–66. (In Persian)

- Deshayes, J. (1968b). Tureng Tepe et la période Hissar IIIc. *Vth International Congress of Iranian Art and Archaeology,* Vol. 1, 139–163.

- Deshayes, J. (1976). Tureng Tepe. *IRAN,* No. XIV, 169–171.

- Dyson, R., & Haward, Jr. (1989). Rediscovering Hasanlu. *Expedition,* 31(2–3), 3–11.

- Fazeli Nashli, H. (2018). *Report of archaeological excavation and test trench excavation report of Ghal e-ben and Shahne-poshte at Babol County.* Document center of the cultural heritage organization. (In Persian)

- Fazeli-Nashli, H., Safari, M., Wu, X., Kalvari, H., & Thomalsky, J. (2022a). Chronology in Northern Slopes of Central Alborz Mountain During the Bronze Age based on the Ghale-Ben

Excavation in Babol, Mazandaran. *Archaeological Research of Iran,* 12(32), 103–134. https://doi.org/10.22084/nb.2022.24603.2354 (In Persian)

- Fazeli Nashli, H., Sarlak, S., Hoseinzadeh, J., Yazdani, S., Rafiei-Alavi, B., & Carolin, S. A. (2022b). The North and South-Central Plateau of Iran During the Third and Second Millennium BCE (3200–1500 BCE). *Journal of Archaeological Studies,* 14(2). https://doi.org/10.22059/jarcs.2022.348692.143160

- Fazeli Nashli, H., Safari, M., Huang, Y., Deng, Z., Davoudi, H., & Wu, X. (2023). The Bronze and Iron Age of Mazandaran (3200–1000 BCE): Resilience and cultural adaptability. In: R. Bernbeck, G. Eberhardt, and S. Polloc (Eds.), *Coming to Terms with the Future:* Concepts of Resilience for the Study of Early Iranian Societies.

- Fazeli Nashli, H., Safari, M., Matthews, R., Thomalsky, J., Lentschke, J., & Madihi, M. (2024a). Revisiting the archaeological stratigraphy of Hotu Cave, Iran: Preliminary report of the 2021 excavation. *Journal of Archaeological Studies,* 16(2), 5–49. https://doi.org/10.22059/jarcs.2025.388982.143332

- Fazeli Nashli, H., Young, R., Gręzak, A., Hassan Afshari, H., & Nazari, H. (2024b). The first farmers and herders of the North Central Plateau and Northeastern Iran: An irrigation society. In J. Thomalsky, H. Fazeli Nashli, M. Reindel, P. Kaulicke, M. Kunst, and A. C. Sousa (Eds.), *From Sedentarisation to Complex Society: Settlement, Economy, Environment, Cult* (Menschen - Kulturen - Traditional, 21: 321–350). https://doi.org/10.34780/1wb6-0caf

- Fazeli Nashli, H., Gregg, M. W., Marinova, E., Bendrey, R., Balescu, S., Brisson, L. F., Lamothe, M., Thomalsky, J., Nazari, H., & Maleki, S. (2024c). Pre-agricultural plant and animal management and the emergence of low-level food production on the Southern Coastal Plain of the Caspian Sea during the Early Holocene. In: J. Thomalsky, H. Fazeli Nashli, M. Reindel, P. Kaulicke, M. Kunst, and A. C. Sousa (Eds.), *From Sedentarisation to Complex Society: Settlement, Economy, Environment, Cult* (Menschen - Kulturen - Traditional, 21: 351–382). https://doi.org/10.34780/1wb6-0caf

- Garazhian, O., Papoli Yazdi, L., & Fakhr-e Ghaemi, H. (2014). Qaleh Khan: A site in northern Khorassan and the Neolithic of the northeastern Iranian plateau. *Archaologische Mitteilungen aus Iran und Turan,* 46, 21–50.

- Ghasemi Gorji, S. (2017). *The beginning of the Iron Age in the Eastern Plains of Mazandaran (Case Study: Gohar Tape, Rostam Kola) (MA thesis).* University of Mazandaran. (In Persian)

- Helmer, D. (1992). *La domestication des animaux par les hommes préhistoriques.* Paris: Masson.

- Helwing, B. (2006). The rise and fall of Bronze Age centers around the Central Iranian Desert: A comparison of Tappe Hissar II and Arisman. *Archaeologische Mitteilung aus Iran und Turan,* 38, 35–48.

- Heydari, N., (2017). *A survey of prehistoric sites' settlement pattern in Mazandaran province from the Paleolithic to the end of the Iron Age* (PhD dissertation). Mazandaran University. (In Persian)

- Heydari, N., Abbasnejad Seresti, R., & Fazeli Nashli, H. (2018). Cultural interactions of the Bronze Age in Mazandaran based on pottery data. *Archaeological Studies,* 10(1), 57–74. (In Persian).

- Heydari, N., Abbasnejad Seresti, R., & Safari, M. (2021). Analysis of settlement patterns of prehistoric sites of Mazandaran. *Journal of Archaeological Studies,* 12(4), 59–75. https://doi.org/10.22059/jarcs.2021.312939.142945

- Heydarian, M. (2011). *The manner of prehistoric cultural evaluation in the west of Mazandaran based on archaeological excavation of Tepe Kelar and Rashk Kelardasht rock shelter* (PhD thesis). Tarbiat Modares University. (In Persian)

- Hillman, G. C. (1973). Crop husbandry and food production: Modern basis for the interpretation of plant remains. *Anatolian Studies,* 23, 241–244.

- Hillman, G. C. (1981). Reconstructing crop husbandry practices from the charred remains of crops. In R. J. Mercer (Ed.), *Farming Practice in British Prehistory* (pp. 123–162). Edinburgh: Edinburgh University Press.

- Helama, S. (2024). The 4.2 ka event: A review of paleoclimate literature and directions for future research. *The Holocene,* 34(9), 1408–1415. https://doi.org/10.1177/09596836241254486

- Hillman, G. C. (1984). Interpretation of archaeological plant remains: The application of an ethnographic model from Turkey. In W. van Zeist and W. A. Casparie (Eds.), *Plants and Ancient Man: Studies in Paleoethnobotany* (pp. 1–41). Rotterdam: Balkema.

- Huang, Y., Deng, Z., Nashli, H. F., Fuller, D. Q., Wu, X., & Safari, M. (2023). The early adoption of East Asian crops in West Asia: Rice and broomcorn millet in northern Iran. *Antiquity*, 97(393), 674–689. https://doi.org/10.15184/aqy.2023.42

- Khazaei Kouhpar, M. (2012). *Comprehensive evaluation of the central part of ancient privacies at Kojur Mazandaran* (Master's thesis). Tarbiat Modares University. (In Persian)

- Lyonnet, B., & Dubova, N. A. (2021). Questioning the Oxus Civilization or Bactria-Margiana Archaeological Culture (BMAC): An overview. In B. Lyonnet and N. A. Dubova (Eds.), *The World of the Oxus Civilization* (pp. 7–65). London/New York.

- Luneau, E. (2017). Transfers and interactions between the north and south in Central Asia during the Bronze Age. In: E. Allinger, F. Grenet, C. Jahoda, M. K. Lang, and A. Vergati (Eds.), *Interaction in the Himalayas and Central Asia: Processes of transfer, translation and transformation in art, archaeology, religion and polity* (pp. 13–27). Vienna: Verlag der Österreichischen Akademie der Wissenschaften. https://doi.org/10.2307/j.ctt1pv891n.5.

- Luneau, E. (2018). Climate change and the rise and fall of the Oxus civilization in Southern Central Asia. In: L. E. Yang, H. R. Bork, X. Fang, and S. Mischke (Eds.), *Socio-environmental dynamics along the historical silk road* (pp. 275–299). Cham: Springer. https://doi.org/10.1007/978-3-030-00728-7_14

- Luneau, E. (2021). The end of the Oxus civilization. In B. Lyonnet and N. A. Dubova (Eds.), *The world of the Oxus civilization* (pp. 496–524). London: Routledge. https://doi.org/10.4324/9781315193359-21

- Mahforozi, A. (2000). *Report of archaeological excavation and test trench excavation report of Tepe Yaghout in Behshahr. Mazandaran.* Document Center of Cultural Heritage Organization. (In Persian)

- Mahforozi, A. (2001). Archaeology of East Mazandaran based on the excavations of Gohar Tepe. *Archaeological Reports,* 7, 347–368. Tehran: Cultural Heritage. (In Persian)

- Mahforozi, A. (2007). *Report of archaeological excavation and test trench excavation report of Tepe Qaleh Pey.* Document Center of Cultural Heritage Organization. (In Persian)

- Mahforozi, A. (2008). *Report of archaeological excavation and test trench excavation report of Tepe Terkam.* Document Center of Cultural Heritage Organization. (In Persian)

- Mahforozi, A. (2009). *Archaeological excavations of Tepe Sad. In Namvarnameh, articles in the protection of the memory of Massoud Azarnoush.* Tehran: Iran Negar. (In Persian)

- Mashkour, M. (2006). Boars and pigs: A view from the Iranian Plateau. In: B. Lion and C. Michel (Eds.), *De la domestication au tabou: Le cas des suidés dans le Proche-Orient ancien* (Travaux de la Maison d'Archéologie et d'Ethnologie de Nanterre 1, pp. 155–167). De Boccard.

- Mousavi Kouhpar, S. M. (2009). *Archaeological excavations in Tepe Kelar e-Kelardasht Chapter, second.* Document Center of Cultural Heritage Organization. (In Persian)

- Mousavi Kouhpar, S. M., & Abbasnejad Seresti, R. (2007). *Report of archaeological excavation and test trench excavation report of Tepe Kelar.* Document Center of Cultural Heritage Organization. (In Persian)

- Nazari, H., Ritz, J. F., Burg, J. P., Shokri, M., Haghipour, N., Vizheh, M. M., Avagyan, A., Fazeli Nashli, H., & Ensani, M. (2021). Active tectonics along the Khazar fault (Alborz, Iran). *Journal of Asian Earth Sciences,* 219, 1–11. https://doi.org/10.1016/j.jseaes.2021.104893

- Olson, K. (2024). Late Chalcolithic to Late Bronze Age settlement patterns in the Gorgan Plain (ca. 3200–1600 BCE). *Journal of Archaeological Studies,* 16(2), 121–149. https://doi.org/10.22059/jarcs.2025.388987.143333

- Olson, K. G., & Christopher, C. P. (2019). *Tureng Tepe, a Bronze Age center in northeastern Iran, revisited.* Iran. https://doi.org/10.1080/05786967.2019.1679034

- Payne, S., & Bull, G. (1988). Components of variation in measurements of pig bones and teeth, and the use of measurements to distinguish wild from domestic pig remains. *Archaeozoology*, 2, 27–65.

- Piller, C. K., & Mahforozi, A. (2009). First preliminary report on the joint Iranian-German excavations at Gohar Teppe, Mazandaran, Iran. *AMIT*, V 2/007/22ai007.3d, 1–34.

- Reid, D. G., & Dean, M. C. (2002). The timing of linear hypoplasias on human anterior teeth. *American Journal of Physical Anthropology,* 113, 135–139. https://doi.org/10.1002/1096-8644(200009)113:1<135: AID-AJPA13>3.0.CO;2-A

- Safari, M., Fazeli Nashli, H., Abbasnejad Seresti, R., & Madihi, M. (2024). Human,

Environment, and Food: Human Productivity of the Environment in the Mesolithic and Neolithic Periods in the Southeast of the Caspian Sea. *Iranian Journal of Archaeological Studies,* 14(1), 63-80. https://doi.org/10.22111/ijas.2024.48612.1299

- Safari, M. (2020). *A chronology and study of intra-and-extra-regional interactions on the northern border of the Central Alborz during the Bronze Age based on the excavation of Bozrudpey Tepe (Ghal e-Ben) in Babol, Mazandaran* (PhD dissertation). Mazandaran University. (In Persian)

- Safari, M., Abbasnejad Seresti, R., Fazeli Nashli, H., Thornton, C., & Thomalsky, J. (2021). The relative chronology of the Bronze Age on the northern side of the Central Alborz based on the typology of pottery discovered at Ghal e-Ben in Babol, Mazandaran. *Parseh Journal of Archaeological Studies,* 5(17), 2. https://doi.org/10.30699/PJAS.5.17.27 (In Persian).

- Safari, M., Nazari, H., Fazeli Nashli, H., Rahimi, E., Madihi, M., Afshari, H., & Heydari, N. (2022). An analysis of environmental evolution in the area of Ghal-e Ben, Babol city, Mazandaran province. *Quaternary Journal of Iran,* 7(3,4), 937–966. https://doi.org/10.22034/irqua.2022.702439 (In Persian).

- Schmidt, E. F. (1937). Tepe Hissar excavations in 1931. *The Museum Journal,* 23(4). Published by The University Museum, Philadelphia.

- Soltysiak, A. (2015). Vascular grooves on human femora and tibiae as a potential activity-related trait. *International Journal of Osteoarchaeology,* 25, 345–351. https://doi.org/10.1002/oa.2282

- Soltysiak, A., Fazeli Nashli, H.; Safari, M., & Moradi, G. (2019a). Human remains from Shahne Poshte, Iran, 2019. *Bioarchaeology of the Near East,* 13, 85–96.

- Soltysiak, A., Fazeli Nashli, G., Safari, M., & Thomalsky, J. (2019b). Human remains from Ghal e-Ben, Iran, 2019. *Bioarchaeology of the Near East,* 13, 97–104.

- Spengler, R., Frachetti, M., Doumani, P., Rouse, L., Cerasetti, B., Bullion, E., & Mar'yashev, A. (2014). Early agriculture and crop transmission among Bronze Age mobile pastoralists of Central Eurasia. *Proceedings of the Royal Society B,* 281, 20133382. https://doi.org/10.1098/rspb.2013.3382

- Shaikh Baikloo Islam, B. (2020). Holocene climatic events in Iran. *Climate Change Research,* 1(4),35–48.https://doi.org/10.30488/ccr.2020.244327.1017

- Shaikh Baikloo Islam, B., & Chaychi Amirkhiz, A. (2020). Adaptations of the Bronze and Iron Ages societies of North Central Iran to the Holocene climatic events. *Climate Change Research,* 1(2), 39–54. https://doi.org/10.30488/ccr.2020.111121

- Shaikh Baikloo Islam, B., Chaychi Amirkhiz, A., & Niknami, K. (2020). Late Holocene climatic events, the main factor of the cultural decline in North Central Iran during the Bronze Age. *Documenta Praehistorica*, 47, 446–460. https://doi.org/10.4312/dp.47.25

- Staubwasser, M., Sirocko, F., Grootes, P. M., & Segl, M. (2003). Climate change at the 4.2 ka BP termination of the Indus valley civilization and Holocene south Asian monsoon variability. *Geophysical Research Letters,* 30(8), 1425. https://doi.org/10.1029/2002GL016822

- Stronach, D. (1972). Yarim Tepe. In: *Excavation in Iran, the British contribution. Organizing Committee of the Sixth International Congress of Iranian Art and Archaeology,* Oxford.

- Tadahiko, O., Kiyohide, F., Takuro, A., Karami, M., Hisashi, N., Yui, A., & Kan, W. (2010). Preliminary report of the Iran-Japan joint research study of the Gorgan material in the National. *Annual report of the Humanities Research Institute: Chikushi Jogakuen University and Junior College,* 129–150.

- Thomalsky, J., & Fazeli Nashli, H. (2024a). Research on the Neolithic in Iran (9600–5200 BCE): State of the art and perspectives. In: J. Thomalsky, H. Fazeli Nashli, M. Reindel, P. Kaulicke, M. Kunst, and A. C. Sousa (Eds.), *From Sedentarisation to Complex Society: Settlement, Economy, Environment, Cult. Proceedings of the workshops in Lisbon, Tehran, and Lima* (Menschen - Kulturen - Traditional 21, pp. 235–264). https://doi.org/10.34780/1wb6-0caf

- Thornton, C. P., Gursan-Salzmann, A., & Dyson Jr., R. H. (2013). Tepe Hissar and the fourth millennium of Northeastern Iran. In C. Petrie (Ed.), *Ancient Iran and its Neighbors* (pp. 131–144). London: Oxbow Books.

- Troter, M., & Gleser, G. C. (1952). Estimation of stature from long bones of American Whites and Negroes. *American Journal of Physical Anthropology,* 10, 463–514. https://doi.org/10.1002/ajpa.1330100407

- Uerpmann, M., & Uerpmann, H. P. (1994). Animal bone finds from Excavation 520 at Qala'at al Bahrain. In F. Hojlund and H. H. Andersen (Eds.), *Qala'at al Bahrain, Volume I, The Northern City Wall and the Islamic Fortress* (pp. 227–237). Aarhus: Aarhus University Press.

- Vaezi, A., Weeks, L., & Routh, J. (2025). From the Last Glacial Maximum to the Late Holocene: Unraveling the dynamic complexities of climate and human history in Western and Southeastern Iran. *Frontiers in Earth Science,* 13, 1477290. https://doi.org/10.3389/feart.2025.1477290

- Vahdati, A. (2018). The Early Iron Age in northern Khorāsān. In J. Lhuillier and N. Boroffka (Eds.), A Millennium of History: The Iron Age in southern Central Asia (2nd and 1st Millennia BCE). *Proceedings of the conference held in Berlin* (June 23–25, 2014), Dedicated to the memory of Viktor Ivanovich Sarianidi (pp. 51–66). Berlin: Dietrich Reimer Verlag.

- Vahdati, A. (2020). Eastern Iran during the Iron Age. In M. Mousavi Kouhpar, S. Aryamanesh, and M. Montazer Zohori (Eds.), *1st International Conference of the Society of Iranian Archaeology* (pp. 165–220). Aryamanesh Publisher. (In Persian)

- Vahdati, A., Biscione, R., Dan, R., & Trémouille, M. (2025). *Grave 12 at Chalow: The burial of a young lady of the "Greater Khorasan Civilization", Iran.* https://doi.org/10.1080/05786967.2025.2488251

- Vahdati, A., Biscione, R., Farina, R. L., Mashkour, M., Tengberg, M., Fathi, H., & Mohaseb, A. (2019). Preliminary report on the first season of excavations at Tepe Chalow. New GKC (BMAC) finds in the plain of Jajarm, NE Iran, in the Iranian plateau during the Bronze Age. In: J.-W. Meyer, E. Vila, M. Mashkour, M. Casanova, and R. Vallet (Eds.), *The Iranian plateau during the Bronze Age* (pp. 179–200). Maison de l'Orient et de la Méditerranée – Jean Pouilloux.

- Von den Driesch, A. (1976). *A guide to the measurement of animal bones from archaeological sites.* Harvard University: Peabody Museum of Archaeology and Ethnology.



مـطالعات باسـتان‌شـنـاسی

شاپای چاپی: ۹۲۹۷-۲۲۵۱ - شاپای الکترونیکی: ۴۲۸۸-۲۶۷۶

| شمارهٔ ۳۹ | دورهٔ هجـدهم | تابستان و پاییز |

https://jarcs.ut.ac.ir/

University of Tehran Prees

روایت جدیدی از عصر مفرغ در جنوب دریای کاسپی براساس کاوش‌های محوطهٔ قلعه‌بِن، ایران

حسن فاضلی‌نشلی[۱]، مجتبی صفری[۲]

۱. گروه باستان‌شناسی، دانشکدهٔ ادبیات و علوم انسانی دانشگاه تهران، تهران، ایران.
رایانامه: hfazelin@ut.ac.ir
۲. گروه باستان شناسی دانشکده میراث فرهنگی، صنایع دستی، گردشگری، دانشگاه مازندران، بابلسر، ایران (نویسندهٔ مسئول).
رایانامه: m.safari@umz.ac.ir

چکیده

بخش مرکزی منطقهٔ جنوبی دریای کاسپی در طول هزارهٔ سوم پیش‌ازمیلاد به‌طور متراکم مسکونی بوده است. از دیدگاه باستان‌شناختی، درک این موضوع اهمیت دارد که محیط‌های سرسبز و حاصلخیز این منطقه از چه زمانی و به چه شیوه‌ای توانسته‌اند جمعیت‌های قابل‌توجهی را در دوران عصر مفرغ پشتیبانی کنند و جوامع ساکن در این ناحیه چگونه در طی هزارهٔ سوم و دوم پیش‌ازمیلاد، ساختارهای جدید اجتماعی-اقتصادی را توسعه داده‌اند. محوطهٔ قلعه‌بِن، یکی از محوطه‌های کلیدی عصر مفرغ در بخش مرکزی استان مازندران است که در سال ۱۳۹۷ مورد کاوش قرار گرفت. استقرار در این محوطه به دورهٔ مس‌وسنگ متأخر، حدود ۳۲۰۰پ.م.، بازمی‌گردد و تا نیمهٔ دوم هزارهٔ دوم پیش‌ازمیلاد، حدود ۱۵۰۰پ.م.، تداوم داشته است. شواهد باستان‌شناختی حاصل از قلعه‌بِن نشان می‌دهد که این محوطه در عصر مفرغ، یک سکونتگاه کاملاً یکجانشین و کشاورزی بوده که جمعیتی قابل‌توجه در آن زندگی می‌کرده‌اند. اقتصاد این جامعه بر ترکیبی از دامداری، شامل: پرورش گوسفند، بز، خوک و گاو و کشاورزی در مقیاس گسترده استوار بوده است. در چارچوب منطقه‌ای، جوامع این ناحیه در هزارهٔ دوم پیش‌ازمیلاد پیچیدگی بیشتری پیدا کردند؛ شواهد این فرآیند را می‌توان در ظهور گورستان‌های بزرگ حاوی اشیائ مرتبط با جایگاه اجتماعی، توسعهٔ نظام‌های جدید کشاورزی و شکل‌گیری شبکه‌های تجارت در مسافت‌های طولانی مشاهده کرد. کشت ارزن دم‌روباهی و ارزن جارویی چینی نشان‌دهندهٔ ورود محصولات زراعی جدید و تحول در نظام اقتصادی کشاورزی این دوره است. برنامهٔ پژوهشی در محوطهٔ قلعه‌بِن نه‌تنها چارچوبی جامع برای گاهنگاری عصر مفرغ در دامنه‌های جنوبی و شمالی رشته‌کوه البرز فراهم می‌کند، بلکه امکان بازنگری در گاهنگاری چندین محوطهٔ دیگر را که پیش‌تر براساس روش‌های نسبی تاریخ‌گذاری شده بودند نیز فراهم می‌سازد.

تاریخچه مقاله

صص: ۱۳۵-۹۹
نوع مقاله: پژوهشی

تاریخ دریافت:
۱۴۰۵/۰۱/۳۱

تاریخ بازنگری:
۱۴۰۵/۰۳/۱۶

تاریخ پذیرش:
۱۴۰۵/۰۳/۲۶

تاریخ انتشار:
۱۴۰۵/۰۸/۰۱

کلیدواژگان:
دریای کاسپی، عصر مفرغ، ساختارهای اجتماعی، ساختارهای اقتصادی، محوطهٔ قلعه‌بِن، سفال خاکستری، سفال با نقش سیاه روی زمینهٔ قرمز کاسپی.

ارجاع به مقاله: فاضلی‌نشلی، حسن؛ و صفری، محتبی، (۱۴۰۵). روایت جدیدی از عصر مفرغ در جنوب دریای کاسپی براساس کاوش‌های محوطهٔ قلعه‌بِن. ایران. مطالعات باستان‌شناسی، ۱۸(۲)، ۹۹-۱۳۵. https://doi.org/10.22059/jarcs.2026.421419.143439

حق انتشار این مستند، متعلق به نویسندگان آن است. ۱۴۰۵ ©. ناشر این مقاله، دانشگاه تهران است.
این مقاله تحت گواهی زیر منتشرشده و هر نوع استفاده غیرتجاری از آن مشروط بر استناد صحیح به مقاله و با رعایت شرایط مندرج در آدرس زیر مجاز است.
Creative Commons Attribution-NonCommercial 4.0 International license (https://creativecommons.org/licenses/by-nc/4.0/).

صفحهٔ اصلی مقاله در سامانهٔ نشریه: https://jarcs.ut.ac.ir/article_108655.html?lang=fa