PRELIMINARY REPORT OF THE CHARMO (JARMO) PREHISTORIC INVESTIGATIONS, 2022

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1. Introduction

The archaeological mission from the University of Tsukuba began to investigate the Neolithic sites in the Iraqi-Kurdistan region in 2014. The purpose of our investigations was to reconsider the issue of Neolithization in Iraqi-Kurdistan, where research began in the 1940s and 50s and was stalled by political issues starting in the 1960s. With the full support of the Directorate General of Cultural Heritage of the Ministry of Culture of the Kurdistan Regional Government and the Slemani Department of Cultural Heritage, we first began our research at the Qalat Said Ahmadan site, located in the Pshdar Plain. We were able to identify the cultural deposits of the end of the Pre-Pottery Neolithic period, those of the Hassuna, Samarra, Halaf, Ubaid, and Iron Age, and have clarified the nature of the Neolithic site located at the edge of the fan deposits [Tsuneki *et al.* 2015, 2016, 2019].

In 2016, we began research in the Chamchamal area, which was the starting point for Neolithization research not only in the Iraqi-Kurdistan but also in the world. The mission of the University of Chicago, led by Professor Robert Braidwood, conducted the Jarmo Prehistoric Project from 1948 to 1955 there [Braidwood *et al.* 1972, 1983]. They left a significant mark on the study of Neolithization by investigating sites in the Chamchamal area. We had a strong desire to address the issue of Neolithization from a new perspective, using a variety of modern research methods in the same area.

Jarmo was then called Charmo, which means “white” hill in Kurdish. In order to keep as close as possible to the local point of view, Jarmo is referred to here as Charmo. However, in a context where academic history is at issue, it may also be called Jarmo.

To develop a more complete scheme of the Neolithization process, we must understand the long cultural sequence from the Epi-Paleolithic to the Pottery Neolithic period. The University of Chicago team discovered a series of prehistoric sites—Charmo, Turkaka, and Karim Shahir—9–11 km east of Chamchamal and 6–8 km southwest of Takia that are located in the hills on both sides of the winding Cham Gawra, one of the rivers flowing from the Zagros Mountains in a southwesterly direction (Figs. 1 and 2). Although these sites were investigated by the Chicago team—and then investigated more recently at Charmo by UCL [Fuller 2015] and at Karim Shahir by the University of Liverpool [Asouti *et al.* 2020]— we believe that renewed investigations of these sites and landscapes with new perspectives and technologies will further our understanding of these sites and, in turn, the Neolithization process.

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Fig. 1 Three prehistoric sites along the Cham Gawra.

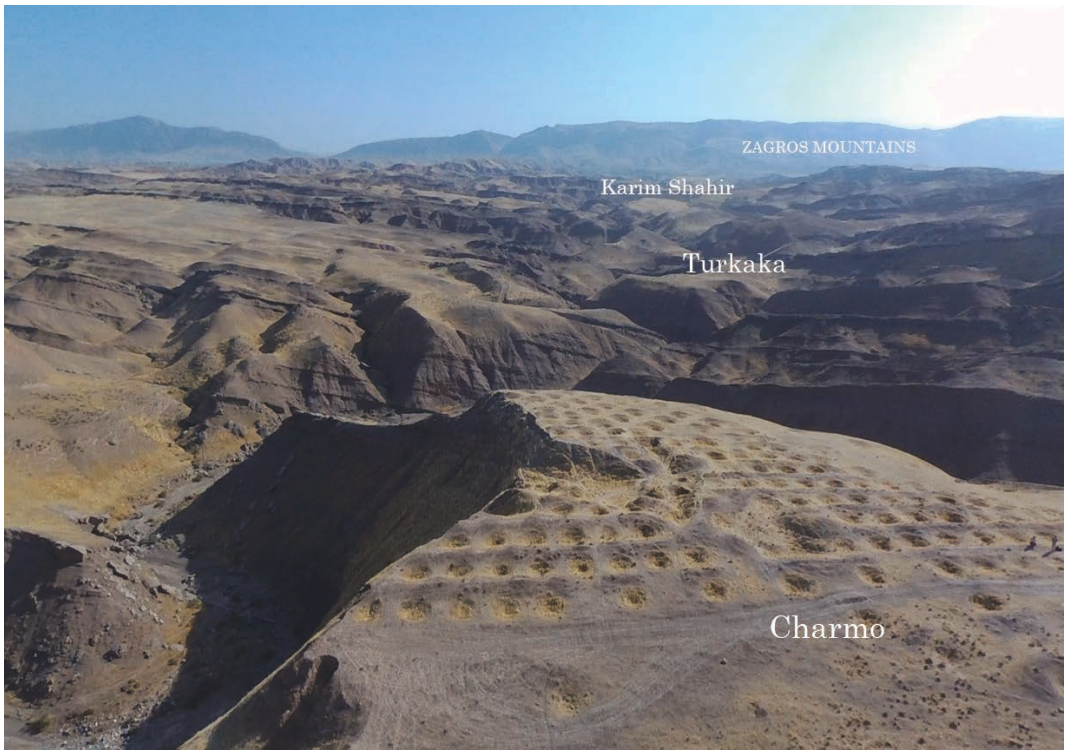


Fig. 2 Charmo, Turkaka, and Karim Shahir with the Zagros Mountains in the background.

Therefore, the operations of the investigations that we planned at Charmo and nearby sites are as follows, and these operations have gradually advanced since 2016.

1) Small-scale sounding excavations to establish the long cultural sequence and chronology for the Neolithization with a clear series of ^{14}C dating.
2) Making complete topographic maps and 3D images around Charmo using UAV (Fig. 3).
3) Positing the Charmo site within the surrounding topography and geology (Figs. 4 and 5).
4) Conducting geophysical prospecting (GPR and magnetometric surveys) to detect the complete extent of Charmo village.

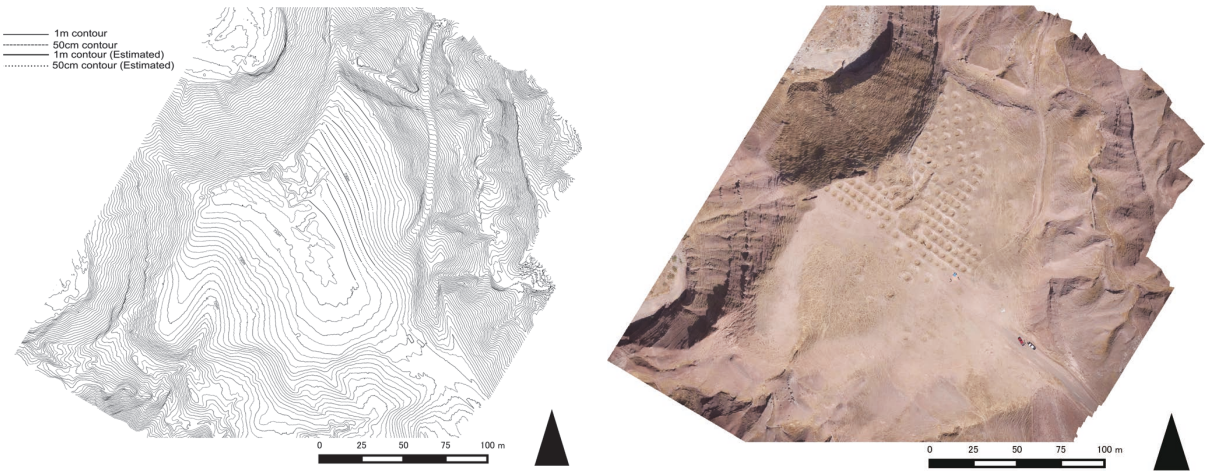


Fig. 3 Topographic map and orthographic image of Charmo (by N. Watanabe).

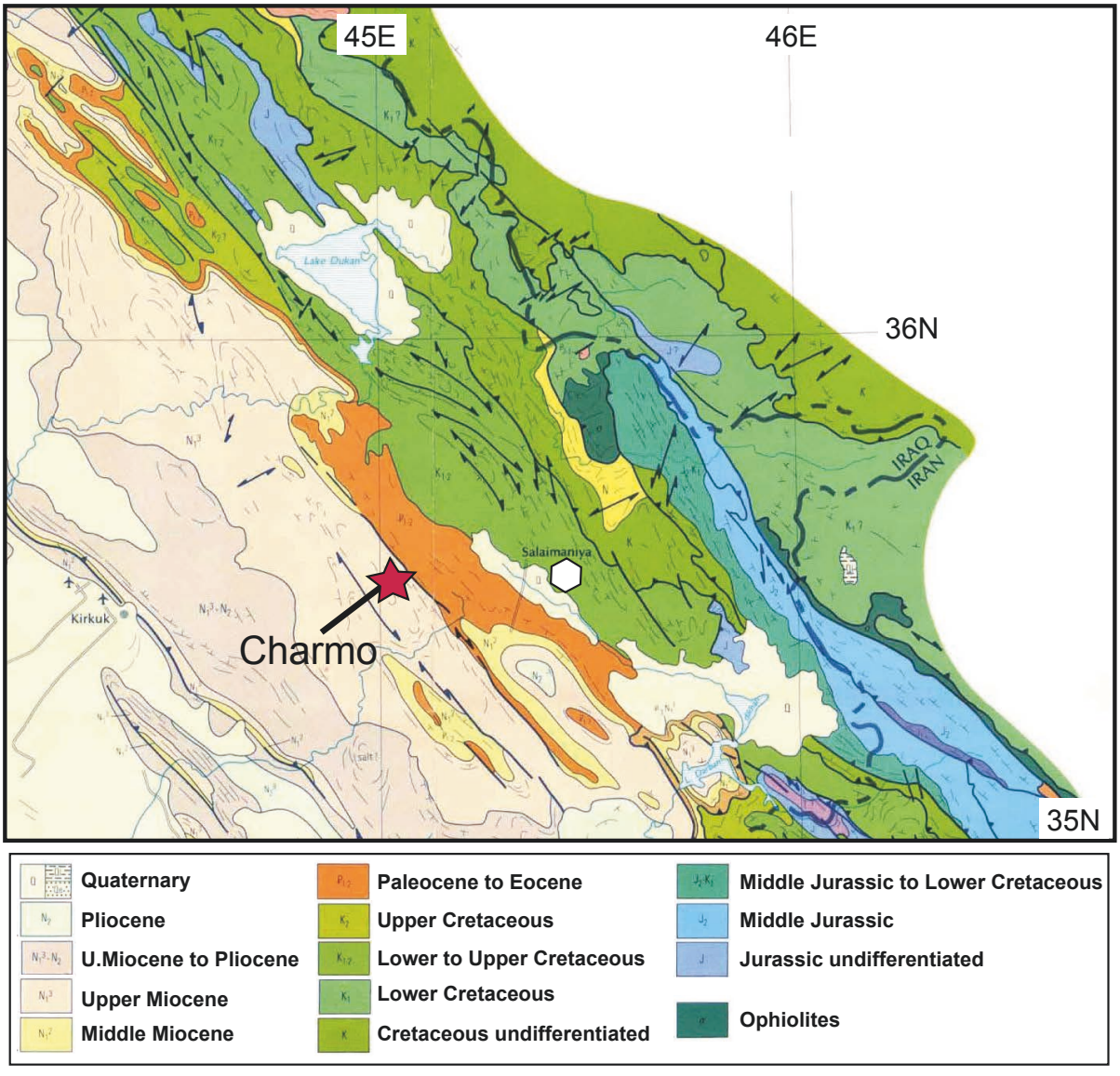


Fig. 4 Geological map of the Slemani region (after Spaargaren 1987, modified by R. Anma).

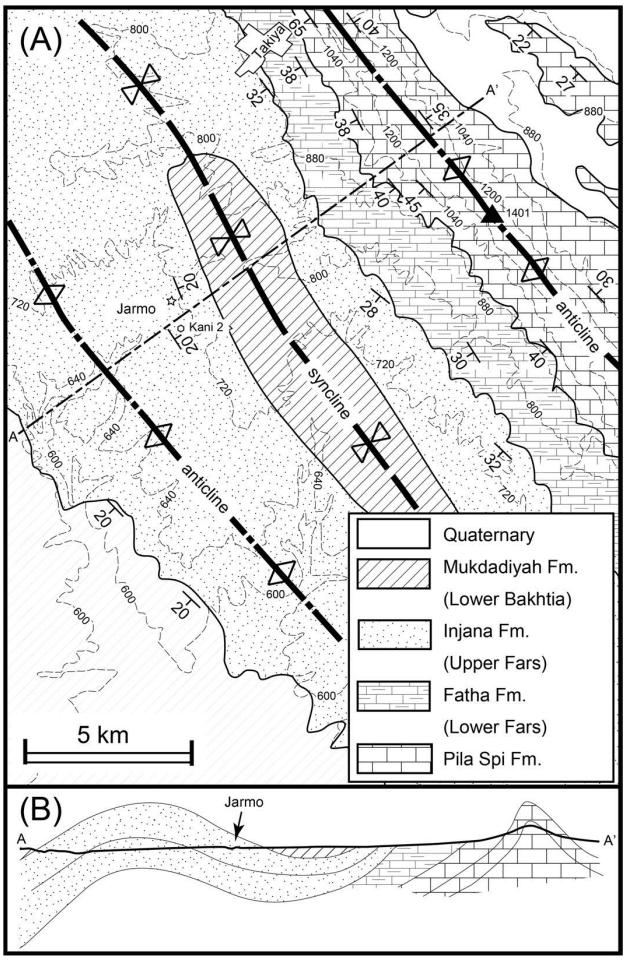


Fig. 5 Geological structure of the Charmo (by R. Anma).

5) Natural environmental surveys to reconstruct the Neolithic landscape.

In 2017, we conducted a trial sounding at Turkaka, an Epi-Paleolithic site. Based on our research, it is concluded that the Turkaka site was a place for the production of chipped stones, especially the blade and micro-blade industry during the Zarzian period, dating between 18,500–16,500 BC [Tsuneki 2019; Tsuneki *et al.* 2019]. The Charmo-Turkaka-Karim Shahir area is extremely rich in both water resources and chert for the lithic industry. These circumstances provided the important motivation for people to make a chipped stone workshop at Turkaka during the Zarzian period.

2. Our Previous Work at Charmo

Thanks to the kind permission of the Department of Antiquity and Heritage of the KRG, we executed a measurement survey at Charmo in the summer of 2016.

In 2017, we executed more extensive GPS and UAV surveys and made a detailed map covering Turkaka and Charmo. All orthographic and measurement maps were made by Nobuya Watanabe, and this detailed map gave us much information as to why the prehistoric people chose Charmo for their early farming village. With the geological information collected by Ryo Amma, we came to understand that Charmo was located on one of the areas extremely prosperous in water, where many springs gushed out of the gap of the underflow water formed by sandstone and marlstone.

We were convinced that this environment certainly affected the formation of early farming villages in this area.

We believe that this work can contribute to a further understanding of Charmo and is indispensable for future archaeological investigation at Charmo. Therefore, in the 2018 season, we continued our measurement survey at Charmo on a larger scale, especially regarding the location of a series of springs. In addition to the measurement survey, we executed remote sensing using GPR to detect the cultural layer. We made small shallow soundings (two 2 × 2 m and one 1 × 2.5 m) in three locations (G-10 Grid, Test pit W and J-II north trench) at Charmo to detect the cultural conditions for further investigations. These investigations led us to recognize that Charmo was managed under extremely fruitful natural conditions. The results suggest that the landscape at Charmo was entirely different 9,000 years ago from today. It is certain, therefore, that the settlement of Charmo extended further to the northwest, and the relative height from the riverbed to the hilltop was lower. It seems quite difficult for people to use water from the river for daily life and farming in modern conditions. However, water sources should have been far more accessible when Charmo was utilized for daily life and farming.

In considering the available water resources, attention was paid not only to Cham Gawra but also to a large number of springs gushing from the sandstone and marlstone cracks in the local cuesta topography. To the south of Charmo, the underflow water from the Zagros Mountains gushes out dozens or even several hundreds of meters. A series of kani ('a spring' in Kurdish) is ranged along a few lines at a gentle slope, and they seem to irrigate the gentle slope land naturally toward the southwest from the northeast.

Thus, it is necessary to reconsider the preconception of primitive farming in the Zagros region as "simple rain-fed farming along the hilly flanks," as proposed by Robert Braidwood [Braidwood 1967]. We may get more fruitful results if we investigate a series of archaeological sites in the Chamchamal area while adding to new perspectives and the concept of "more complicated farming using springs in the water reservoir area" [Tsuneki *et al.* 2019].

Based on these previous investigations, we were convinced that Neolithic Charmo people had used the hill area just south of Charmo site because this southern field is now used for wheat and barley farming, and is watered by many springs. In addition, we collected Neolithic materials around some of the springs. Therefore, we spent a week executing surface collection in the southern field in the 2019 field season. The number of archaeological materials is very small, as we could collect just 30 objects, and did not collect objects besides Neolithic and Islamic/modern objects. The distribution of the Neolithic objects is shown in the red circle in Fig. 6. These results indicate that the southern field was used only in the Neolithic and Islamic/modern periods.

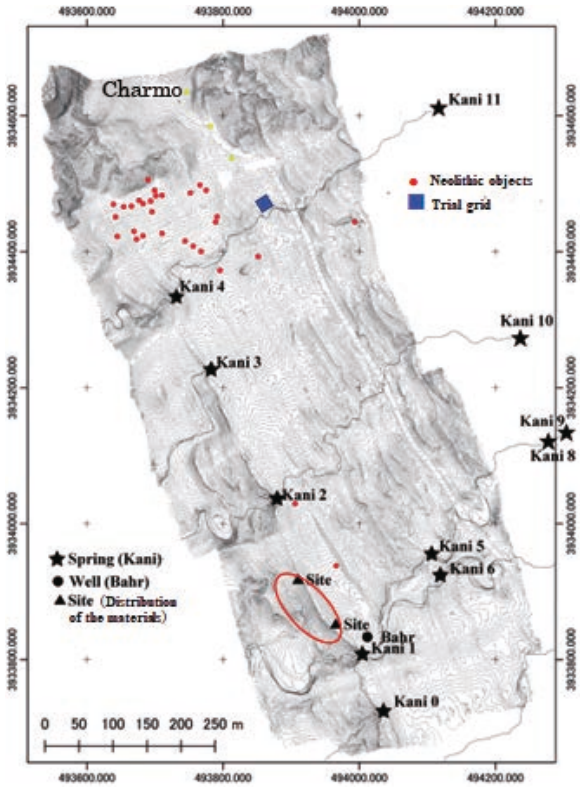


Fig. 6 Map of the Charmo site and southern field. Red circles show the distribution of Neolithic material. The blue square indicates the excavated area of the farming field.

Neolithic objects were collected from the neighboring place, that is, low hills on the north side of the line linking Kanis 11 and 4. We expected to find the sickle elements and stone hoes for prehistoric farming, but there were no such objects. Therefore, we searched for evidence of prehistoric farming fields by excavation. We fixed a 10 × 10 m trial grid north of the wadi between Kanis 11 and 4 (blue area in the map of Fig. 6), and dug 0.5 m deep. We chose this area because of the high support for plants by spring water in the early spring. The surface layer is used by modern farmers to grow wheat and barley. Under this modern soil, we found another agricultural field showing a similar direction of furrows (Fig. 7-1). It seems that these fields were used only in recent years. On this level, about −20 to −30 cm from the surface, the magnetometric surveys were executed by Yuki Tatsumi (Fig. 7-2). Though we obtained reflections of different directions and widths of furrows, they were a quest structure of sandstone and marlstone. We obtained a land snail just above the quest structure rocks, that we brought back to Japan and sent for ^{14}C dating. The ^{14}C age of the snail is 1510 ± 20 BP, which corrected to calibrated age (1*SD*) is 541–586 AD (TKA-22138). Thus, even if this location was farming land, it would have been in the Sasanian-Persian period. However, it is almost certain that these southern fields were used as farming land during the Neolithic period, and we thus would like to find evidence of Neolithic farming land in the southern fields.

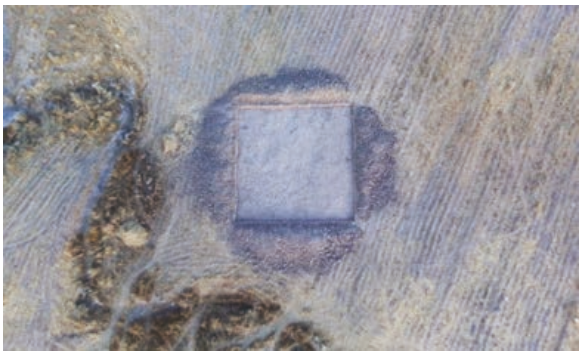


Fig. 7-1 Trial grid in the south field showing the same direction of furrows as modern ones (−20–30 cm).

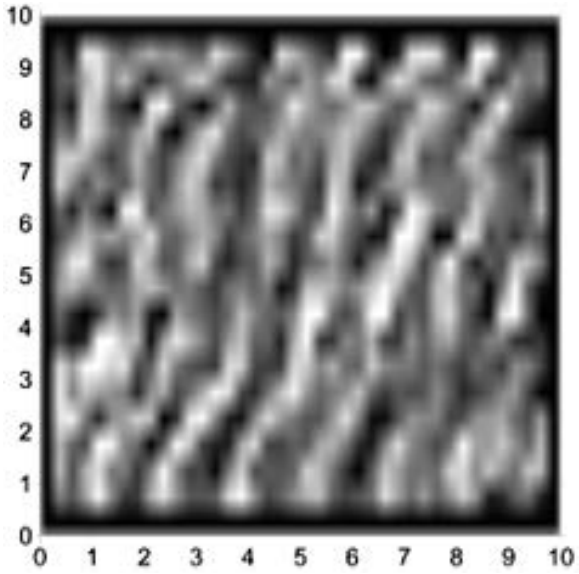


Fig. 7-2 Magnetic gradient map of the trial grid in the south field.

In the 2019 season, we also continued our work to extend the topographic map around Charmo using magnetometric surveys and sounding excavations. A new sounding step trench named J-II south (2 × 5 m), which was located southwest of Braidwood's Operation J-II, was dug down about 1.8 m below the surface in the southwestern step and another 0.9 m deep in the northeastern step. Over 1,200 potsherds were discovered from all layers. In particular, Layers 5–6 of the J-II south trench produced a large number of potsherds. The number of potsherds drastically decreased in Layers 7–9. Many large fragments of potsherds were included among the pottery from Layers 5–6 (Fig. 8). It is interesting to note that some of the large potsherds were heavily covered

Fig. 8 J-II south trench, showing the potsherd distribution in Layers 5–6.

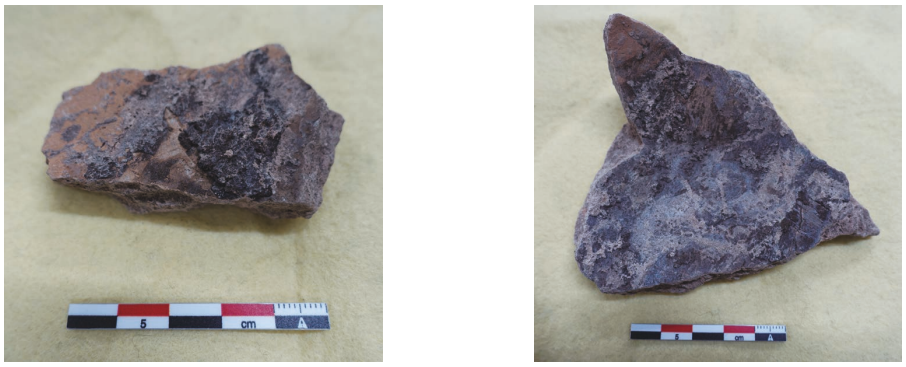


Fig. 9 Potsherds heavily covered with carbide.

with carbide (Fig. 9). ^{14}C samples for Layers 5–6 date most of the layers to around 7,000 cal BC, and these layers can be dated to the beginning of the Pottery Neolithic period. However, many of the carbides on the pottery are dated DEAD, to much over 40,000 years BP. The shape and C/N ratio of the thick carbides and the dating results strongly suggest that they are of bitumen origin. The pottery is attributed to "later manifestation" by McC. Adams study in a report of Jarmo. If they are of bitumen origin, it is highly probable that these pottery vessels were used to warm the bitumen. These pottery vessels undoubtedly date to the first half of the 7th millennium BC. Therefore, it is highly probable that these early vessels were used not only for heating or processing food, but also for making utensils, such as warming bitumen.

For the 2020 and 2021 seasons, the Slemani Department of Heritage commissioned sounding excavations for a week or so each due to the COVID-19 pandemic. The exploratory excavation was conducted in a 1 × 2 m trench on the northeast side of J-II south trench. The results of each season's exploratory sounding reinforced the results of the J-II south trench sounding in 2019.

3. Excavations at Charmo, 2022 Season

The 2022 season excavations had two main objectives: First was to establish the chronology of the Charmo site both relatively and absolutely. It is clear that the Charmo site has cultural deposits dating from the Pre-Pottery Neolithic to the Pottery Neolithic period. According to the investigations conducted by the University of Chicago, potsherds were discovered at some locations and not at others in each of the trenches (operations) all over the site. These two kinds of trenches exist in a mess throughout the site. Thus, it is not clear whether the transition from the Pre-Pottery Neolithic to the Pottery Neolithic occurred throughout the entire village or whether pottery was accidentally introduced only in a portion of the Charmo village. In other words, the appearance of pottery cannot be clearly explained at Charmo. The pottery of Charmo still seems to be among the oldest in the Zagros region. Establishing the first pottery in Charmo is thus nothing less than exploring the beginning of the Pottery Neolithic in the Zagros region. Therefore, we want to capture how pottery emerged in Charmo. The University of Chicago study indicated a transition from more elaborate "earlier manifestation" pottery, such as small amounts of painted pottery, to more coarse ones called "later manifestation" pottery. We would like to confirm whether such a transition really occurred at Charmo.

Excavations by the University of Chicago were conducted in the late 1940s and early 50s, when beta ray dating of ^{14}C had just begun. Of course, state-of-the art dating at the time was carried out, but unfortunately the results were quite variable given today's knowledge. Therefore, with the latest ^{14}C measurement by the AMS method, we would like to determine the absolute ages of Charmo settlement. We have already made sounding excavations beside the Braidwood's Operation

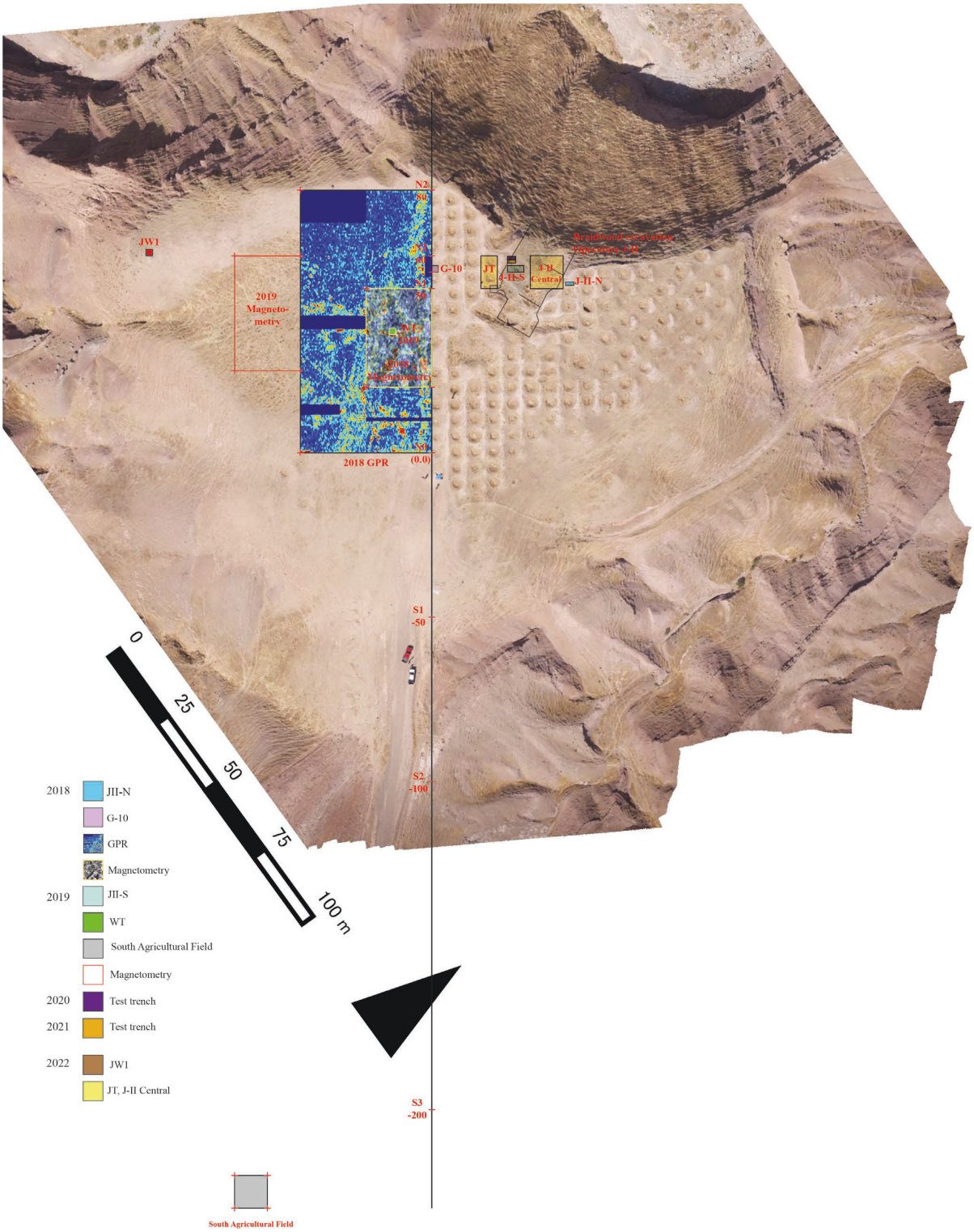


Fig. 10-1 Locations of the excavated squares at Charmo.

(excavation square) J-II (J-II north and J-II south trenches in 2018 and 2019, respectively), and obtained a good series of calibrated ^{14}C ages between 7296–6651 cal BC from the J-II north trench [Tsuneki *et al.* 2019] and 7289–6689 cal BC from the J-II south trench [Miyata, Itahashi and Tsuneki 2021]. The cultural layers investigated in these two trenches can be considered to correspond roughly to the level 5–level 1 building layers in Operation J-II of Braidwood, and can be dated from the end of the Pre-Pottery Neolithic period to the early Pottery Neolithic period. In the 2022 excavations, we would like to increase the amount of ^{14}C data from before and after these cultural layers.

Second, as we have excavated only very small trenches so far, it was hoped that a wider excavation would reveal various aspects of the Charmo Neolithic way of life, particularly in the early Charmo village. As mentioned above, we assumed that Charmo farming was complicated by combining rainwater and spring water, so it is possible that village life at Charmo was not very simple but formed a rather complex society. We thought that it would be possible to pursue such aspects of village life by more intensive excavations.

In accordance with the above two main objectives, a 5 × 10 m excavation square (named JT square) was set up west of Braidwood's Operation J-II and a 10 × 10 m excavation square (J-II central square) almost within the Operation J-II area. The locations of these two excavation squares are shown in Fig. 10. JT square was set at the highest elevation at the Charmo site in order to look for the final stage of Neolithic deposits as well as to trace the longest continuous stratigraphic sequence possible. Contrariwise, J-II central square aimed to trace the earlier Charmo Neolithic deposits. Neolithic deposits excavated to virgin soil at Charmo include Step Trench J-A and Operation J-I, both in the north scarp of the mound cut by Cham Gawra. Only a very small area of virgin soil was reached in Step Trench J-A, while at least nine architectural levels were identified in Operation J-1, with virgin soil below them. To excavate earlier Neolithic deposits, it may be better to investigate the north scarp of the mound being cut at Cham Gawra, as in the two Braidwood's Operations. However, the digging was somewhat hazardous on the slope side and there were fears that the deposits had already been scraped away. Therefore, we decided to dig in a 10 × 10 m excavation square within the Operation J-II, where Braidwood's team had already excavated over 3 m of later Neolithic deposits. As Braidwood's team had found good architectural remains in the lower levels of this Operation, we thought that continued excavation of this area might yield more information about the early farming village of Charmo.

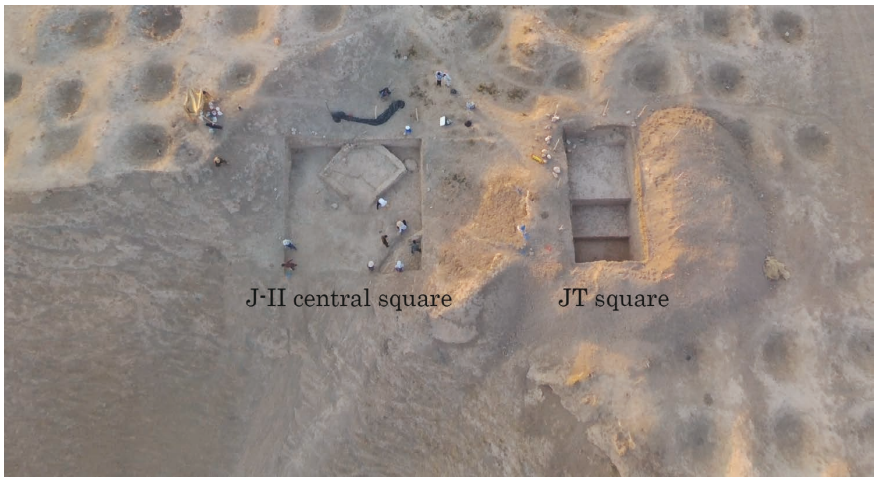


Fig. 10-2 JT and J-II central squares.

(Akira Tsuneki)

3-1 JT Square (Figs. 11 and 12)

JT excavation square falls 50–60 m northwest on the G line from the southwest corner of the G24 Grid of Braidwood's excavation (our benchmark of the Charmo site), and 15–20 m northeast from that point. The aim of this excavation square was to establish the chronology of the Pre-Pottery Neolithic to the final period when the village of Charmo was inhabited. The uppermost layer of the excavation, excluding the Braidwood's excavation pile of waste soil, is 731.2 m above sea level, close to the highest point of Charmo village, and appears to be the final end of the settlement. It falls in an area where not many structure remains have been expected, based on information from the trial sounding pits dug by Braidwood. As expected, nothing resembling structures was found in the upper 2m-plus deposit, apart from a couple of stone concentrations (Structures 1–3). Rather than splendid structural remains being detected, a very large number of potsherds were recovered, together with lithic tools and animal bones (Table 1). These potsherds consisted of many heavily chaff-tempered coarse ware and a few burnished fine ware. The carinated bowls with opposing longitudinal handles shallow bowls and generally thick pottery with rare decoration are the characteristics of coarse ware. On the other hand, burnished fine ware was scarce and consisted only of small fragments. No pottery that could be described as Hassuna- or Sammara-type pottery has been found at all, and it is also very different from the so-called Pre-Hassuna. Some of the elements, such as applique decoration, are somewhat similar to proto-Hassuna pottery; however, coarse ware are the very pottery vessels that Robert McC. Adams called "Later manifestation" in the Jarmo final report [Braidwood *et al.* 1983]. Thus, for the moment, the final settlement at Charmo came to an end roughly in tandem with or before the proto-Hassuna period. In this sense, the central ^{14}C date we obtained from the J-II north trench, 7296–6651 BC, can be considered

Fig. 11 3D image of JT square.

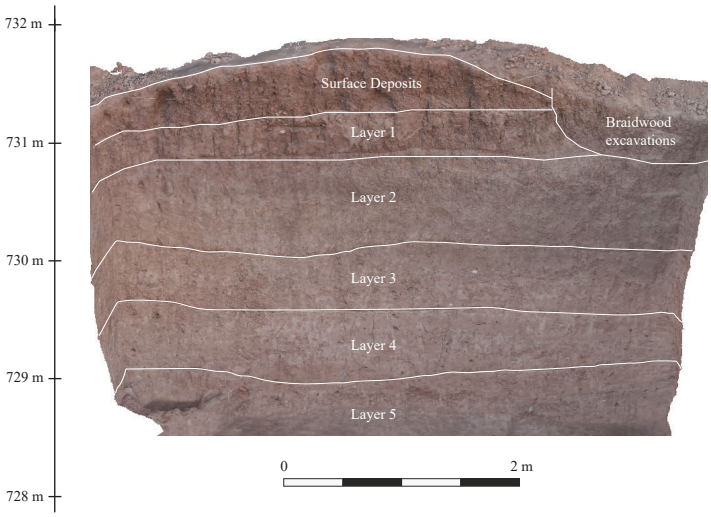


Fig. 12 North section of JT square.

Table 1 Number of potsherds discovered from JT square

Layer	Total number of sherds	Number of coarse ware sherds (rim sherds)	Number of fine ware sherds (rim sherds)
Surface	42	40	2
Layer 1	1,562	1,502 (81)	60 (22)
Layer 2	3,191	3,073 (218)	118 (19)
Layer 3	783	695 (28)	88 (30)
Layer 4	29	29	0
Layer 5	1	1	0
Total	5,608	5,340 (327)	268 (71)

the final age of the Charmo settlement. The samples obtained from JT square will also undergo ^{14}C dating, which should confirm this prospect. In Layer 4 of JT square, there is a sharp decline in the number of potsherds and very few are excavated. Near the eastern wall of the trench between Layers 4 and 5, a carbonized area was uncovered. This area was not revealed completely because it continued off the excavation area. However, continuous traces of black color were visible on the east and north section walls of Layer 4 and continued to Layer 5. At Layer 5, only one small potsherd was excavated. We are now almost in the Pre-Pottery Neolithic cultural layers. Instead of fewer artifacts, Layer 5 yielded a fragment of what appears to be a *tannor* and two human infant skulls from nearby. Horns of an animal and many animal bones were also recovered in Layer 5. The absolute elevation of this Layer 5 is 728–729 m asl, which is almost the same as the elevation of Layer 5 of our J-II central square (meaning Level 5 of Braidwood's Operation J-II).

(Sari Jammo)

3-2 J-II Central Square

The aim of the investigation in this excavation square, in contrast to JT square, is to explore the older cultural layers of Charmo. As mentioned above, Braidwood's research shows that the oldest cultural layers of Charmo were only detected in a small part of Step Trench A and in the bottom of Operation J-I at the north scarp of the mound. This leaves it ambiguous as to when and how the first settlement in Charmo began to operate. Therefore, we decided to dig further by cleaning the J-II operation, which is the widest and reaches the most extensive and relatively earlier cultural layer excavated by Braidwood and his colleagues. As with the establishment of JT square, a 10 m × 10 m excavation square was set up (almost entirely within the Braidwood's Operation J-II area), using our benchmark as a starting point, and hitting a point 50–60 m to the northwest and 30–40 m to the northeast, we cleaned and dug down.

Braidwood excavated the northeastern half of Operation J-II up to what Braidwood calls Level 6 (our renamed Layer 6) and the southwestern half up to Level 5 (Layer 5). Many structures were detected by his excavations; however, unfortunately almost 70 years after the excavations, few structures remained. During this season, we excavated the architectural remnants of Layer 5 and new architecture of Layer 6, so the main structures were detected in the southwestern half of J-II central square, because the structures of Layer 5 in the northeastern half of the excavation square had already been removed by Braidwood to excavate the lower Layer 6 structures.

3-2-1 Structures in Layer 5 (Fig. 13)

As for the structures of Layer 5, the southwestern half of the J-II central unearthed structures of the stone row (Str. 4) from the southeast corner of the excavated area, and from the middle of the border with the northeastern half of the J-II central, a *tannor* (Str. 11) was detected. A few other Layer 5 structures remained in the unexcavated area by Braidwood. One of the most interesting structures is Str. 8, which appears to have been a cache of tools and materials for manufacturing chipped stones and stone vessels (Fig. 14). The structure contains a primary chert core with cortex roughly stripped, hammer stones, and anvil stones. It also contains rough marble stones that were the material for stone vessels. Grinding stones might have been used for marble shaping. Preparation flakes and other items were discovered in clusters from immediately to the north of this structure, too.

Along the southern limit of J-II central square, an ash pit (Str. 9, Fig. 15) was detected in the lower level, but this pit was dug down from Layer 5. In this pit, a broken marble bowl and a beautiful marble spoon, which was broken in two but joined and complete, were discovered (Fig. 16). It is most probable that the marble bowl and spoon formed a set that was discarded in this ash pit after being used for some special ceremony.

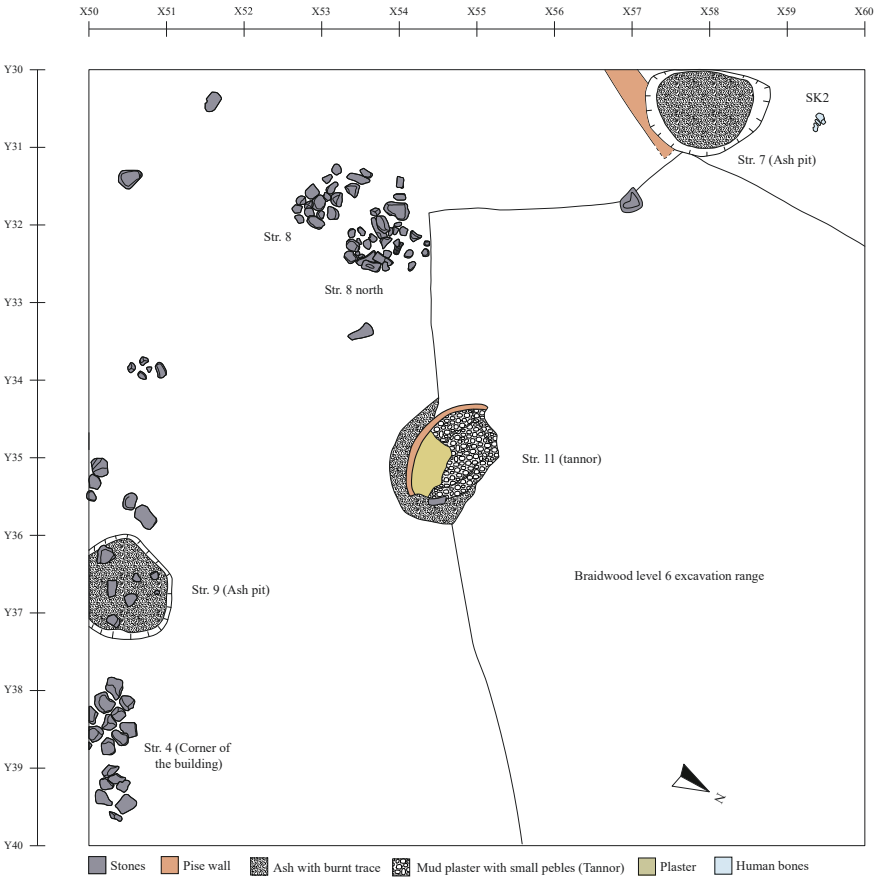


Fig. 13 J-II central, Layer 5 structures.

Fig. 14-1 Str. 8, a cache of tools and materials for manufacturing chipped stones and stone vessels discovered in Layer 5 of J-II central.

Fig. 14-2 Tools and materials for manufacturing chipped stones and stone vessels.

Str. 11 was detected almost in the center of J-II central square. For the northern portion, it was lowered to excavate the Layer 6 by Braidwood and colleagues, so only the southern half remained. It was an oval planned *tannor* measuring about 1.0 m in diameter, and small river pebbles were laid under the blackened plaster floor. As this *tannor* was constructed from the upper levels, the wall at the north corner of Building Str. 10 of the Layer 6, discussed below, was scraped away.

In the northeastern half area of J-II central square, only about 1.0 m along the west side of

Fig. 15 Structure 9 (ash pit) in Layer 5.

Fig. 16-1 Marble bowl and spoon discovered in Structure 9.

Fig. 16-2 Marble spoon.

Fig. 16-3 Marble bowl.

the square was unexcavated by Braidwood. From there, ash pits and pisé walls have been found in fragments. These structures extend further west outside of the excavation square.

3-2-2 Structures in Layer 6 (Fig. 17)

After removing the remnants of Layer 5 structures, we found a square-planned pisé building structure in the topmost of Layer 6 (Str. 10, Fig. 18). The building measures 4.9 m × 4.6 m with pisé walls 0.34–0.45 m in thickness. A large limestone hollow stone was found outside, west of the southern corner of this square building (Fig. 19), and was likely to have been used as a door pivot. If so, there was an entrance/exit at this corner.

Detection of the Structure 10 pisé wall and floors reveals that it had been re-stacked several times, partly with foundation stones in between. This square building seems to have been built from the time of Layer 6 almost in the same place, and at least two or more floor surfaces have been detected (Fig. 20). Fragments of matting have been found here and there inside and outside this square building. They are probably remnants of rugs that were laid on the floor and other surfaces in the period of the upper level of Layer 6. The condition of the surviving mats is not good, but as they have been recorded in 3D images, there is a good chance we will identify the material and how it was woven. Materials seem to have been made of reeds and other herbaceous plants, and were made by alternately crossing several flattened bundles of materials, or by arranging the bundles as they were (Fig. 21).

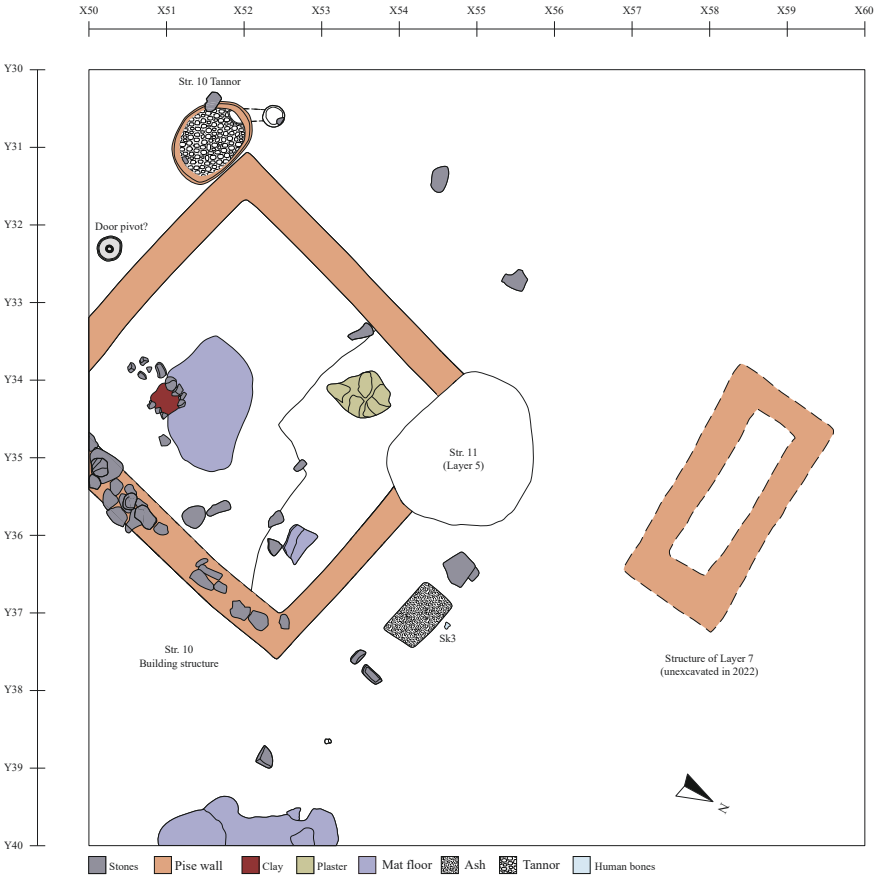


Fig. 17 J-II central, Layer 6 structures.

Fig. 18 Building Structure 10 in Layer 6 upper.

Fig. 19-1 Stone door pivot.

Fig. 19-2 A hollow stone as a door pivot.

Fig. 20 Str. 10 building with several floors in Layer 6.

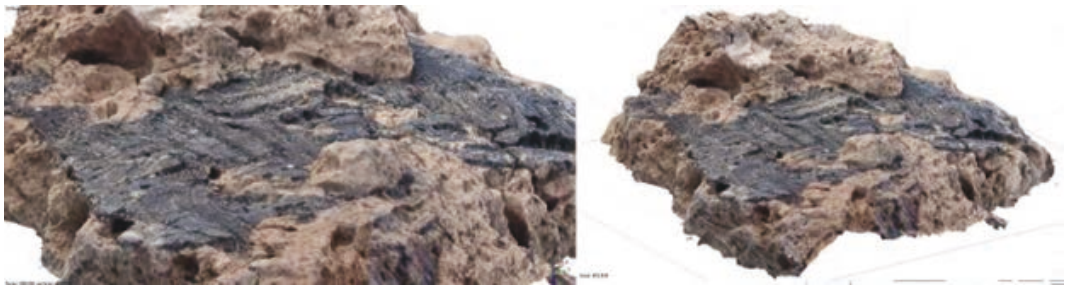
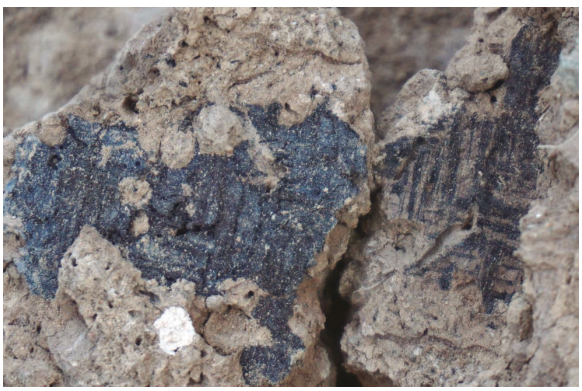


Fig. 21-1 Mat on the clay found east of Str. 10.

Str. 21-2 Mat on the clay discovered inside Str. 10.



Str. 21-3 Mat on the clay around Str. 10.

Fig. 22 Strs. 10 and 12 in Layer 6 lower.

Fig. 23 Square clay structure on the second floor of Str. 10.

Fig. 24 Three clay animal figurines discovered around a small clay square structure on the older floor of the Str. 10 building.

At the time of Layer 6 lower, this Str. 10 pisé wall survived at more than 0.5 m in height (Fig. 22). In several places inside the building Str. 10, partial floor surfaces remained.

One of the most interesting discoveries is on the part of such a matting floor, which was a part of the lower floor of the Str. 10 building. It was a 30 cm × 30 cm square clay structure, partially surrounded by stones. Three animal clay figurines were discovered around this structure (Fig. 23). All these animal figurines lack head and toes (Fig. 24). We can imagine that people gathered around this small square structure and performed some kind of ritual with the animal clay figurines.

An unbaked clay female figurine was also discovered outside west of the Str. 10 building (Fig. 25). Although small and tiny, it should be noted that four clay figurines have been discovered in association with this building.

It should also be noted that a very good preserved *tannor* (Str. 12) has been detected externally on the west wall of Str. 10. The floor surface of the *tannor* is made of a very beautiful

Fig. 25-1 Clay female figurine discovered west of Str. 10 building.

Fig. 25-2 Clay female figurine.

blackened mud plaster, with a hole laid on the northern side for smoke exhaust or air vents (Fig. 26). Braidwood also discovered a similar structure, and *tannor*s of this construction are characteristic of Charmo. At the discovered level, this *tannor* appears to have been attached to the western wall of Str. 10 during Layer 6 lower.

For the northeastern half of J-II central square, almost the entire area had been excavated to Level 6 (our Layer 6) by Braidwood and his team, except along the western wall of the square. Therefore, few remains were detected. However, in the middle of this half, a structure that appears to be pisé walls was found, and it is assumed to be either a remnant of the structures of Level 6 or the topmost surface of the Level 7 structures. We have not excavated these structures this season.

Although a relatively large area was excavated in J-II central square, with the context of cleaning, very few small potsherds were recovered from Layers 5–6 (Table 2). This aspect is similar to Levels 5 and 6 at the time of the Braidwood's excavations, and it is assumed that these layers are already Pre-Pottery Neolithic cultural layers. Dating of carbon samples recovered from these layers is currently underway.

There is almost no pottery found, but a large number of chipped stone tools and animal bones were unearthed. The main materials of chipped stones are chert and obsidian. 321 chert chipped stones and 288 obsidian chipped stones were excavated. Among the former, the main stone implements are blades, including sickle elements, while micro-blades are mainly prominent among the latter. The high percentage of obsidian tools is characteristic of Charmo, but the aspect of the stone implements also indicate that Layers 5–6 belong to the terminal Pre-Pottery Neolithic period.

Instead of pottery vessels, a total of 20 stone vessels were recovered from J-II central. None of the vessels are complete, but include a good marble stone vessel. Many others are made of limestone or sandstone. Fig. 27 shows a sandstone animal figurine from Layer 6. Fig. 28 is a marble ornament also excavated from Layer 6. Other ground stone objects such as hammerstones and grinding stones are also prominent in the excavation.

Fig. 26 *Tannor* (Str. 12) discovered on the western wall of the Str. 10 building.

Table 2 Number of potsherds discovered from J-II central

Layer	Total number of sherds	Number of coarse ware sherds	Number of fine ware sherds
cleaning	12	11	1
Layer 5	4	2	2
Layer 6 upper	0	0	0
Layer 6 lower	2	2	0

(The two pieces from Layer 6 lower may be intrusive because they were discovered during the cleaning of the layer)

Fig. 27 Sandstone animal figurine discovered in Layer 6.

Fig. 28 Marble ornament discovered in Layer 6.

Animal bones are being analyzed by Dr. Hitomi Hongo, who has reported that domesticated sheep and goats dominate the animal bones excavated from the J-II north and south trenches.

(Akira Tsuneki)

4. Measurement and Survey to Evaluate the Erosion Surface around Charmo

4-1. Evaluation of geomorphological features around the Charmo archaeological site

The Charmo archaeological site is cut by a deep valley made by the flow of Cham Gawra, which implies an occurrence of massive erosion since the time of habitation in the Neolithic Period. It is worth reconstructing the paleo topography, which can help in considering the land use and early farming by providing a tangible spatial structure. Reconstruction of past topography is a challenging task that requires various information from different study fields. Geomorphological feature is one of them, which is directly related with the spatial structure and its shape of the terrain surface. Thus, information about the overview of the topographic characteristics, detection of remaining surface, and the strength of on-going erosion/deposition should provide a good starting point for the preliminary reconstruction of the land. An analysis by DEM, observation of the erosion nowadays of the northern cliff of Charmo, and a survey around Charmo were conducted to fulfill this aim.

4-2. Evaluation of the topography and erosion based on Charmo DEM

GIS analysis was employed to evaluate the characteristics of the topography and to roughly estimate the past topography. Generation of a summit level map and ridge map were attempted using AW3D DEM (50 cm resolution). The summit level map was calculated from a contour derived from the equispaced points containing the highest elevation values within certain extent[1]. As a result, the calculation will smooth out the topography and fill the small-scale valleys[2], which is expected to roughly represent the topography before erosion. Intensity of erosion was indicated by subtracting the summit level map from the original DEM (Fig. 29 left). The ridge detection map, in contrast,

1) Distance (extent) parameter changes the scale of the valley to be smoothed. Thus, the amount of erosion (which is decided by distance parameter) represents the time scale at the same time. In this study, a parameter that smoothed small valleys and left the channel of the Cham Gawra visible, was selected by comparing several results from different parameters.

2) The wider the extent, the smoother the result. Appropriate values for the extent are decided from a graph depicting the relation between the heights from the selected main summits and the distances from the summits.

is expected to extract the remaining surface. The MRVBF module in the QGIS (SAGA plugin) is used to calculate the MRRTF index[3]. The ridge-shaped surface was extracted by setting a threshold to the calculated indexes (Fig. 29 right).

The result shows that erosion to the north of Charmo is significant, while Charmo itself is characterized by its comparatively connected area of ridges. Actually, there are several areas where ridged areas are connected more widely. These areas tend to be far from the river channels, which is not surprising when considering the process of erosion. However, these areas may not be advantageous for habitation, given their access to water could be more difficult. Thus, a ridged area that is close to the river channel may have priority when conducting a survey.

4-3. 3D measurement of the valley surface of Charmo and detection of the change

A comparison between the 3D measurement results of the northern valley of Charmo in 2019 and 2022 was conducted. The difference within this three years is visualized by subtracting the point clouds of 2019 and 2022 (Fig. 31).

The calculation result shows the erosion in the upper part of the gouged slope, and the deposition in the bottom as a result of the erosion. The slight erosion observed widely in the upper area is due to the different condition of the grass, while the deposition is of the soil dug out in the excavation. The result shows an active erosion deposition process today, which implies the

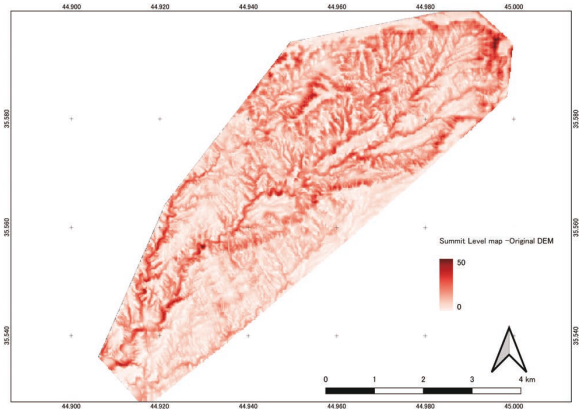


Fig. 29 left: Intensity of the erosion (subtraction of the summit level map from original DEM).

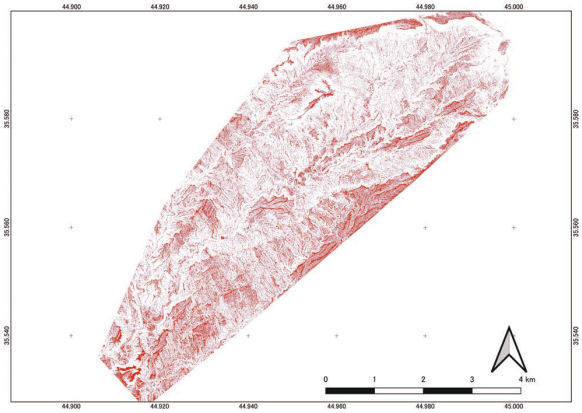


Fig. 29 right: Extracted ridge-shaped terrain based on MRRTF.

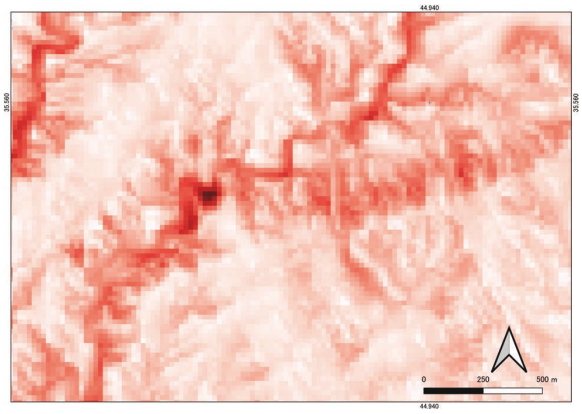


Fig. 30 left: Intensity of the erosion around Charmo.

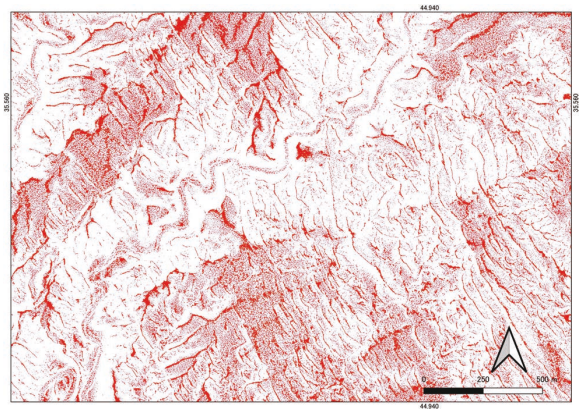


Fig. 30 right: Extracted ridge shape terrain around Charmo.

3) MRVBF (Multi Resolution Valley Bottom Flatness) is a function and index to distinguish a valley bottom from a hillslope, while MRRTF (Multi Resolution Ridge Top Flatness) is used to distinguish the ridge [Gallant and Dowling, 2003].

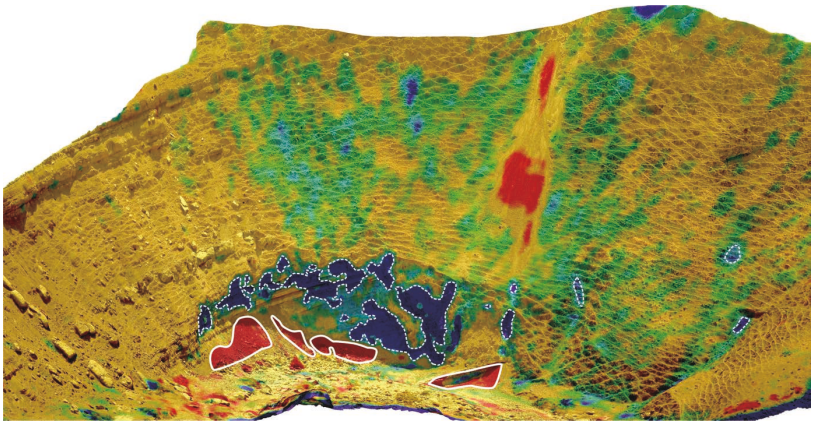


Fig. 31 Difference between 2019 and 2022 (dotted line show eroded area while white line shows deposited area).

occurrence of a significant change in terrain and landscape around Charmo within the past several thousand years.

4-4. Survey around Charmo

The land where archaeological sites are found can be an area with less erosion than others. Thus, grasping the distribution of archaeological sites can be helpful in understanding the erosion and the original landscape at the time. From this perspective, a survey around Charmo was conducted in 2022. A track-log and representative points of artifacts found were recorded by a handheld GPS device. Mapping of both track-log and points will indicate not only the places where artifacts were found but also the places where artifacts were not found[4] (Fig. 32). It is expected to provide a basic idea of the land surface when it was less eroded. The distribution of stone tools, which is relict from the older time and closer to our interest, was an area of particular focus (Fig. 33).

The result shows a cluster of points with a comparatively large number of stone tools to the northwest of Charmo, while stone tools are almost absent on the southern bank of Charmo (Fig. 33), perhaps due to the comparatively strong erosion that can be observed in Fig. 30 (left). The clustered points in the northwest area imply intense human activity, but the fact that tools made of obsidian can only be found at Charmo makes it difficult to think of these areas and Charmo as forming one united area.

4-5. Attempt at preliminary surface reconstruction

Interpolation using the elevation values of the points where stone tools were found (which we regard as less eroded area) around Charmo was conducted (points within the white box in Fig. 34 were used). This is another preliminary attempt to estimate an old terrain surface, which is a different approach from the summit level map in Section 4-2. This surface is expected to show the highest possible surface around Charmo[5].

4-6. Summary

The results from the above observations can be summarized as follows: 1) Charmo is located in an area where erosion is comparatively strong within the Cham Gawra Basin, 2) stone tools were

4) Of course, there is a great difference between “surveyed but nothing found” and “not surveyed, so no symbols of artifact area” in the map. Attempt was made to avoid survey bias; by including different landscapes and filling the area as equally as possible, when selecting the survey routes.

5) Further evaluation and screening of the possibility of the artifacts flowing in from other places, and unevenness of habitation should be taken into account.

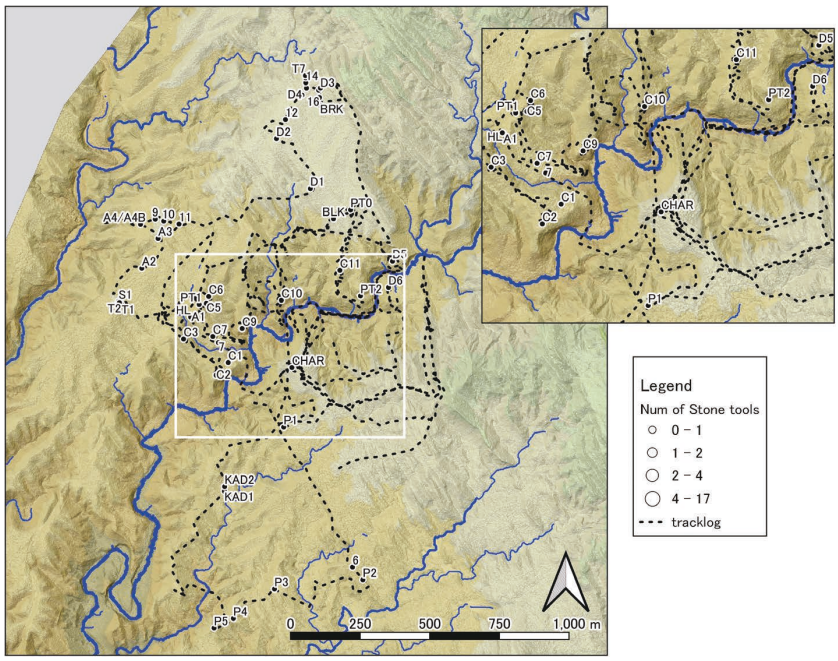


Fig. 32 Sites recorded by the survey in 2022.

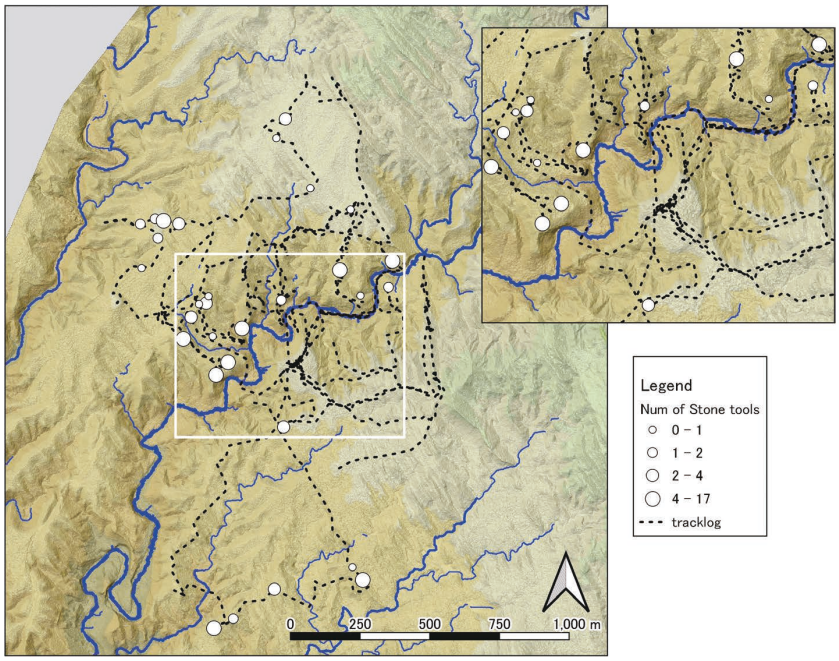


Fig. 33 Numbers of stone tools found.

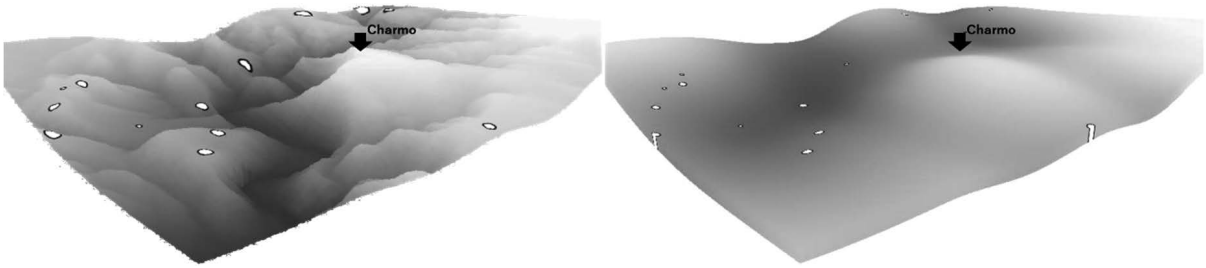


Fig. 34 right: Interpolated DEM from points where stone tools were found.

mainly detected in an area that is ridged and near a river channel, 3) the erosion/deposition process remains active (at least strongly enough to be detectable over a few years) around Charmo, and 4) points where stone tools were found are scattered more to the northwest of Charmo. Preliminary information and visualization were employed as a basis of paleo terrain reconstruction.

(Nobuya Watanabe)

5. Obsidian Stratigraphy of Charmo JT and J-II Central Squares and Stratigraphic Correlations between the Previous Trenches (Figs. 35–39)

Aiming to construct an obsidian stratigraphy of the Charmo site, obsidian tools excavated from JT and J-II central squares in the summer of 2022 were subjected to chemical composition analysis using a portable X-ray fluorescence spectrometer (pXRF). We used an Olympus VANTA VCR-CCC (Rh target, 4W X-ray tube) for the measurements and allocated 30 seconds to Beam 1 (at an accelerating voltage of 40 kV to measure the concentrations of Ti, V, Cr, Mn, and 23 elements heavier than Fe), and 60 seconds to Beam 2 (concentration measurement of Mg, Al, Si, P, S, K, Ca, Ti, and Mn at an acceleration voltage of 10 kV) X-ray irradiations. The reliability of the measurements was evaluated by measuring a set of standard rock-slab samples with known concentrations of each element.

We analyzed 508 obsidian stone tools excavated from JT and J-II central (J-IIC) squares during the 2022 field season. In order to suppress the influence of changes in the analytical values due to surface conditions (surface irregularity, roughness, etc.), the analytical values were evaluated for 368 obsidian pieces where LE (the total amount of elements lighter than Na) fell within the range of 50% ±5%. Al, Si, P, K, Ca, Ti, Mn, Fe, Cu, Zn, Rb, Sr, Y, Zr, Pb, and Th concentrations were used for the further analyses, which were determined to be reliable as a result of repeated analysis of the rock-slab standards.

A principal component analysis was performed using the concentration of elements as variables after applying a centered log-ratio transformation to each concentration [Aitchison 1986; Kucera and Malmgren 1998]. In the case of zero concentration values, we substituted the value with one

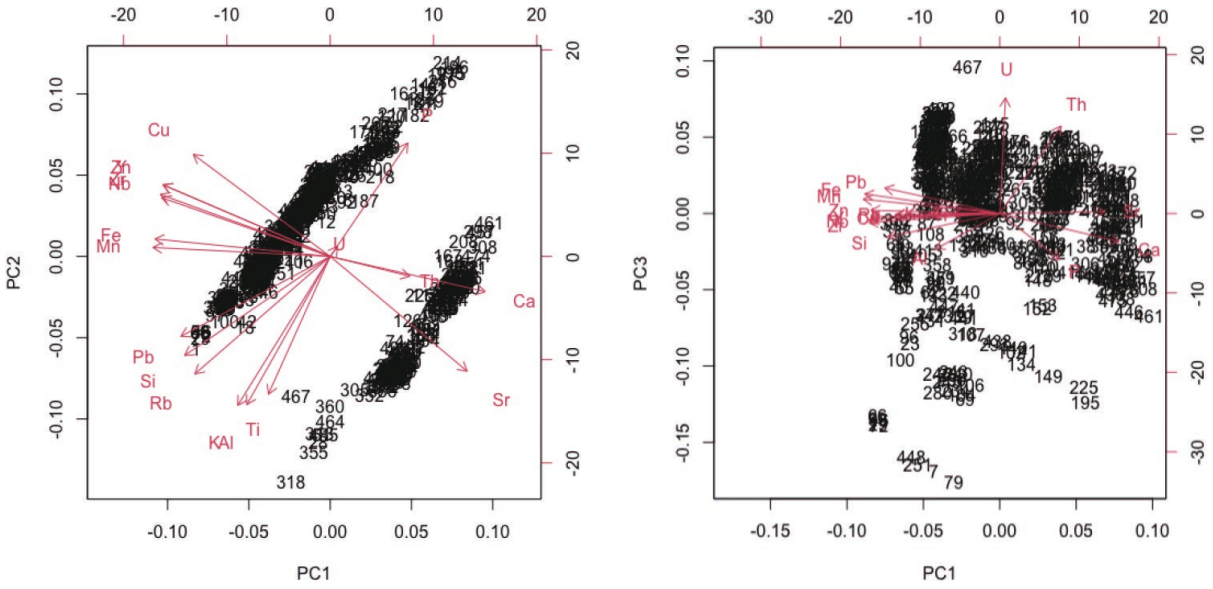


Fig. 35 Results of the principal component analysis for the chemical compositions of the obsidian stone tools excavated from the JT and J-IIC trenches of the Charmo site. By taking PC3 into consideration, the obsidian tools could be further divided into 5 or 6 groups.

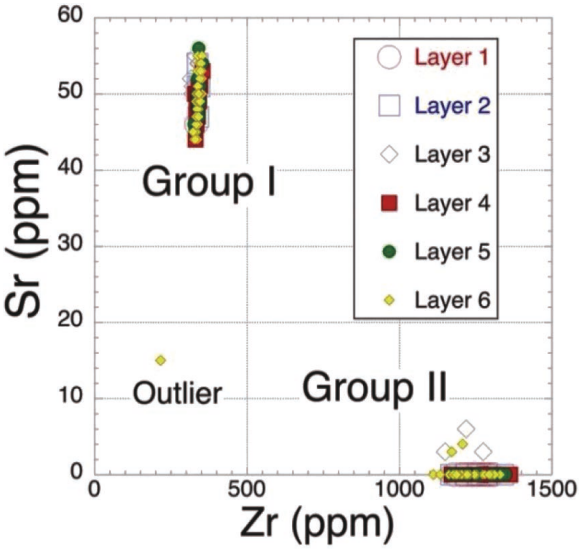


Fig. 36 Sr-Zr plot for the obsidian tools excavated from the JT and J-IIC trenches.

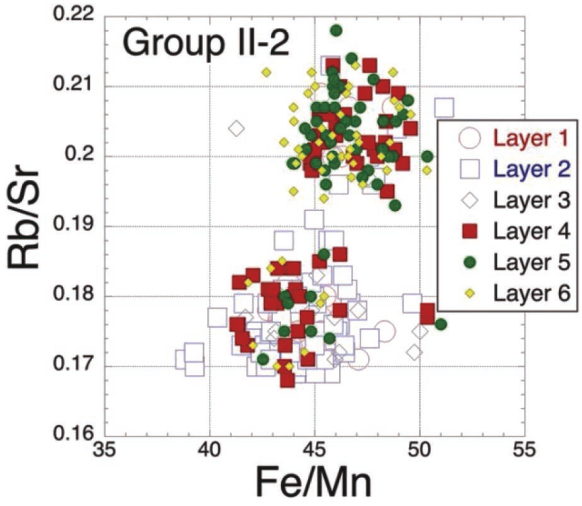


Fig. 37 Rb/Sr-Fe/Mn plot for the obsidian tools excavated from the JT and J-IIC trenches.

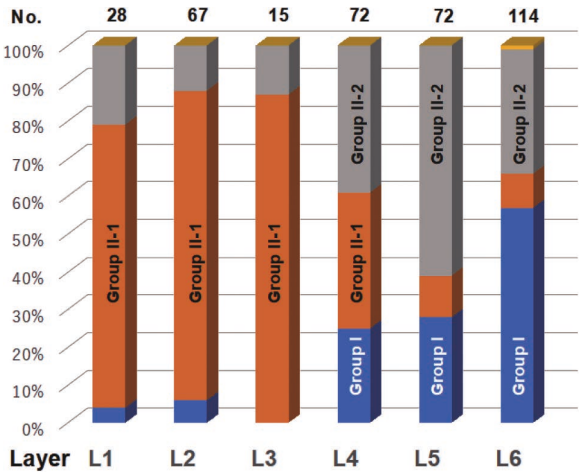


Fig. 38 A standard obsidian stratigraphy of the Charmo site established using the same data set.

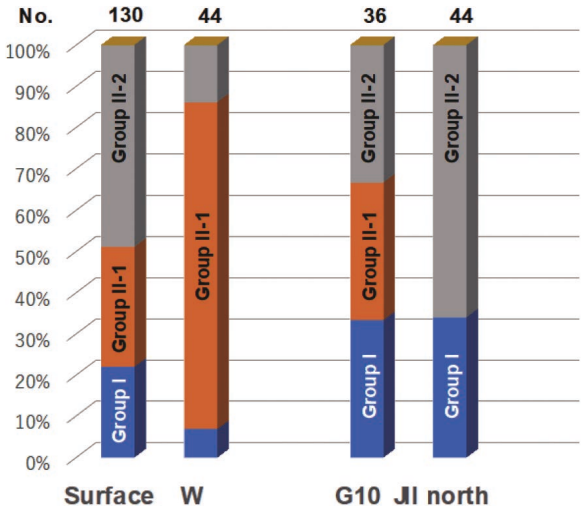


Fig. 39 Stratigraphic correlation with the W, G10, and J-II north trenches.

tenth of the minimum concentration of the corresponding element. As a result, 80% of all data are represented by the first three principal components. Obsidian samples are divided into two clusters by the first principal component (PC1), which has a particularly high contribution (55%). In the Zr and Sr plots, which have large loadings on the PC1, the measured obsidian tools can be broadly divided into two groups: Group I with Zr concentrations of 200 to 300 ppm and Sr concentrations of approximately 50 ppm, and Group II with Zr concentrations of over 1,000 ppm and almost no Sr. Group II obsidians could further be divided into group II-1 with Rb/Sr ratios below 0.19 and group II-2 with Rb/Sr ratios above 0.19 by taking the Rb/Sr and Fe/Mn ratios associated with second principal component (PC2) as axes. Thus, the obsidian excavated from JT and J-IIC squares of Charmo can be divided into three composition groups, except for one outlier excavated from the deepest layer. In comparison with previous studies [Maeda 2009; Frahm 2012; Chataigner and Gratuze 2014a, b; Campbell and Healey 2016], Group I obsidian was most likely sourced at Bingöl B obsidian site, whereas Group II-1 and Group II-2 obsidians can be correlated with the Nemrut

Dağ and Bingöl A obsidian sites, respectively.

To establish a standard obsidian stratigraphy that represents the Charmo site based on the geochemistry of the obsidian tools, frequency of occurrences of these obsidian groups were analyzed for each stratigraphic horizon of JT square, that is, Layer 1 to Layer 5 described in the previous chapters. For this analysis, geochemical data of obsidian tools excavated from the J-II central Layer 6 upper were merged into JT Layer 5 data based on our stratigraphic correlation, and together described as Layer 5 in Fig. 38. Similarly, those of J-II central Layer 5 were merged into JT Layer 4, and together described as Layer 4. Those from the J-II central Layer 6 lower were solely treated as Layer 6. The frequency of the obsidian groups indicates that Group II-1 obsidian was mostly used in upper Layer 1 to Layer 3, while in the lower Layer 5 and Layer 6 horizons, Group I and Group II-2 obsidians were dominant. The large transition occurred during the Layer 4 period. Thus, in the Layer 6 period, which corresponds to Pre-Pottery Neolithic according to field observation, obsidians seemed to have been used from various producers, including an outlier obsidian, but nearly half was provided by Bingöl B (Group I obsidian) producer. As time passed, but still during the PPN period, the Bingöl A (Group II-2 obsidian) producer won the position of the primary producer, but its glory did not last long. Their prominence quickly moved to the Nemrut Dağ (Group II-1 obsidian) producer by the period of Layer 3, that is, the Pottery Neolithic, and it continued until the abandonment of the Charmo site.

The suggested obsidian stratigraphy could be applied to the other trenches of the neighboring areas excavated previously. By comparing the obsidian stratigraphy with the frequency of the obsidian groups, we suggest that obsidian-yielding strata of the J-II north (J-II-N) trench corresponds to Layer 5 (PPN) of the JT square, whereas the obsidian-yielding strata of the G10 trench belong to Layer 4 (PPN/PN transition), and those of the W trench to Layer 2 (Pottery Neolithic).

The obsidian frequency from the surface layer, which is basically debris from the previous excavations, provides an interesting addendum to the suggested obsidian stratigraphy of the Charmo site. Unlike the Layers 1–3 obsidian frequency, the surface layer is rather abundant in Group II-2 obsidian tools and depleted in Group II-1 obsidian tools. Considering Group I and Group II-2 frequency and their ratio, the previous excavation obviously reached to the level of our Layer 5. Depletion of Group II-1 obsidian tools from the surface layer suggests that the pioneering excavators collected the Group II-1 obsidian tools selectively, and removed them from the ground. This hypothesis could easily be tested by measuring the chemical compositions of the obsidian tools from the Charmo site now stored in the museums.

(Ryo Anma and Yu Saitoh)

6. Searching for Charmo's Burials

Investigations in the previous 2018 and 2019 seasons focused on reconstructing the ancient landscape during the time of the Neolithic village and understanding the complex chronology of the site [Tsuneki *et al.* 2019]. Excavation in this season also aimed to gain a further understanding of the chronology of the site, in addition to detecting the ancient village and search for Charmo's burials.

6-1. Neolithic burials in Zagros area

The western wing of the Fertile Crescent (Levant and Anatolia) has long been the focal region for studying Neolithization, and the large number of burials uncovered from various sites provides insights into the Neolithic mortuary variability [Kenyon 1981; Rollefson 2000; Stordeur and Khawam 2007; Goring-Morris and Horwitz 2007; Akkermans 2008; Croucher 2012; Haddow and Knüsel 2017; Tsuneki *et al.* 2022]. The study of the burials helps us understand and estimate funerary practices and compare these results with those for other sites to understand the prevalent regional rituals and

compare them with neighboring regions. Recently, the eastern wing of the Fertile Crescent has become a core area for investigating the Neolithic transition. In Iraqi Kurdistan, excavation of the Charmo site by Braidwood in the 1940s–1950s long dominated the investigation of early farming settlement in the Zagros region. However, recent investigations in a number of sites in the eastern and western ends of the Zagros such as in Iraqi Kurdistan, including at Bestansur, Shahrizor Plain and Charmo [Matthews *et al.* 2019; Tsuneki *et al.* 2019; Odaka *et al.* 2020], and west Iran at Sheikh-e Abad and Jani [Matthews *et al*. 2013], have yielded new insights into the Neolithization and formation of the early villages and architectures in this region.

A large number of burials were uncovered at a number of sites in the western and eastern ends of the Zagros. Excavations at Ganj Dareh in west Iran, revealed remains of 41 individuals from all levels [Smith *et al.* 1972; Smith 1974]. One adolescent burial was adorned with an elaborate necklace of 71 shell and stone beads [Smith 1974]. Genetic evidence from a few individuals revealed that the Ganj Dareh population was more closely connected to hunter-gatherers of the Caucasus region than Anatolian populations, suggesting autonomous expansion of agriculture in the Zagros [Riel-Salvatore *et al.* 2021]. Burials were also uncovered from Ali Kosh [13 burials; Sołtysiak and Darabi 2017] and Sheikh-e Abad [9 burials; Cole 2013]. The burials were in some instances associated with specific areas bearing ritual significance, containing animal skulls and horn cores. These specific evidence were uncovered from other sites in west Iran, such as Sheikh-e Abad, Ganj Dareh, and Ali Kosh [Darabi *et al.* 2017].

The study of Neolithic burial customs in the western Zagros is relatively inadequate. Burials uncovered from this region in the past and from ongoing excavations are limited. However, recent excavations in Bestansur have unearthed a large number of burials that shed light on the complexity of funerary practices in this region. Remains of 67 burials were uncovered from different interment contexts in Bestansur [Walsh 2020]. Many burials were uncovered in so-called Space 50 in building 5 and were accumulated in three phases. It is suggested that this building was used for ritual purposes and treatment of the dead [Richardson *et al.* 2020]. This deposit comprises intact and disarticulated human remains, including detached crania and skulls, demonstrating that the dead were subjected to multi-stage postmortem treatment [Walsh 2020].

The assemblage of burials in building 5 in Bestansur somehow resembles the special purpose and ritually significant buildings that were excavated widely during the Neolithic period in the western wing of the Fertile Crescent. These buildings served various functions, some related to successive ritual practices such as the "Charnel House" at Abu Hureyra [Moore *et al.* 2000], or specifically used for burials, and a large number of individuals were uncovered inside them, such as "House of the Dead" at Dja'de el-Mughara [Coqueugniot 1998]. Several non-residential structures were uncovered in Central and Southeastern Anatolia, such as the storage of human remains at PPNA-PPNB Çayönü "Skull Building" [Özdoğan 1999], the Early MPPNB "temple" of Nevalı Çori [Hauptmann 1993]. Burials were missing from non-domestic buildings, or they were buried after the building lost its original function, such as Tell Qaramel [Mazuroweski *et al.* 2012], Nevalı Çori [Hauptmann 1993], Beidha [Makarewicz and Finlayson 2018], and ʿAin Ghazal [Rollefson 2000], but present in the domestic buildings. These new pieces of evidence will enrich our understanding of the characteristics, social structure, and common funerary practices of the Neolithic societies during the transition into the settled farming way of life in different regions of the Fertile Crescent.

6-2. Burials at Jarmo

The excavation of Jarmo in the late 1940s and early 1950s by Robert J. Braidwood of the University of Chicago revealed a small number of burials. Despite a sounding pit covering a large area of the site, skeletal remains were scarce. Therefore, it was difficult to understand life in the farming village of Charmo from the perspective of burials and funerary practices.

During Braidwood's excavations, burials from different age groups were uncovered, although the estimated age and sex are not precise (Table 3). In general, there was no clear evidence of grave pits, except for one case (J2−S3); there were no grave preparations or grave goods accompanying the dead; and the burials lacked uniformity. The human remains uncovered at the site were "hardly burials" [Braidwood *et al.* 1983: 427], and failed to provide sufficient information about life and death from the perspective of burials. Given the limited number of burials compared to the large number of test pits covering the surface of the mound, it is suggested that the Charmo people made their burials off-site [Braidwood *et al.* 1983].

Excavations in the Fertile Crescent have so far revealed no off-site cemetery, either in the Early Neolithic period or in the transitional period between the Pre-Pottery Neolithic B (PPNB) and Pottery Neolithic (PN) periods; rather, most of the burials were at the site. Crowded cemeteries located adjacent to the residential area were discovered in the Northern Levant at Tell el-Kerkh and Tell Sabi Abyad [Tsuneki *et al.* 2022; Akkermans 2008]. Though no off-site cemetery was uncovered in the Pottery/ Late Neolithic period, we pondered where the Charmo people buried their dead. Thus, we decided to carry out test excavations at the far edges of the mound, and we started with JW1 square.

Table 3 Excavated burials at Jarmo between 1948 and 1955 [Braidwood *et al.* 1983]

Square	Year	Skeleton no.	Layer/Skeleton location	Age	Sex	Burial type	Position	Body axis direction	Face direction	Remarks
J-I	1948	S1	In cleaning the upper most meter of deposit	Infant			Flexed positions		Facing opposite direcctions	
		S2								
		S3	Lying upon the third floor in one corner of a portion of *tauf* walling	Adult?	Neither the sex nor the age (beyond the fact that the individuals were adults) could be ascertained.					Accidental death
		S4								
		S5								
		S6								
J-II	1950	S1	In cleaning the first floor of J-II	Recent skeleton						
		S2	Second floor of J-II	Young adult						Partial and fragmented remains
		S3								Fragments of a right arm, some ribs and a few bits of skull and jaw and partly overlying J2-S4
		S4		Adult	Male		Prone		West	
		S5	In clearing of the second floor in J-II	Teen	Female		Supine flexed			
M20	1955		0.75 m in depth, near one face of the two-meter square M20	Adult						

6-3. JW1 square

JW1 is a 2 ×2 meters square located at the westernmost side of the site along the N2 60-meter line near the end of the slope overlooking the valley of an ancient riverbed. No excavations or survey were carried out in this part of the site. The purpose of excavation at this square is to:

① Reveal the distribution of the archaeological features of this part of the mound.

② Verify Braidwood's suggestion of the existence of an off-mound cemetery.

In the 2018 and 2019 seasons, geophysical prospecting (GPR and magnetometric surveys) was undertaken on the southwestern slope of the mound (Fig. 10-1). The results indicate that the Neolithic village extended into the southern slope of the mound (Tsuneki *et al.* 2019). In 2019, another magnetometric survey was undertaken on the lower slope of the mound. The survey

results show that there are no magnetic anomalies except for very subtle anomalies caused by the geographical slope. This demonstrates that there are no archaeological features directly beneath the surface such as that identified at the upper slope around W trench [Tatsumi's field report 2019].

JW1 was set up about 25 meters to the west of the 2019 magnetometric survey area. There appear to be fewer archaeological features on the west slope than at the top of the mound, which could be a place for burials adjacent to the Neolithic village (Fig. 10-1). We dug approximately 0.8 m below the surface; however, no remains or objects of any kind were uncovered (Fig. 40). Therefore, excavation was suspended in this square and in this part of the site, and the excavation pit was filled in. We then wondered whether the Charmo people really buried their dead that far away, or even off the mound. The ancient natural landscape in the Chamchamal region could help reveal the answer. Charmo, like other sites in this region, is situated on the top of a hill surrounded by steep slopes formed over thousands of years from intensive erosion by a river. As mentioned above, Watanabe indicated that the relative height from the riverbed to the hilltop was lower 9,000 years ago, and water sources should have been more accessible at that time. Therefore, if the settlement of Charmo was surrounded by rivers, subsidiary rivers, and streams, it would mean that the mound was surrounded by natural terrains that would have made it difficult to transfer a corpse from one site to another, not to mention the difficulty in transferring a corpse off-site during the rainy seasons, when the level of rivers and streams is high. Therefore, it seems that the dead were buried in the village, as commonly known in the Neolithic era, between and beneath the floors of buildings or adjacent to the village.

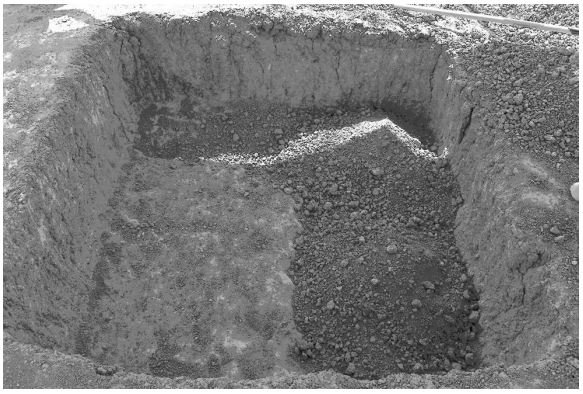


Fig. 40 Square JW1.

Meanwhile, excavations were continued in two different parts of the site in JT and J-II central squares, and fragments of human remains have been excavated: one or two in JT and two in J-II central.

6-4. Burials at Charmo

SK1

This find comprises fragmented human bones belonging to a young individual discovered at a depth of approximately 3 meters in layer 5 at JT square (Fig. 41). Primary analyses of the bones in situ indicate that they might belong to an infant. This individual is represented partially by a fragment of skull, a few long bones and ribs (Fig. 42). The human bones are dispersed over a space covering about 1.5 meters long, and they do not form a skeleton in its normal anatomical position. The human remains were mixed with animal bones and small stones. Near this accumulation at the corner of the excavation square, a *tannor* like-structure of compact orange-colored soil was discovered. At the same level to the northeast of SK1, animal bones including a large animal

Fig. 41 An overview of the SK1 deposit.

Fig. 42 SK1 skull and other bone fragments.

horn were found (Fig. 43). Near the horn, other fragments of human bones, probably of a skull that might have belonged to an infant, were discovered (Fig. 44). There is no clear evidence of a grave pit or grave preparation, so it is barely a grave. The discovery of the *tannor* and the human-animal bones in this area may indicate human activities bearing symbolic or ritual significance. Further investigation will be conducted in this area in the following excavation season.

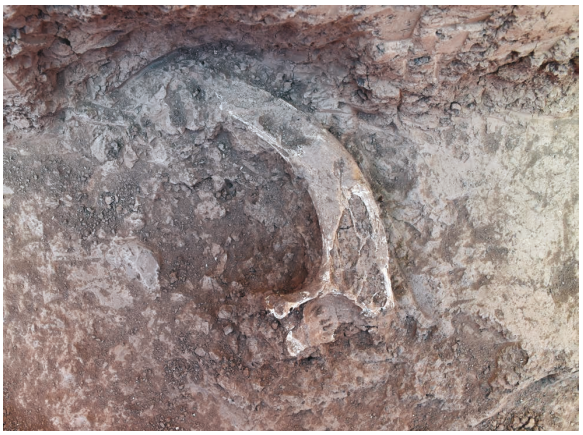


Fig. 43 Animal horn.

Fig. 44 Fragment of a skull of a probable infant near the animal horn.

SK2

This is a fragment of a skull discovered in layer 5 in the western wall of J-II central square (Fig. 45). Initially, a portion of the skull was visible in the wall section, and other parts were revealed after removing the upper layers of the wall. It was a fragmented skull that might have belonged to an infant. The skull fragments were solo, and no other skeletal elements were uncovered in situ. The skull was discovered in a thick charred layer of soil that extended over a wide area and continued out of the excavation area. However, the skull fragments show no traces of fire, which indicates that it was not initially buried in this location. Like SK1, there is no clear evidence of a grave pit or grave preparation.

SK3

This is another fragment of a skull discovered on the floor of J-II central pit to the north of a structure building (Str. 10). The skull fragment is small and probably belonged to an infant. There is no clear evidence for a grave pit, and it is difficult to determine how this fragment ended up at

Fig. 45 Fragment of an infant skull from the west wall of J-II Central.

this location and whether it is associated with the structured building.

(Sari Jammo)

7. Conclusion

After a two-season hiatus due to the COVID-19 pandemic, we resumed our investigations at Charmo this season. Through this investigation, we aimed to determine the final date of existence of the Neolithic village at Charmo and to shed some light on the reality of its village life. We slightly expanded the excavation area, which had been limited to a very small trial soundings in former seasons.

For the first objective, i.e., determining the final date of the Neolithic village, a new JT square was established at the highest elevation of the Charmo site. Hence, it is likely that the oldest Pottery Neolithic cultural deposits in Zagros, even older than the Proto-Hassuna period, were the terminal stage of the Neolithic Charmo village. The ^{14}C-dating of the charcoal samples collected this season is underway; however, the dating of most of the samples collected from the J-II south trench, east of JT square excavated in 2019, indicates the beginning of the 7th millennium BC, making it extremely probable that the Neolithic village at Charmo came to an end in the early 7th millennium BC.

Regarding the second objective, i.e., the elucidation of the specific living conditions in Charmo, the excavations in J-II central square yielded several fruitful discoveries. A cache of tools and materials for manufacturing chipped stones and stone vessels, a set of beautiful marble bowl and spoon, and a square planned pisé building with several floors, which were covered with a mat made of woven plant fibers, were discovered. In the building, a small clay platform was placed on the lower floor, surrounded by three broken animal figurines. These findings suggest that ritual practices were frequently performed during everyday life. To understand the realities of Charmo's people, careful excavation will be necessary to recover a more concrete context.

The topography and environment around the Neolithic Charmo village must have been quite different from that of today, which we have been trying to reconstruct. Nobuya Watanabe used the SfM to make 3D measurements of Charmo in 2019 and 2022 to determine the topographic changes over these three years due to erosion. In addition, he surveyed the off-sites around Charmo to determine the distribution of lithics, potsherds, and other artifacts. Based on these data, he reconstructed a preliminary paleo-environment around the Neolithic Charmo village. His reconstruction plan shows a very gently sloping topography with very little erosion around Cham Gawra, which will be very useful data for us to reconstruct the livelihood and social life of the

Charmo people.

Reconstructing the paleo-landscape around the Charmo site, Ryo Amma collected samples for the Terrestrial Cosmogenic Nuclides (TCN) dating on the geomorphological surface around the site. His dating research is currently underway and will soon produce a paleo-environmental reconstruction map of Charmo. In addition, Ryo Amma also conducted chemical composition analyses of 508 obsidian lithic artifacts excavated from JT and J-II central squares, using a portable X-ray fluorescence spectrometer (pXRF) and summarized the characteristics of each layer. Reliable Al, Si, P, K, Ca, Ti, Mn, Fe, Cu, Zn, Rb, Sr, Y, Zr, Pb, and Th concentrations of each element were used in the analysis and it was determined that the obsidian group could be divided into three compositional groups, except for one sample. These were compared to the previous studies. He concluded that Group 1 was Bingöl B, Group II-1 was Nemrut Dağ, and Group II-2 was Bingöl A obsidian. Looking at the usage frequency of these obsidian groups by excavation layers, Group II-1 obsidian was used in the upper Layers 1 to 3, while Group I and Group II-2 obsidian were predominant in the lower Layers 5 and 6. The change of major obsidian resources occurred in Layer 4. Since Layer 4 corresponded to the transition period from PPN to PN, it is highly suggestive that the obsidian origin was changing during this transitional period. Whether similar changes are present in other artifacts is worthy of further studies.

A study of the Charmo villagers must be made from excavated human bones. However, we have not yet encountered good-condition burials at Charmo. Sari Jammo tried to discover the burial field outside the village and made a trial trench at JW 1 square. Unfortunately, he did not find any cultural deposits, including burials. Instead, one or two child burials were found in JT square and two in J-II central square. The condition of these human bones was poor and no definite burial posture or other information was known. At present, it is believed that adults, semi-adults, and juveniles were mainly buried outside the village, and infants and small juveniles were buried near their homes. However, future research may uncover adult burials within the village.

This season's work at Charmo has advanced our understanding of the Charmo Neolithic society. We hope to continue these efforts to further our understanding of the Charmo site, which is of great scholarly and historical importance, and further the study of Neolithization in the eastern wing of the Fertile Crescent.

(Akira Tsuneki and Saber Ahmed Saber)

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Bibliography

Akkermans, P.M.M.G.
2008 Burying the dead in Late Neolithic Syria. In: J.M. Cordoba, M. Molist, C. Perez, I. Rubio and Martinez S. (eds.), *Proceedings of the 5th International Congress on the Archaeology of the Ancient Near East, Madrid, April 3–8, 2006*: 621–645. Universidad Autónoma of Madrid, Madrid.

Aitchison, J.
1986 *The Statistical Analysis of Compositional Data.* Chapman and Hall, London.

Asouti, E., Baird, D., Kabukcu, C., Swinson, K., Martin, L., García-Suárez, A., Jenkins, E. and Rasheed, K.
2020 The Zagros Epipalaeolithic revisited: New excavations and ^{14}C dates from Palegawra cave in Iraqi Kuridistan, *ProsOne* 15(9): e0239564. https://doi.org/10.1371/journal.pone.0239564

Braidwood, L.S., Braidwood, R.J., Howe, B., Reed, C.A. and Watson, P.J.
1983 *Prehistoric Archaeology along the Zagros Flanks*. Oriental Institute Publications 105. University of Chicago, Chicago.

Braidwood, R.J.
1967 *Prehistoric Men (Seventh Eedition)*, Scott, Foresman and Company, Glenview.

Braidwood, R.J. and Howe, B. (eds.)
1972 *Prehistoric Investigations in Iraqi Kurdistan.* Studies in Ancient Oriental Civilization, No. 31. The Oriental Institute of the University of Chicago, Chicago.

Campbell, S. and Healey, H.
2016 Multiple sources: The pXRF analysis of obsidian from Kenan Tepe, S.E. Turkey, *Journal of Archaeological Science, Reports* 10: 377–389.

Chataigner, C. and Gratuze, B.
2014a New data on the exploitation of obsidian in the southern Caucasus (Armenia, Georgia) and eastern Turkey, part 1: Source characterization, *Archaeometry* 56: 25–47.
2014b New data on the exploitation of obsidian in the southern Caucasus (Armenia, Georgia) and eastern Turkey, part 2: Obsidian procurement from the Upper Palaeolithic to the Late Bronze Age, *Archaeometry* 56: 48–69.

Cole, G.
2013 Human Burials. In R. Matthews, W. Matthews, and Y. Mohammadifar (eds.), *The Earliest Neolithic of Iran: 2008 Excavations at Sheikh-e Abad and Jani: Central Zagos Archaeological Project, Volume 1*. Vol. 4: 163–174. Oxbow Books, Oxford.

Coqueugniot, E.
1998 Dja'de el Mughara (moyen-euphrate), un village néolithique dans son environnement naturel à la veille de la domestication. In M. Fortin and Aurenche O. (eds.), *Espace naturel, espace habité, en Syrie du Nord (10e-2e millénaires av. J.- C.)*: 109–114. Canadian Society for Mesopotamian Studies (Bulletin 33) Travaux de la Maison de l'Orient Méditerranéen. Vol. 28, Toronto and Lyon.

Croucher, K.
2012 *Death and Dying in the Neolithic Near East*. Oxford University Press, Oxford.

Darabi, H., Bahramiyan, S., Mostafapour, S., Khademi, Bami, M. and Yari, A.
2017 Re-excavation at Tapeh Ali Kosh, Deh Luran Plain, Iran. *Neo-Lithics* 2: 15–18.

Frahm, E.
2012 Distinguishing Nemrut Dağ and Bingöl obsidians: Geochemical and landscape differences and the archaeological implications, *Journal of Archaeological Science* 39: 1436–1444.

Fuller, D.
2015 Jarmo, In Kapanias, K. MacGinnis, J. and Ur, J. (eds) *Archaeological Projects in the Kurdistan Region in Iraq*: 23, The Directorate of Antiquities of Kurdistan.

Gallant, J. C. and Dowling, T. I.
2003 A multi-resolution index of valley bottom flatness for mapping depositional areas, *Water Resources Research* 39(12): 4–13 DOI: 10.1029/2002WR001426

Goring-Morris, N. and Horwitz, L.K.
2007 Funerals and feasts during the Pre-Pottery Neolithic B of the Near East. *Antiquity* 81(314): 902–919.

Haddow, S.D. and Knüsel, C.J.
2017 Skull retrieval and secondary burial practices in the Neolithic Near East: recent insights from Çatalhöyük, Turkey. *Bioarchaeology International* 1: 52–71.

Hauptmann, H.
1993 Ein Kultgebäude in Nevali Çori. In A. Palmieri, M. Frangipane, H. Hauptmann, and Liverani M. (eds.), *Between the Rivers and over the Mountains: Archaeologica Anatolica et Mesopotamica*: 37–69. Alba Palmiera Dedicata, Rome.

Kenyon, K.M.
1981 Excavations at Jericho. Vol. 3. *The Architecture and Stratigraphy of the Tell 3*. British School of Archaeology in Jerusalem, London.

Kucera, M. and Malmgren, B.A.
1998 Logratio transformation of compositional data — a resolution of the constant sum constraint. *Mar. Micropaleontol* 34: 117–120.

Maeda, O.
2009 *The Materiality of Obsidian and the Practice of Obsidian Use in the Neolithic Near East.* PhD thesis. University of Manchester.

Makarewicz, C.A. and Finlayson, B.
2018 Constructing community in the Neolithic of southern Jordan: quotidian practice in communal architecture. *ProsOne* 13(6): 1–20.

Matthews, R., Matthews, W., Richardson, A. and Raheem, K.R.
2020 The Neolithic transition in the Eastern Fertile Crescent: project themes, aims and objectives. In R. Matthews, W. Matthews, K.R. Raheem, and A. Richardson (eds.), *The Early Neolithic of the Eastern Fertile Crescent: Excavations at Bestansur and Shimshara, Iraqi Kurdistan*: 1–18. Oxbow Books, Oxford.

Matthews, R., Matthews, W., Richardson, A., Walsh, S., Iversen, I., Mudd, D., Rasheed, K., Raeuf, K., Bendrey, R., Whitlam, J., Charles, M., Bogaard, A. and Elliott, S.
2019 The Early Neolithic of Iraqi Kurdistan: current research at Bestansur, Shahrizor Plain. *Paléorient* 45–2: 13–32.

Matthews, R., Matthews, W. and Mohammadifar, Y. (eds.)
2013 *The Earliest Neolithic of Iran: 2008 excavations at Sheikh-e Abad and Jani.* Oxford: Oxbow Books (British Institute of Persian Studies Archaeological Monograph 4).

Mazuroweski, R.F., Białowarczuk, M. and Januszek, K.
2012 Architecture. In R.F. Mazuriwski and Y. Kanjou (eds.), *Tell Qaramel 1999–2007 Protoneolithic and Early Pre-Pottery Neolithic Settlement in Northern Syria*: 34–59. PCMA Excavation Series 2. Polish Center of

Mediterranean Archaeology, Warsaw.

Miyata, K., Itahashi, Y. and Tsuneki, A.
2022 Preliminary observations on carbide attached pottery excavated from the Charmo site. In Yamada, S. (ed.) *The Essence of Urban Civilization: An Interdisciplinary Study of the Origin and Transformation of Ancient West Asian Cities, Reports of Survey Results for FY2021*: 17–28. (in Japanese)

Moore, A.M.T. and Molleson, T.I.
2000 Disposal of the dead. In A.M.T. Moore, G.C. Hillman and A.J. Legge (eds.), *Village on the Euphrates from Foraging to Farming at Abu Hureyra*: 276–299. Oxford University Press, Oxford.

Özdoğan, A.
1999 Çayönü. In M. Özdoğan and N. Başgelen (eds.), *Neolithic in Turkey: The Cradle of Civilization*: 35–63. Arkeoloji ve Sanat Yayınları, Istanbul.

Odaka, T., Maeda, O., Shimogama, K., Hayakawa, Y.S., Nishiaki, Y., Mohammed, N.A. and Rasheed, K.
2020 Late Neolithic in the Shahrizor Plain, Iraqi Kurdistan, new excavations at Shakar Tepe. *Neo-Lithics*: 53–57.

Richardson, A., Matthews, R., Matthews, W., Walsh, S., Raeuf, Aziz K. and Stone, A.
2020 Excavations and contextual analyses: Bestansur. In R. Matthews, W. Matthews, K. R. Raheem, and A. Richardson (eds.), *The Early Neolithic of the Eastern Fertile Crescent: Excavations at Bestansur and Shimshara, Iraqi Kurdistan*: 115–175. Oxbow Books, Oxford.

Riel-Salvatore, J., Lythe, A. and Albornoz, A.U.
2021 New insights into the spatial organization, stratigraphy and human occupations of the Aceramic Neolithic at Ganj Dareh, Iran. *ProsOne* 16(8): e0251318.

Rollefson, G.O.
2000 Ritual and social structure at Neolithic ‘Ain Ghazal. In I. Kuijt. (ed.), *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation*. Kluwer Academic. 163–188, New York.

Smith, P.E.L., Bivar, A.D.H., Fehervari, G., Burney, C., Ghirshman, R., Weiss, H., *et al.*
1972 Survey of excavations in Iran during 1970–1971. *Iran* 10: 165–186.

Smith, P.E.L.
1974 Ganj Dareh Tepe. *Paléorient* 2(1): 207–209.

Sołtysiak, A. and Darabi, H.
2017 Human remains from Ali Kosh, Iran, 2017. *Bioarchaeology of the Near East* 11: 76–83.

Stordeur, D. and Khawam, R.
2007 Les crânes surmodelés de Tell Aswad (PPNB, Syrie). Premier regard sur l’ensemble, premières réflexions. *Syria* 84: 5–32.

Tsuneki, A., Rasheed K., Saber S.A., Nishiyama S., Anma R., Ismail B.B., Hasegawa A., Tatsumi Y., Miyauchi Y., Jammo S., Makino M. and Kudo, Y.
2015 Excavations at Qalat Said Ahmadan, Slemani, Iraq-Kurdistan: first interim report (2014 season), *Al-Rāfidān* 36: 1–50. The Institute for Cultural Studies of Ancient Iraq, Kokushikan University, Tokyo.

Tsuneki, A., Rasheed, K., Saber, S.A., Nishiyama, S., Watanabe, N., Greenfield, T., Ismail, B.B., Tatsumi, Y. and Minami, M.
2016 Excavations at Qalat Said Ahmadan, Qaladizah, Iraq-Kurdistan: second interim report (2015 season), *Al-Rāfidān* 37: 89–142. The Institute for Cultural Studies of Ancient Iraq, Kokushikan University, Tokyo.

Tsuneki, A., Watanabe, N., Anma, R., Tatsumi, Y., Jammo, S. and Karim, R.
2020 Neolithization in eastern part of the Fertile Crescent: investigatnions at Charmo, Slemani, Iraqi-Kurdistan (2019), *Proceedings of the 27th Annual Meeting of Excavations in West Asia*: Japanese Society for West Asian Archaeology (in Japanese).

Tsuneki, A., Hironaga, N. and Jammo, S. (eds.)
2022 *The Neolithic Cemetery at Tell el-Kerkh*. Al-Shark 5: University of Tuskuba, Studies for West Asian Archaeology, Excavation Reports of Tell el-Kerkh, Northwestern Syria 2. Oxford: Archaeopress Publishing LTD. ISBN 978-1-80327-026-5, ISBN 978-1-80327-027-2 (e-Pdf)

Tsuneki, A., Rasheed, K., Watanabe, N., Anma, R., Tatsumi, Y. and Minami, M.
2019 Landscape and early farming at Neolithic sites in Slemani, Iraqi Kurdistan: a case study of Jarmo and Qalat Said Ahmadan. *Paléorient* 45(2): 33–51.

Walsh, S.
2020 Human remains from Bestansur: demography, diet and health. In R. Matthews, W. Matthews, K.R. Raheem, and A. Richardson (eds.), *The Early Neolithic of The Eastern Fertile Crescent: Excavations at Bestansur and Shimshara, Iraqi Kurdistan*: 429–459. Oxbow Books, Oxford.