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## Report on the Fifth Season of Excavations at Girdi Qala and Logardan

Regis Vallet, Marie-Odile Rousset, Saber Ahmad Saber, Cheima Abdulmassid,  
Rateb Al-Debs, Johnny Padovani Baldi, Claire Padovani, Sidonia Obreja,  
Kamal Rahoof, Caroline Douché, et al.

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# REPORT ON THE FIFTH SEASON OF EXCAVATIONS AT GIRDI QALA AND LOGARDAN

RÉGIS VALLET

CNRS – INSTITUT FRANCAIS DU PROCHE-ORIENT (IFPO)



*Logardan, aerial view from the west (2019)*

DIRECTORATE OF ANTIQUITIES OF SULEYMANIAH  
GENERAL DIRECTORATE OF ANTIQUITIES OF KURDISTAN REGIONAL GOVERNMENT



NOVEMBER 2019





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*NOVEMBER 2019*







## TABLE OF CONTENTS

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INTRODUCTION <i>Régis Vallet</i> .....	5
GIRDI QALA, THE UPPER LEVELS OF THE CITADEL <i>Marie-Odile Rousset, Saber Ahmad Saber, Cheïma Abdulmassid and Rateb al-Debs</i> .....	13
LOGARDAN TRENCH D: STRATIGRAPHY AND ARCHITECTURE <i>Johnny Samuele Baldi and Claire Padovani</i> .....	23
LOGARDAN: SUMMARY REASSESSMENT OF STRATIGRAPHY AND ARCHITECTURE OF THE UPPER TERRACE <i>Johnny Samuele Baldi, Sidonia Obreja, Rateb al Debs and Kamal Rahoof</i> .....	51
ETHNOGRAPHIC STUDY: EXPLOITATION OF THE NATURAL RESOURCES IN THE TAVUQ ÇAY VALLEY <i>Carolyne Douché and Claire Padovani</i> .....	63
THE LITHIC ASSEMBLAGES OF GIRDI QALA AND LOGARDAN, PRELIMINARY OBSERVATIONS <i>Francesca Manclossi</i> .....	73
ARCHAEOBOTANICAL REPORT <i>Carolyne Douché</i> .....	95
CONSERVATION REPORT OF THE FRENCH ARCHAEOLOGICAL MISSION IN WESTERN QARA DAGH <i>Chamsia Sadozai</i> .....	115
BIBLIOGRAPHICAL REFERENCES.....	125
APPENDIX A: RADIOCARBON DATING.....	131
APPENDIX B: FINDINGS LIST.....	135
APPENDIX C: EXPORTED SAMPLES.....	143





# INTRODUCTION

Régis Vallet

The fifth campaign of the archaeological mission in Girdi Qala and Logardan lasted from September 9 to October 2, 2019 for the fieldwork activities, until October 12 for the study of the material, in our accommodation in Chamchamal, near the sites (Fig. 1).

The team, under the direction of Régis Vallet (IFPO-CNRS), gathered 17 researchers and engineers from France, Belgium, Italy, Iraq and Germany (by alphabetic order) : Cheïma Abdulmassid (University of Suleymaniah, archaeologist), Johnny Samuele Baldi (CNRS-IFPO, archaeologist and ceramologist), Laurent Colonna d'Istria (University of Liège, epigrapher and archaeologist), Rateb al-Debs (University of Damascus, currently in Osnabruck, archaeologist), Carolyne Douché (MNHN, archaeobotanist), Alisée Devillers (University of Liège, archaeologist), Jonathan Lisein (Certus Visio, photogrammeter), Francesca Manclossi (University of Paris 10, lithician), Sidonia Obreja (University of Paris 1, archaeologist), Ali Othman (University of Paris 1, archaeologist and drawer), Claire Padovani (University of Paris 1, archaeologist), Kamal Rahoof (Directorate of Antiquities of Suleymaniah, archaeologist), Sabah Rahoof Aziz Yussef (assistant paleobotanist), Marie-Odile Rousset (CNRS-University of Lyon 2, archaeologist), Saber Ahmad Saber (Directorate of Antiquities of Suleymaniah, archaeologist) and Chamsia Sadozai (CRAterre, curator of earthen architecture).



Fig. 1 – Regional map showing the location of the sites.



Mohammed Rahim Aziz and Ruzgar Fatah Qader (site guards), Hallo Wasie Karim (cook), Faizulla Abdullah Muhammad, Kamal Jalal Muhammad, Tahir Nejem Mohammad (drivers) and Jamal Jalal Muhammad, steward of the expedition and keeper of our storage, composed the logistic team (Fig. 2).



*Fig. 2 – Part of the 2019 team (from left to right): R. al-Debs, S. R. Aziz Yussef, A. Othman, S. Ahmad Saber, M.-O. Rousset, C. Abdulmassid, J. Lisein, C. Douché, A. Devillers, a squirrel (no known surname), S. Obreja, K. Rahoof, H. Wasie Karim, J. S. Baldi, G. Ruzgar Fatah and C. Padovani.*

In 2019, field operations concerned only trenches B of Girdi Qala and D of Logardan. Limited verifications took place in Logardan Trench E, while the objectives of Girdi Qala Trench D having been achieved the previous year (Vallet ed. 2018), that trench was not pursued. At Girdi Qala B, the five-year program of Liège is now over (our Belgian colleagues only came for a few days for controls in Level 6), but Marie-Odile Rousset (CNRS-University Lyon 2) has joined the project (with funding from MSH Lyon-St Etienne) to study the upper levels, Islamic and Sassanid, of the main mound of the site<sup>1</sup>.

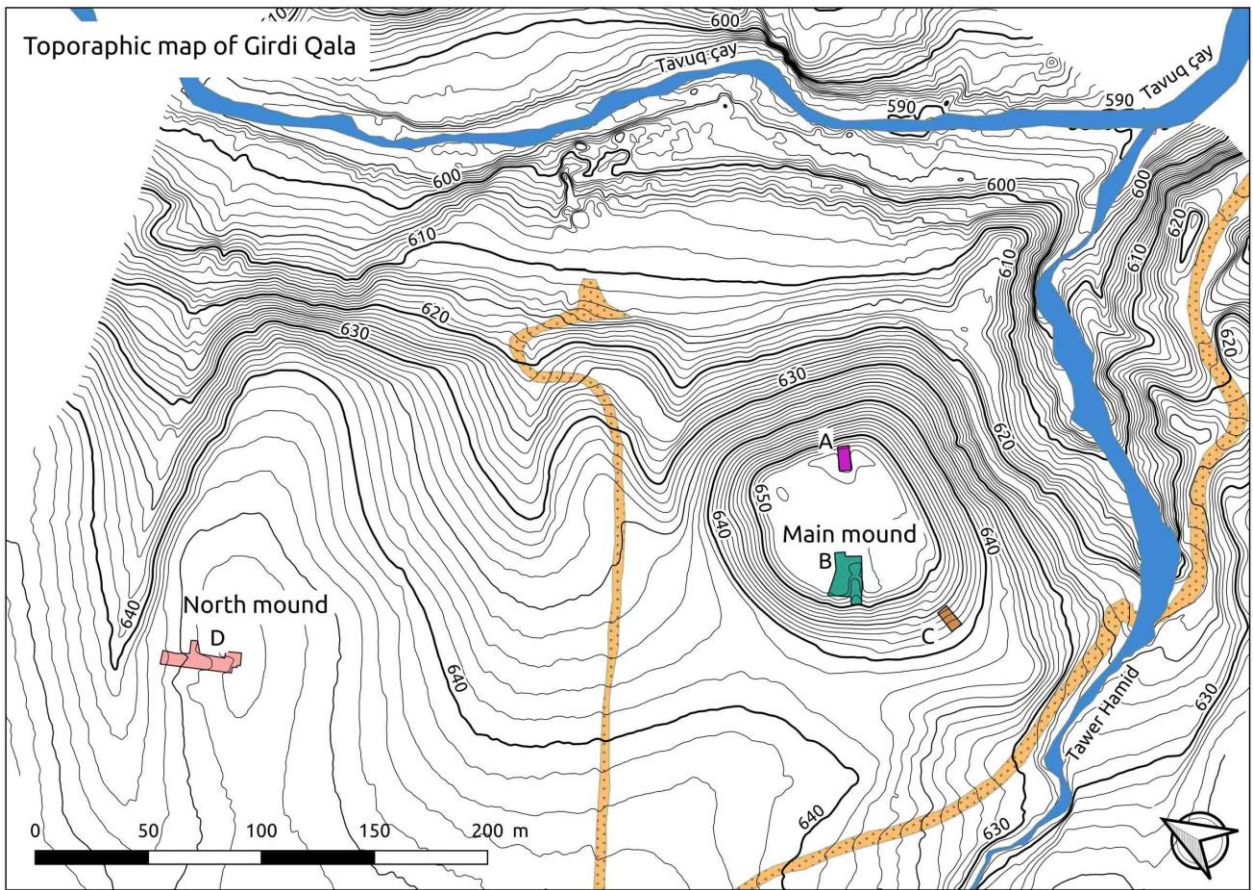
In Girdi Qala B therefore (M. - O. Rousset, S. A. Saber, C. Abdulmassid and R. al-Debs), work focused on the study of the already existing long north section, set back by one meter on this occasion, and the extension of the trench, increased to an area of approximately 200 square meters, following the opening of another 120 square meters (Fig. 3 and 4).

The sequence recognized since 2015 is not fundamentally altered but clarified, including the dating of certain levels, by new in situ material and C14 dating (Appendix A). Level 1, which has been the subject of extensive clearance this year, is more recent than envisaged since it dates from the 17th-18th centuries AD. Its architectural remains are poorly preserved, due to both erosion (agricultural crops in particular) and rudimentary construction techniques (poor quality mud brick, no well-arranged masonry apparatus).

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<sup>1</sup> The 2019 campaign was funded by the excavation commission of the French Ministry of Foreign Affairs, the IFPO, the MSH Lyon-St Etienne, the CNRS and the universities of Paris 1 and Liège.





*Fig. 3 – Topographic map of Girdi Qala (Coordinate system WGS84/UTM38N – J. Lisein 2019).*



*Fig. 4 – Aerial view of Girdi Qala Trench B, from the south-east (2019).*

It is, as we thought following the results of geomagnetic prospecting (Darras and Benech 2015), a dense and fortified habitat, with a large house of at least nine rooms of small or medium module, backed by a rampart 1.2m wide (in mud brick, completely melted). Level 2 probably corresponds to the same type of occupation, with a narrower rampart, located a little back, which probably corresponds to that identified in 2015 in Trench A. But so far it has only delivered furnaces of potters, in B as in A (again with a large potter's kiln, leaning against the rampart, Parayre and Sauvage 2015). It could date from the 15th-16th centuries (Late Islam).

Level 3A, again with kilns (and associated floors) yielded additional material that can be assigned to the 13th-14th centuries (Middle Islam), while from level 3B (other kilns) probably come the seeds having provided in 2015 several radiocarbon dates of the 11th-12th centuries (Middle Islam). Level 4 contains domestic architecture and associated material attributable to the 8th-9th centuries (Early Islam). Lower, Level 5, with at least two levels (5A and 5C, separated by a layer of destruction '5B'), yielded Sassanid material belonging to two distinct phases of the period, Late at the top and Early Sassanid at bottom (Ahmad 2016). The whole of this sequence seals the large Hellenistic building of Level 6, on which the excavation has stopped for the moment.

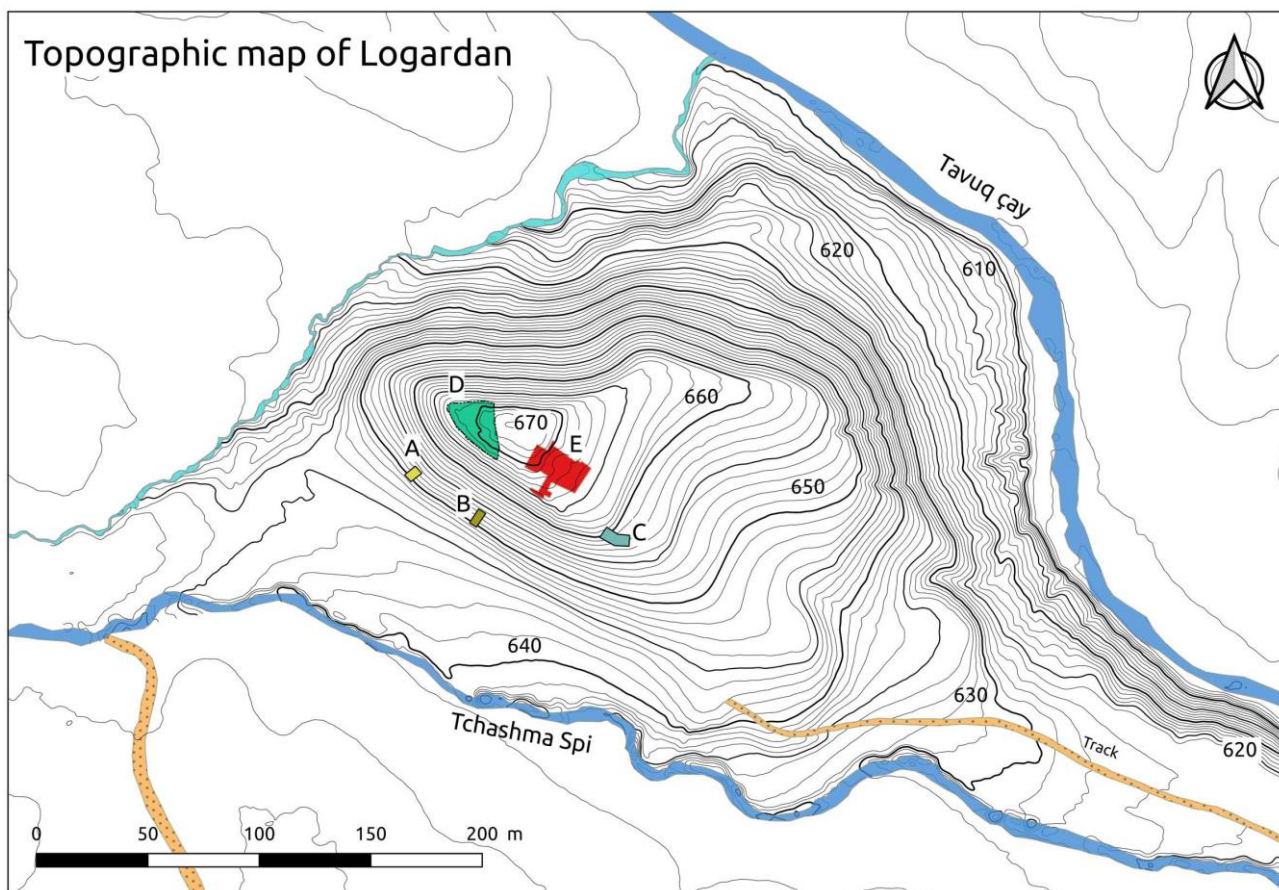
It goes without saying that this reading of the stratigraphy remains provisional, and will certainly be corrected by future work. The widening of the trench will make it possible to understand, as it has just done for Level 1, the succession of occupations that are too poorly preserved to be properly understood on a small area, before resuming the excavation of the lower levels. The long-term objective of the trench remains indeed to obtain a complete sequence, and in particular to reach the local LC site, which we know for the moment only through the material dispersed in the sectors properly Uruk (Girdi Qala C and D, Logardan).

At Logardan D (J. S. Baldi, C. Padovani), work focused on the north and south flanks of the Tell, extending the long eastern section of the trench, which now crosses from north to south the entire summit of the site; essential operation before an extension towards the east, to make junction with Trench E. At the end of these works, Trench D exceeds 600 square meters in area (Fig. 5 and 6).

Let us recall that the site documents (with Trench C at Girdi Qala) the oldest Uruk presence in northern Mesopotamia, about three centuries before the date admitted so far for the beginnings of the Uruk expansion, i.e. around 3900 BC, during the Early Uruk period (Vallet ed. 2016, 2017, 2018; Vallet, Baldi et al. 2017; Vallet, Baldi, Zingarello et al. 2019; Vallet 2020). The monumental acropolis of the Early Uruk phase (level 4B), takes on a more defensive and fortified character in the Middle Uruk period (level 4A), during which the Uruk regional presence and influence grows strongly (foundation of the colony of Girdi Qala North, and others, on both sides of the Qara Dagh). After a hiatus of about nine centuries, the site was put back in defense in the ED IIIB period (level 3D), then took on a residential and administrative aspect (level 3C), but still fortified, before being razed and converted into a ceramic factory with the advent of the Akkadian power and until the end of the 3rd millennium (levels 3B to 1).

In 2019, the clearing of level 4 made little progress as it is sealed almost everywhere by later remains, except in the north where the impressive stone foundations of complex 4A could be widely exposed, a platform of large flat blocks supporting powerful walls and serving as a peripheral walkway. We now have for the Middle Uruk phase, between Logardan and Qirdi Qala North, a solid series of C14 dates, with three new dates (Appendix A) in addition to the previous ones.





*Fig. 5 – Topographic map of Logardan (Coordinate system WGS84/UTM38N – J. Lisein 2019).*



*Fig. 6 – Aerial view of the top of Logardan, with trenches D (left) and E (right), at the end of the 2019 season.*

As is the case throughout the site, the Uruk ruins were constantly reused as a foundation, and first by the level 3D stronghold, a little less than a millennium later. This takes up the large northern rooms of the Uruk building and adds to them a powerful bayonet wall to the south, around which several important accesses are organized (wide threshold passage, paved forecourt, staircases). But it is on level 3C that knowledge advanced the most, with the discovery of a strip of rooms flanking to the south part of the complex and its large backyard to the west. The Level 3C complex presents two successive states with important changes: a new staircase in the northwest vestibule below (unroofed, r. 686) giving access to the courtyard, an additional room to the north (with a long pottery pipe flowing into the courtyard), over the old Uruk walkway that was reused for a time. The main building itself is redesigned (walls 983, 991, 992), so that it is clear that we are dealing with a general reconstruction (which we could distinguish, IIIC1 and IIIC2, pending the revision of the whole sequence). Moreover, the high quality of the volumes and fittings of the building (spacious and well-appointed spaces, sidewalks, pipes) sufficiently shows the functional change compared to the squat fort of the previous level, transformed into a large sumptuary and administrative residence. It is likely that the site then became the seat of a governor, sent by the regional power who took control of it and which only an epigraphic discovery would allow to identify (Arrapha? Kunara?).

The study of the next levels has also progressed a lot. These see the site's transformation into a regional center for ceramic production, at a time that material culture (including a cylinder seal, Paladre 2016) and several C14 dates invite to place at the advent of Akkad. This report offers a detailed first reading of the operation of these workshops and in particular of the true "machines" that were their cooking devices. They are not simple batteries of ovens, as there have been at least since the Uruk (cf. Girdi Qala C – batteries which are not simply juxtaposed ovens, but linked together and forming a whole from a functional point of view) but very elaborate, high-tech devices, the remarkable complexity and increasing rationalization of which can be precisely followed along the 3rd millennium sequence.

At Logardan E, no real excavation operations this year but essential stratigraphic verifications in this difficult trench (partly due to the slope arranging the structures in tiers) where several structures remained stratigraphically floating. Work focused on three locations. In the south-east (J. S. Baldi), where the succession of structures has been clarified and several stratigraphic attributions defined or corrected. In the north (S. Obreja), where the long north section (east-west) of the trench has been drawn and studied, discovering in particular a series of kilns from the end of the 3rd millennium extending those of Trench D. Some had been previously seen but wrongly attributed to the Late Bronze Age. Finally to the south (R. al-Debs, K. Rahoof), where we followed a long wall in a narrow strip, reaching the edge of the Tell and its constructions.

The result of this work is a reorganization that does not radically change the previous scheme but clarifies it by correcting a certain number of stratigraphic attributions. In particular, most of the Uruk structures belong to the Middle Uruk phase (IVA). Only the entrance to the acropolis, occupying the summit, to the west of the trench, can be attributed with some certainty to the Early Uruk level (IVB). It follows that the plan of the next level (IIIE), dating from the beginning of the 3rd millennium (level for which we do not yet know the counterpart in Trench D, according to our current analysis), takes up as a foundation or basement all of the IVA level structures.

For the following levels, from the ED IIIB period, access to the fort of level IIID seems to have been rather rudimentary, through a simple recess, possibly protected by a bastion, while that of the fortified residence IIIC seems to have been, at least initially, bent (via a lateral landing) and not straight, while its two bastions present two states which harmonize well with those of Trench D, confirming the hypothesis of a general reconstruction of this level. Then, as already said, come the potters' workshops of the end of the millennium (level II), set in the slope of the terrace, followed by two Late Bronze levels

(and not three), with domestic structures (level IB), silos and culinary ovens (but no habitat), replaced by, again, potters' kilns (level IA), the whole perforated by the graves of a small Hellenistic cemetery, most certainly that of the contemporary settlement at Girdi Qala.

In all, the sequence of Trench E is very close to that of D, which is actually quite normal. The 2019 works are therefore a first step towards establishing a unified sequence for the site, while waiting for the two trenches to be reunited and for the connection to be made with Trench C, a little further east, and its sequence going back to the Late Halaf, on virgin ground (Baldi and Naccaro 2015, Vallet, Baldi, Zingarello et al. 2019).

Concerning material and specialized studies, this report does not contain any ceramic study, which is a first. There are two reasons for this. The material from the 4th millennium has already been the subject of detailed presentations, both typological and technological, so there are no new observations to report this year. In the case of later periods, our specialist in Early Bronze Age ceramics was unable to join us this fall. We have therefore put this material aside pending its upcoming review. The same goes for that of the following periods. Nevertheless, alongside the excavation operations, we were able to pursue or initiate various specialized studies.

Carolyne Douché continued her study of archaeobotanical remains, coming from the two trenches opened this year but also by analyzing some samples from last year. In the 3rd millennium BC, we see a predominance of hulled barley (as in Brak and other sites of Djazirah), which could indicate conditions a little more arid than before. But at the same time emmer wheat is increasing, which does not support this hypothesis. Although the combustion of plants from the near slopes of the Jebel Qara Dagh cannot be completely excluded, it is likely that the main fuel of the potters' kilns was animal excrement, which is mainly found at the bottom of the kilns and which are still used today. Two Late Bronze Age *tannur* have provided a great deal of grass pea, used to make bread or beer, which is rare in the Near East (more common in Africa), and may indicate more diverse dietary practices than previously thought. The data collected in Girdi Qala, with a much higher number of fruits, also indicate that the use of the bottom of the valley of Tavuq Cay, small but deep at this place, as it is exploited today (orchards, small fields), was set up at the latest at the Sassanid period, or possibly a little earlier, but not in the Bronze Age (or earlier).

The study is in fact extended to the environment of today, both to constitute a local botanical reference and to put the identified practices into perspective. Carolyne Douché and Claire Padovani give a brief account here of this work, which was also the occasion to explore the clayey earth resources around the sites, the consumption of which was to be considerable when the large potters' workshops of the 3rd millennium were in operation. Just over 2 km from Logardan, the Kurata deposit, where the last families of traditional potters in the region live and still work, linked to the site by an ancient path, was probably one of the sources of supply for the ancient potters, but probably not the only one<sup>2</sup>. Samples taken should provide the first answers.

Francesca Manclossi began the study of lithic material from the 4th-3rd millennia, coming from trenches D of Girdi Qala and Logardan. Beside rudimentary tools and a reduced quantity of obsidian, which obviously only has a marginal function, most of the assemblages consists of narrow blades, produced on site by pressure, the Canaanite blades being very few. The closest parallels are found at Helawa in the Erbil Plain and Gird-i-Shamlu in the Sharizor Plain.

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<sup>2</sup> We know that ceramic pastes are manufactured products that generally mix several earths (Roux 2017: 60). Iraqi potters who still work according to so-called "traditional" methods can mix up to five earths (some rich in feldspars, or added sand silica in particular) from different but generally close origins; in France, this figure can go up to nine, for the most elaborate fabrics (personal communications J. Crozat, Establ. Bermann-Terre).



Finally we had the visit of Chamsia Sadozaï, specialist in the conservation of earthen architecture, to help us protect Logardan, which we do within the limited means of the mission, and, perhaps, later, enhance the site for the public. The site is indeed exceptional, both from a historical and heritage point of view, thanks to its unique architectural remains relatively well preserved, and from a natural and environmental point of view. It would greatly deserve a specific effort for its conservation and restoration to be undertaken, with a view to possible classification. Hopefully the measures advocated in this report will one day find decision makers' ears.

#### *Acknowledgments*

*This report is the last written under our direction, the project being now in the hands of Johnny S. Baldi, who has accompanied us from the beginning and to whom we wish every success. Even more than in past years, this is therefore an opportunity for us to thank all the colleagues who took part in the project, whose names are recorded in each report and who need not be repeated here. We would like to thank the members of the KRG Antiquities Directorate, their directors MM. Mala Awat then Kayfy Ali, and of Souleymanieh, as well as the authorities of Chamchamal and Shorsh, Mr. Sarwar Ahmad Karim in particular, mayor of Shorsh, without forgetting the inhabitants for their warm welcome and their work alongside us on the sites. We especially want to thank three people whose help has been instrumental. Mr. Kamal Rashid Rahim, director of antiquities of the governorate, each of whom knows the work he does in favor of heritage and archeology, has been a constant, benevolent and effective support from day one. Mr. Kamal Rahoof has been more than a representative, a savvy field researcher and a trusted partner, valued by all. Finally, Mr. Jamal Jalal Mohammed, our steward, guaranteed the smooth running of our work on a daily basis, through his practical genius and his dedication. May all be thanked here, and take these few pages as a token of our friendly gratitude.*



*MM. Jamal Jalal Mohammed (left) and Kamal Rahoof (right) at Logardan (2019).*



## GIRDI QALA, THE UPPER LEVELS OF THE CITADEL

Marie-Odile Rousset, Saber Ahmad Saber,  
Cheïma Abdulmassid and Rateb al-Debs

**F**ieldwork in Girdi Qala took place from Tuesday 10 September to Wednesday 2 October 2019. The objective of this campaign was a better understanding of the Islamic levels of the citadel of Girdi Qala, levels identified since 2015 by the team of the University of Liege (Colonna d'Istria et al. 2015, 2016, 2017 and 2018) in Trench B, located on the southwestern part of the high mound (14m) of the site. The constructions on Level 1, at the top, under the current surface, are poorly preserved and very difficult to see on the ground. This is why we initially opted to study stratigraphic sections in order to carry out an initial overview of this level, which we then excavated extensively to the north and east of Trench B (Fig.1 and 2).



*Fig. 1 – Trench B in 2019, drone view from the southwest (J. Lisein).*





*Fig. 2 – Ortho-image of Trench B with location of the section.*

#### NORTHWESTERN SECTION OF TRENCH B

The northwestern section, which had remnants that are more visible in stratigraphy than the southeastern section, was preferred for analysis. Indeed, many pits were discovered on the southeast side of the trench and are cut by the section (Colonna d'Istria et al. 2018, fig. 12). This section of the trench is therefore very incomplete for the study of the remains of levels 3 to 5. Furthermore, its orientation makes it difficult to read as it is backlit in the morning and illuminated by low light in the afternoon. Description of the stratigraphic northwestern section attempts to follow the levels defined during excavation of Trench B (Fig. 3).

##### *Level 0*

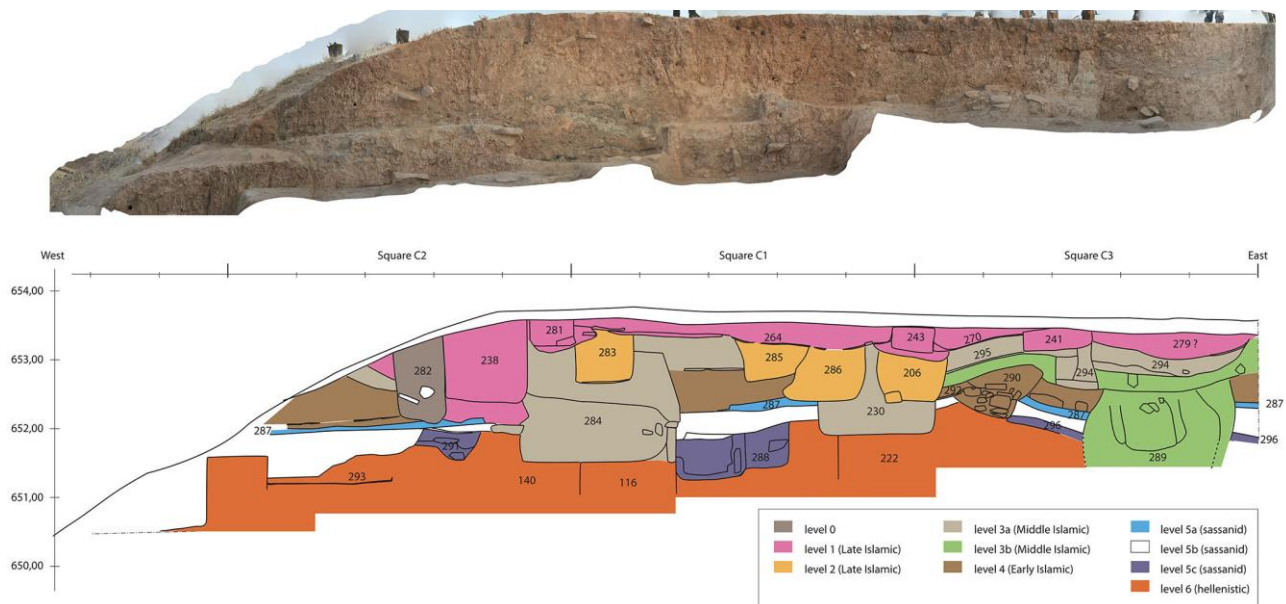
Below the ploughed layer, about 20 cm thick, Level 0 is visible in the form of a pit (loc. 282) that destroyed the western side of the rampart (loc. 238). Deep, it goes down to the bottom of the rampart's foundation trench.

##### *Level 1*

Level 1 is illustrated by the rampart (loc. 238), located at the slope discontinuity of the Tell and a building attached to it, to the east. The rampart is built in a foundation trench opened to the outside of the Tell and is placed against the inside of this vertical trench. It is built in very poorly preserved mud brick, of which only a few vertical joints are visible; a few stones are included in its structure. Its visible width in the section is 1.20 m but the loc. 282 pit cuts it. Its retained height, attested in the section, is 1.20 m.

A wall is almost next to it, 10 cm to the east (loc. 281). About 60 cm wide, its base is marked by the presence of a large stone, embedded in an earth mortar. The mud bricks are not visible. Against its eastern side, a plinth stone is placed at the top of its foundation trench, against its base and beneath the floor connected to it (loc. 264). This floor has several states, a first one of granular and yellow nature

(about 4 cm thick) and a second one, red and thin (2 cm). It collapses above the loc. 286 pit, whose filling must have been rather loose and has been compacted over time. The floor then rises up against the base of wall loc. 243, whose foundation trench, with a total width of 1 m, is about 15 cm deep. Between the walls loc. 243 and loc. 241, the floor loc. 270 is only preserved as a boundary between the collapse layer of the building and that of the previous constructions (loc. 295). The wall loc. 241 appears as a brick mass 1m wide: this is its foundation. The eastern limit of this mass is difficult to see because it is extended on this side by a thick layer of the same composition. It could be the foundation of a wall linked to loc. 241 and kept in the berm (loc. 279). In support of this hypothesis, let us note the absence of floor found on this side and the base of this layer located at the same altitude as that of the other walls (652.95).



*Fig. 3 – Northwestern section of Trench B (M.O. Rousset, 2019)*

### *Level 2*

Level 1 floors directly cover the level of levelling/conservation of Level 2 structures. The 85 cm wide loc. 283 wall is located 70 cm inward from the loc. 238 rampart. It is in the form of a mass of light brown brick earth with a square section. This could be the same wall as wall 1031-1033 discovered in Trench A in 2015 (Parayre and Sauvage 2015, p. 29). Also 85 cm wide, it is placed 70 cm inside the enclosure wall. It could correspond to an enclosure wall around the Tell, prior to the rampart on Level 1. The other elements that could belong to Level 2 are three pits (loc. 285, 286 and 206). The traffic levels from which they were opened disappeared when Level 1 was installed.

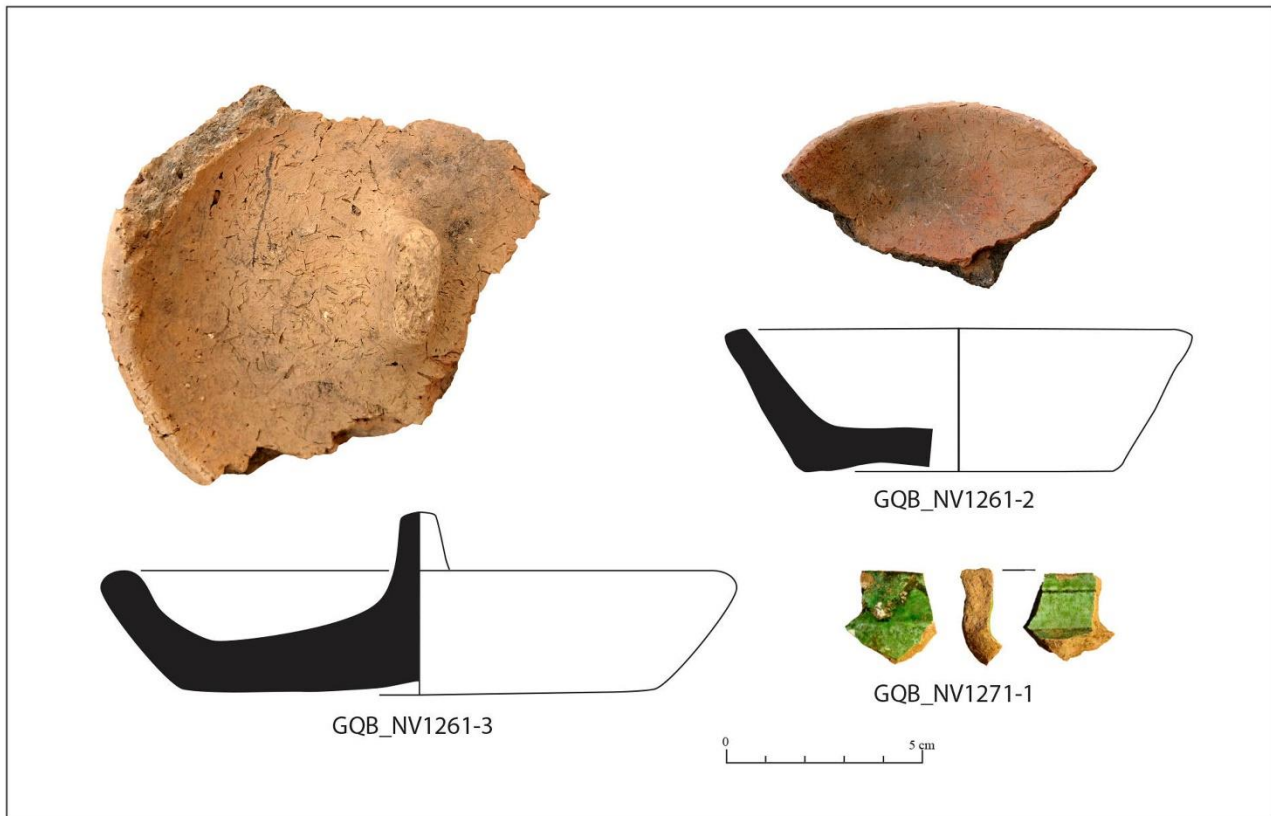
### *Levels 3 a-b*

Level 3a contains two large ovens, connected by a floor level topped by a collapse layer. In the eastern part of the section, this level is higher because the base of the oven loc. 294, at its lowest point, is at altitude 652.70, while that of the western oven is at altitude 651.50, i.e. more than 1 m lower; the floor loc. 295 has a slope of 30 cm per 1 m. The ovens are wide: at least 2.30 m. Loc. 284 has a flat bottom covered with a thin white layer. The walls are made of bluish mud bricks for loc. 294 and mud bricks and stones for loc. 284. There are several phases in their filling: layers of collapsing walls and ashes. A large flat-bottomed pit, 1.70 m in diameter (loc. 230) is inserted between the two ovens.



A pottery lid and a small bowl with vegetal inclusions came from the ashes of the filling of the oven loc. 284 and a fragment of a bowl with incised decoration through slip under a green glaze was found in the filling of the pit loc. 294, excavated north of the berm (Fig. 4). These objects make it possible to attribute this level to the 13th-14th centuries (Middle Islamic period).

Level 3b is mostly readable in the eastern part of the cut. It corresponds to a large pit 2.20 m in diameter with sandy brown sediment covering a kiln 1.10 m in diameter (loc. 289). The walls of the kiln are made of earth and its ashy filling contains some stones.



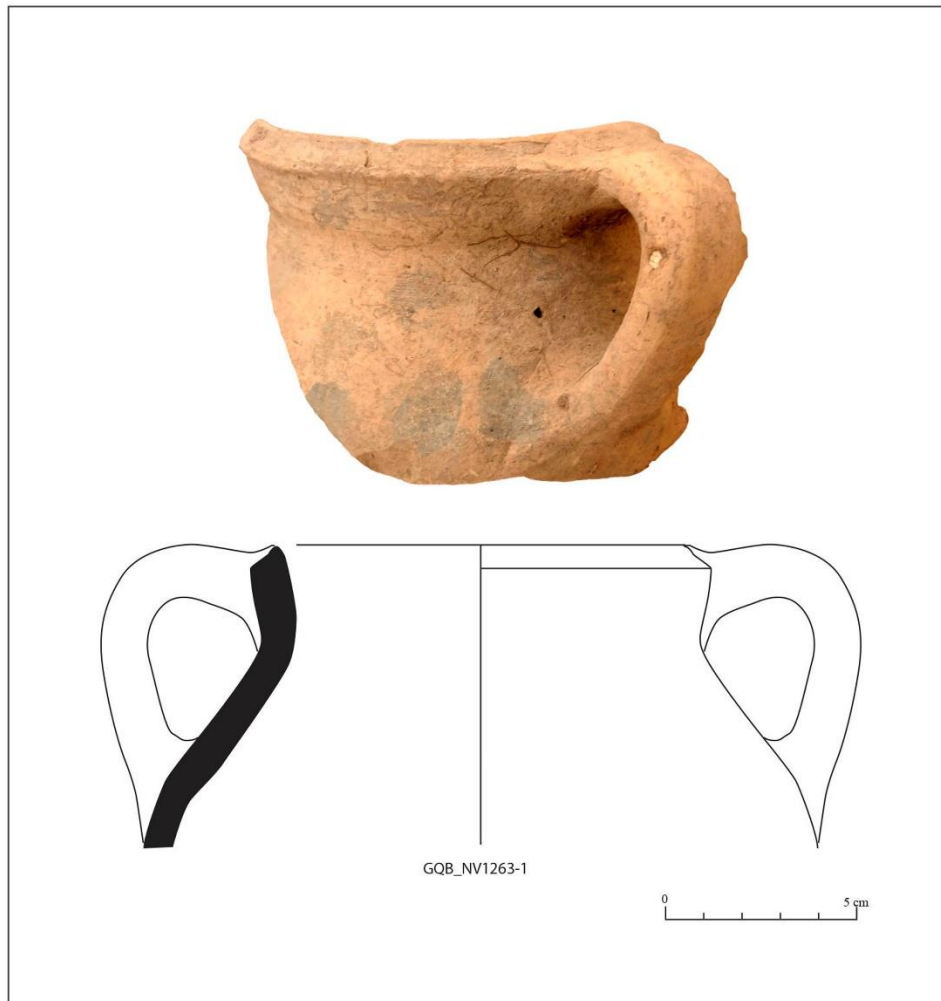
*Fig. 4 – Pottery found in Level 3a (drawing A. Othman).*

#### **Level 4**

Still in the eastern part, Level 4 corresponds to a building of which a mud-brick wall (loc. 290), with a stone threshold marked by a crapaudine, and a vestige of the floor (loc. 292) remain. The interior of the room was to the west of the wall. In the western part of the section, a fragment of a pea-decorated pot with a handle has been discovered in this level (Fig. 5). A fragment of glass blown in a mould (late 8th-9th c.) was discovered in the installation pit of the kiln loc. 284. It comes from a level prior to the digging of the furnaces, perhaps this Level 4. This leads us to date this level to the Early Islamic period.

#### **Levels 5 a-b-c**

The bluish floor of Level 5a, about 10 cm thick, is found throughout the section (loc. 287). It covers a level of destruction, Level 5b, itself on several structures showing the use of fire (Level 5c): to the west, loc. 291 could be a pit or a wall in section. As in Level 3b, a pit (loc. 288) with a diameter of 1.65 m was dug to install a 1 m diameter kiln, with walls built of mud and stones, one of which was laid vertically. The pit was dug in the collapse of Level 6. On the eastern side, a very ashy layer (loc. 296), about 12 cm thick, overlies the destruction layer, with a steep eastward slope. It was destroyed by the installation of the kiln loc. 289.



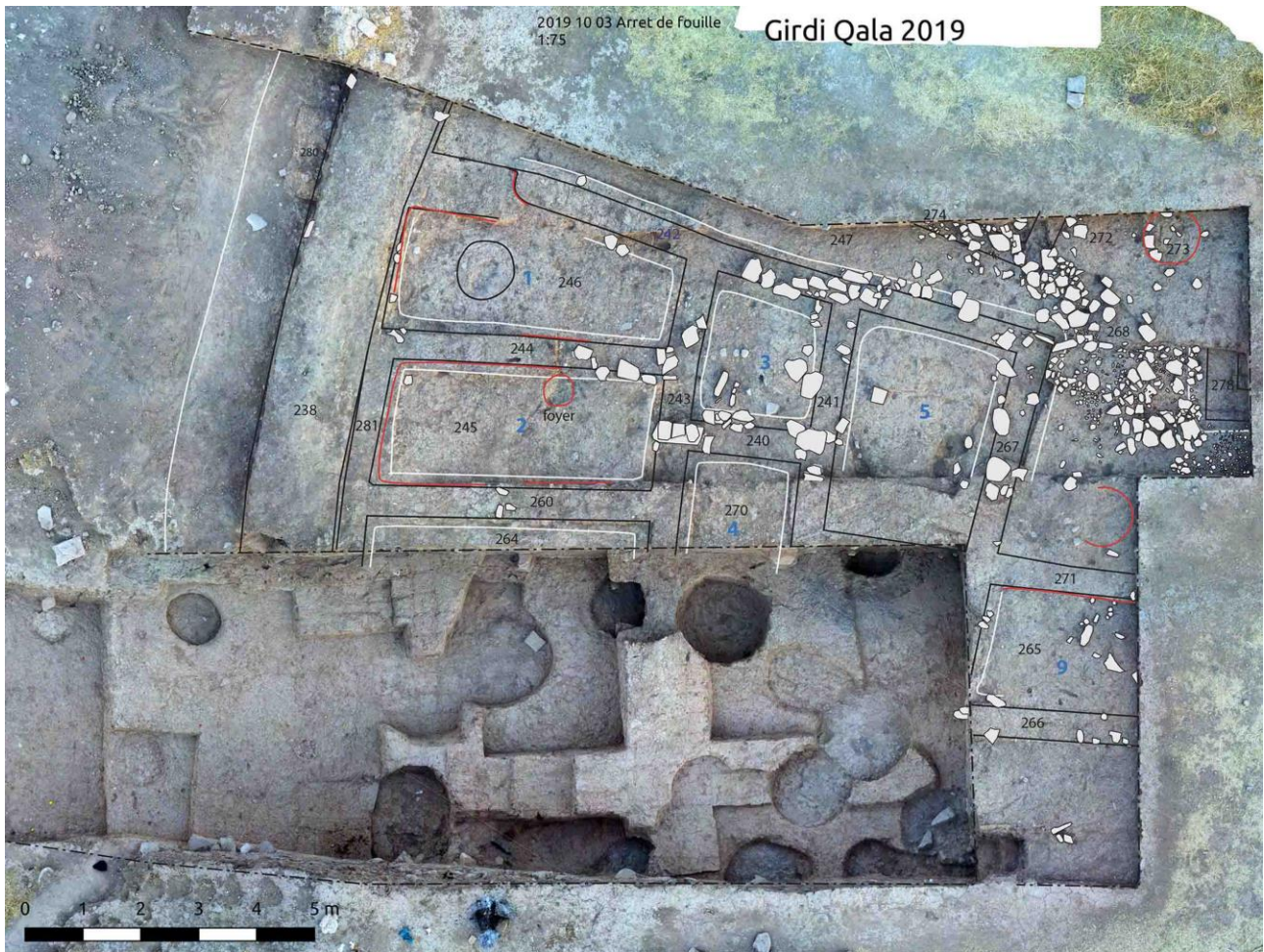
*Fig. 5 – pottery from Level 4.*

### *Level 6*

The maximum conservation elevation of Level 6 varies from 652.50 m east to 651.70 m west. This level corresponds to a large building attributed to the Hellenistic period, built in orange mud-brick (Colonna d'Istria et al. 2015, 2016, 2017 and 2018). Several walls appear in the section (loc. 140; 116; 222), as well as an ashy floor loc. 293 to the west. The collapse layer reaches the conservation level of the walls.

### **EXTENSIVE EXCAVATION OF LEVEL 1**

Level 1 has been identified over the whole of the cleared area, i.e. over an area of approximately 120 m<sup>2</sup> (Fig. 6 and 7). In terms of altitude, it is immediately below the surface, sloping from the edge of the Tell to the centre. The structures that have been observed are located at an altitude ranging from 653.62 for the conservation summit of the rampart; 653.57 for the highest wall (loc. 244) and descend to 653.02 m (loc. 243) / 653.08 m (loc. 278) below the foundations. A large part of the plan of a building attached to a rampart was uncovered, as well as a street to the northwest and the corners of a second and third building to the north of the trench. The outer facing of the rampart (loc. 238) was excavated over 8.55 m. The width of the wall is 1.80 m. The very poor state of conservation of the structure makes it impossible to see whether it is made of mud bricks or bauge or pisé, or whether it is curved or composed of straight segments. In its northern part, it is based on a rectangular mass of yellow mud brick (loc. 280 alt. 653.10).



*Fig. 6 – Level 1 structures in the 2019 extension of Trench B (M. O. Rousset).*

The building leaning against the rampart has a slightly trapezoidal plan. It is 11.25 m long by at least 7 m wide (east side). Six of its rooms have been identified. The whole building is much leveled. Near the rampart, it is only preserved, in elevation, over a few centimetres. Elsewhere, only their foundation trenches attested the walls. These are 90 cm wide and deeper in their central part, in the path of the wall that was built from the bottom of the trench. The sides of the trench were then backfilled with mud bricks, mortar and some stones. In places, stones were thrown at the bottom of the trench, as in the case of wall loc. 242, but this practice is far from systematic. More often, the top of the trench was covered with flat stones forming a plinth that supports the floor near the wall. The parts of the walls that remain in elevation are built of poor-quality, even reused, raw brick and have pink coating (in Rooms 1, 2 and 9) thicker in the corners of the rooms (Fig. 8).

To the west, three rectangular rooms are perpendicular to the rampart (Room 1, 4.90 m x 2 m, Room 2, 4.80 m x 2.10 m and Room 6, 4.90 m long). In Room 1, stones laid against the base of the wall loc. 238 reinforce the coating. In Room 2, a second wall (loc. 281, visible in the northern section, Fig. 3) doubled the wall of the rampart. The middle part of the building is occupied by two roughly square rooms (Room 3, 2 m x 2.45 m and Room 4, 1.95 m wide) while Room 5 occupies its eastern end, 2.70 m wide. Room 9 to the south-east of the building is at least 2.75 m long and 2 m wide.





*Fig. 7 – General views of Level 1 from the east (left) and south (right).*

Due to the lack of elevation, the passages between rooms were not preserved. A return of coating on the western end of wall loc. 242 and a larger brick mass in this part makes it possible to propose an access to the building from the bottom of the alley, against the rampart, with a threshold wider than the wall or a step. The floors of Building 1 slope from west to east. In the rooms adjoining the rampart, the floors range in altitude from 653.58 to 653.22 in Room 1 (loc. 246) and from 653.42 to 653.23 in Room 2 (loc. 245). The easternmost floor of the building, in Room 9 (loc. 265) is at an altitude of 653.21 m. The floor of the street, loc. 247 to the west, is at 653.35 m and its paved part, to the east (loc. 268), is at an altitude of 653.23 m at its lowest point and 653.47 (loc. 272) at its highest.

In Room 1, a small pit with an ashy filling turned out to contain many cereals (Douché, this volume). The C14 analysis carried out on the seeds (sample GQB FL23) gives a dating in any case not before the 17th c. AD (see Appendix A). A fireplace was found on the floor of Room 2 and two installations with stones laid on edge forming rectangular structures, which could be built fireplaces, in Rooms 3 and 9. The pottery collected in the building is scarce and very fragmented. It is mainly modelled ware with very simple bowl shapes, attributable to the Late Islamic period. A large quantity of animal bones were found on the stone floor of the street loc. 268, and several objects in the surface layers: a metal needle and spoon, some beads and fragments of glass bracelets.



*Fig. 8 – Pinkish coating in Room 2, against facing of the wall loc. 260.*





Photographs of the dismantling of the berm between Squares C1 and C3 in 2018 show a mass of red coating similar to that found in the corners of Rooms 1 and 2. This coating patch could correspond to the northwest corner of a Room 7. Between Rooms 7 and 9, numerous fireplaces were found during the 2018 campaign, within and south of what may be Room 8 (loc. 180, 183, 184, 186, 188 and 187, located between 653.07 and 653.17 altitude). Finally, a tannur was discovered during the dismantling of the berm between Squares C1 and C3, against the south berm (loc. 221, altitude of its summit: 653.28). Another tannur (or rather a fireplace?) was noted at the same altitude, in the southwest quarter of Square 1 (loc. 24).

In the current state of research, this building seems to correspond to a domestic installation within a fortified perimeter. The few elements on Level 2 that were explored below it correspond to the installation of pottery kilns. Some potsherds also attest to the production of pottery: a shard with inclusions of scoria fragments, and two melted sherds while firing (Fig. 10). Future campaigns will make it possible to specify the nature of these productions.



*Fig. 10 – Sherds showing pottery production at Girdi Qala B Level 2.*





## LOGARDAN TRENCH D: STRATIGRAPHY AND ARCHITECTURE

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Johnny Samuele Baldi and Claire Padovani

**E**xcavations have been carried-out during three weeks between September 9<sup>th</sup> and September 29<sup>th</sup> in the aim to enlarge the trench and better understand the organization of the structures previously identified in Levels 4-1 on the western edge of the site. The entire excavated area (all levels combined) is currently around 600 m<sup>2</sup>, with a height difference of about 6 m between the surface and the deepest vestiges (Fig. 1). The main chronological phases recognized since 2016 have been confirmed by our fieldwork activities in 2019. Compared to the 2018 season, the eastern limit of the trench has remained the same, but the excavated area has expanded significantly on the northern and southern slopes, so the section of the excavation limit to the east is much longer than in 2018 (Fig.2).



*Fig. 1 – Aerial view of Logardan Trench D, from the south-west.*



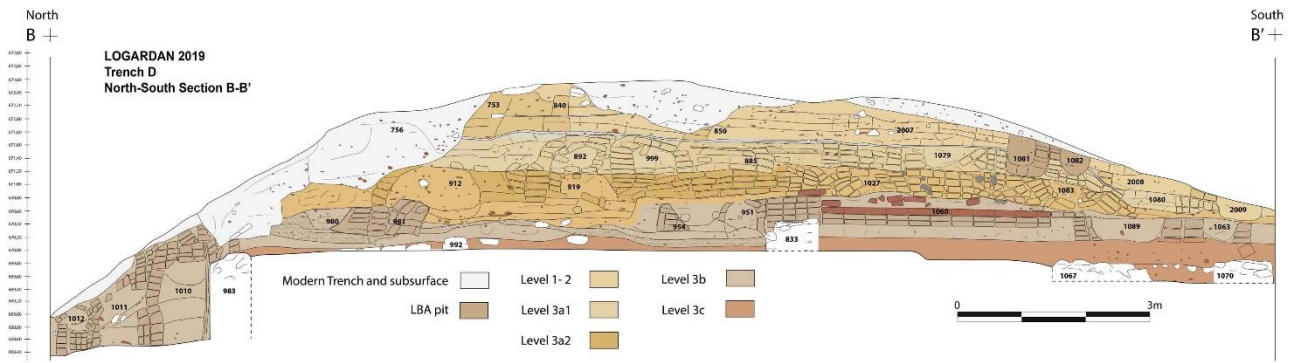


Fig. 2 – East Section of Logardan Trench D.

#### LEVELS 4

In 2019, operations in these levels were relatively limited, but compared to 2018, a broader portion of the plan of Level 4a has been brought to light (Fig. 3). The northern and western sectors of the complex are severely damaged, both by the reuse of the structures in later levels 3b and 3a, and by the severe weathering erosion on the slopes. Nevertheless, as already stressed in 2016-2018, it is the first time that in northern and central Mesopotamia monumental buildings are associated with early 4<sup>th</sup> millennium ceramic materials belonging to the Early Uruk south-Mesopotamian horizon.

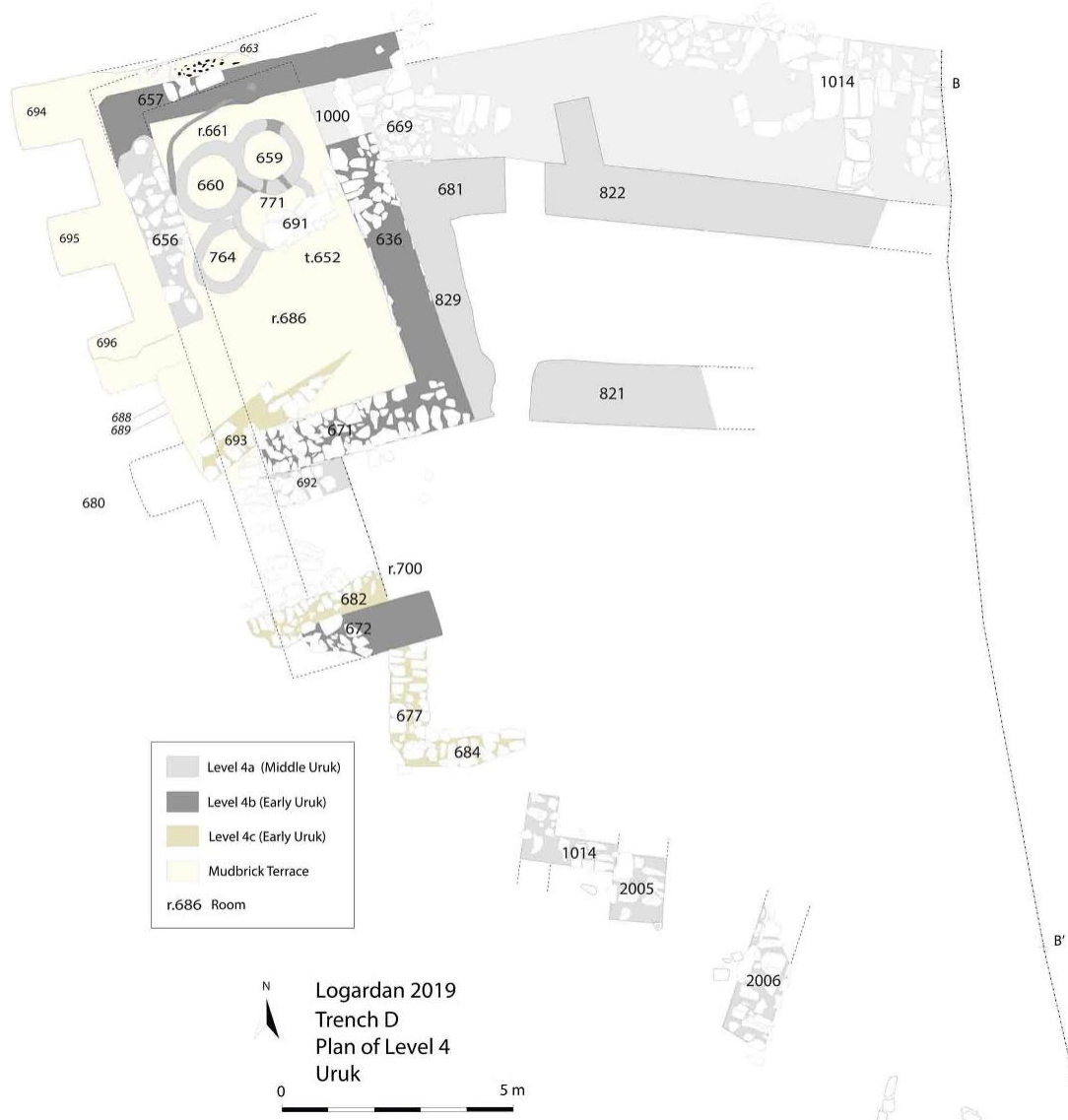


Fig. 3 – Plan of Levels 4.

The first phase (Level 4c) of this occupation was not affected by recent works, therefore it is still very little known and characterized by some agglutinated architectures rather than wide planned structures. The second phase (Level 4b), represents the main occupation of Levels 4. The remains constitute the west wing of a large complex, which can be interpreted as a bi-partite building, even if the plan of the monumental complex (with 80 cm thick stone walls) is very partially known. The plan has a different orientation from the previous level and consists of several cells, which adapt to the configuration of the edge of the site, with Wall 657 forming a boundary to the north. This Level was not affected by works in 2019.

In a third moment (Level 4a), the whole complex was restructured. Level 4a represented both the last stage dating back to the 4<sup>th</sup> millennium occupation (early Middle Uruk) and a major phase in the evolution of the entire excavated area. The complex was transformed in a stronghold composed by several agglutinated units with divergent orientations. In the north-eastern sector, Wall 829 was built against Wall 636: it has the same orientation and thickness as Wall 636 and forms a 90° angle with Wall 671. This north-eastern sector of Trench D, which was the eastern wing of the complex in Level 4b, became an independent rectangular east-west oriented unit, delimited by Walls 821, 822 and 681. If the attribution of the Walls 829 and 681 to Level 4a was proven since the 2018 fieldwork season, a 4a stage of Walls 821 and 822 have been documented in 2019. We have not yet reached inside the stronghold a 4a Level floor connecting all these walls together, but early (4a) stages of these structures, characterized by a different laying of the stone blocks, have clearly been observed respectively south of Walls 821 and north of 822. This eastern unit communicated with other internal and external spaces through two doors, respectively on its northern (between Walls 681 and 822) and southern side (between Walls 829 and 821) and was separated from Room 686. To the north, Walls 681 and 822 were based on a very solid and regular stone platform, constituting not only the base of these ramparts, but also a kind of sidewalk all along the northern slope (Fig. 4).



*Fig. 4 – Passage 1002 between Walls 681 (right) and 822 (left), from the north.*





First, the central sector is separated in two different rooms (825 and 826) by the construction of Wall 820. It partitions the interior space and even if it is thinner than the other walls, it is reinforced by various smaller structures. In the south-eastern corner of Room 825, close to the door, a stone bench (827) supports the corner between Walls 820 and 821. On the other side, in the north-western corner of Room 826, a small stone fireplace (824) is built against the corner between Wall 820 and 822. On the exterior side of this same corner, Wall 822 is reinforced by a stone pillar (832) located almost exactly in the continuity of Wall 820. A fireplace (1003) was built against the corner between this pillar (832) and Wall 822 (Fig. 6). This space was a small kitchen arranged on the outer fortifications: the remains of at least one cooking pot (a large casserole), with ashes and a huge quantity of shells from the rivers near the site (whose mollusks probably were boiled before being eaten) have been identified in this corner. Incidents, facilitated by the wind hitting the hillside, must not have been uncommon, judging from the fire traces expanding from this small cooking area (1003) and spreading all along Wall 822. The latter was interrupted by small passages placed at a regular distance from each other (1016, 1017) along the patrol walkway on the north side of the hill. In this sector, the main access to the complex is certainly represented by the door open between Wall 822 and Wall 681: during the last fieldwork season, a stone staircase (about 1m large) was brought to light (Fig. 5). The steps were made of reused stone slabs, coming from the stone foundation of the Middle Uruk fortress of Level 4a and even though they were not completely preserved, the steps still had a slightly rounded orientation. The direction of the patrol walkway to the north was from east to west, and then entered into the room 825 via a curved staircase, sheltered on the west side.



*Fig. 6 – The small cooking place 1003, from the north.*

Both rooms 825 and 826 are carefully paved by a tile flooring in mudbricks (floor 938 and 983). Bench 827 and Fireplace 824 were founded on these mud-bricks floors, which have yielded in-situ materials. After a long hiatus during the second half of the 4<sup>th</sup> millennium and the first half of the 3<sup>rd</sup> millennium,



the reconstruction of the acropolis of Logardan renews the fortified nature of the Middle Uruk structure, with narrow accesses close to the slopes, thick buttressed walls and little rooms. Walls 821-822 were reconstructed with the same orientation as in Level 4a. This is also the case of Walls 829 and 821 that, in Level 3d, were connected by a monumental stone threshold related to floor 938. The north-west sector is represented by a large rectangular space (Room 686). Although the northern portion of this area (Wall 657) was very badly preserved, the room was delimited by Walls 636, 656 and 671, reconstructed on the remains of the Early Uruk complex on Level 4b. In the northern portion of Room 686, ancient Room 661, with the alimentary ovens of Level 4a, no longer existed. However, the door 1000 was still used to access a western part of the fortress. This one was greatly disturbed by the later levels, no floor of the 3d level was found in Room 686.

Some noteworthy changes occurred in the central sector, where a little utilitarian room (687) was enclosed by thin walls (670, perpendicular to Wall 671, and 674, parallel to the big wall 671). Wall 846, excavated in 2018, was preserved on four stone layers and closed the room. The entrance was on the east side through Wall 846, where a small door-socket was found in-situ. All these walls were built without any foundation trench. The small room 687 is part of a space of the complex where many floors (935, mud brick; 990, covered with sherds) have been found. A similar situation characterizes another closed space (1006), partially excavated at the eastern limit of this central area. For the time being, it is difficult to determine whether this space is a room closed by the little wall 1004 and the large Wall 821, but the floors of this area, with large traces of ash and remains of phytolites (Fig.7), have been regularly renovated, as have all the ceramic-paved floors (935) of the central area. These floors connect these different structures (687 and 1006) with the southern part of the complex.



*Fig. 7 – Remains of phytolites in Space 1006.*





*Fig. 8 – Stone base 931 (right) of Wall 685 (left), from the east.*

To the south, the upper portion of Wall 672 was rebuilt upon Early Uruk 4b remains and, on its southern side, a mud-bricks terrace (815) was built to raise the floor. This one was paved with large-sized stones to cover a quite sizable forecourt (685-683). This paved area represented the access and the southern limit of the complex. The first north-south oriented segment of the stairway, with large monolithic steps, led to a 2x3,5m wide stone paved forecourt (683), and then, after a 90° angle, a second roughly west-east oriented segment of the stairway climbed up the slope of the hill, flanked to the north by the thick wall 685. In this southern sector, there were certainly other sloping passages or stairs to climb up the hillslope: for now, we know only a few traces of these facilities, such as the small paved area 2010. Nonetheless, the paved forecourt and the large southern staircase (683) giving access to the entire complex were planned to respect a north-south axis with three doors (respectively Staircase 683, between Walls 829 and 821, and Walls 681 and 822) crossing through the whole stronghold. All these structures were built according to the orientation of ancient 4<sup>th</sup> millennium vestiges (Level 4a). Therefore, Staircase 683 was north-south oriented and slightly divergent if compared to the rest of the edifice, even if it respected the topography of the tell in this area. The huge stone Base 931, sustaining Wall 685 (Fig. 8), confirms this. Wall Base 931, made of smaller stones, was dug into Floor 935 and leans against the base of Wall 685. The latter presents several construction phases and a stepped wall to the northwest, leaning on 931 to adapt to the staircase 683. This huge wall (685) has the same dimensions as Wall 821 (1.30 m large). They are parallel to eastern structures of the stronghold (Walls 821-822), while the lowest step of Staircase 683 and Walls 672 are parallel to western wall 671. This reveals the existence of a well-organized plan established to respect previous (Level 4a) orientations since the construction of Staircase 683. Further south, some fragments of walls with a different orientation framed spaces (Rooms 2003-2004) whose perimeter was probably not always quadrangular but adapted to the topography of the tell.



*Fig. 9 – Plan of Level 3c.*

### LEVEL 3C

The following phase (Level 3c) is represented by the construction of a conspicuous building with monumental doors and large halls (Fig. 9). The main edifice is located in a dominant position in the eastern portion of the excavated area and is delimited by Wall 976. This one constitutes the western façade of a roughly north-south oriented complex, separated in two units by Wall 977, perpendicular to Wall 976. South of Wall 977, a room of about 8x3 m has been excavated. Since the first architectural stage of Level 3c complex, this southern hall is accessible from an entrance (996) with a door socket and a carefully made stone threshold between Walls 976 and 833. This latter could have existed since the previous phase, but in Level 3c definitely represents a major partition within the whole complex. North of Wall 977, in a space that might be interpreted as a room or a courtyard accessible from the northern slope of Logardan, the clay floor, although eroded by the weathering, has yielded abundant in-situ ceramics and many figurines (several animals, probably bovines, and two chariots, cf. Appendix B). A possible clue in favour of the interpretation of this northern space as a courtyard is represented by the



fact that a wall on its northern side did not delimit it, although it is possible that such a wall had slipped down the valley due to erosion and steepness of the slope. However, along the north slope, where in Level 3d there was a patrol walkway that used the ancient stone foundations of the Middle Uruk fortress as a paved sidewalk, in the first phase of the Level 3c complex the path allowed to go up the difference in height to the top of the hill through a staircase (1013). This staircase, solidly built of mudbricks supporting steps made of 1 m large stone slabs (three of them were perfectly preserved), was framed by small walls and, with respect to the path along the north slope, formed two elbow angles, and then climbed up towards Wall 976, namely the west façade of the architectural complex (Fig. 10). Just as a door (996) was located next to the southern limit of this western façade (976), another door (989) also traversed the northern limit of the same façade. As the southern one, the northern door had a stone threshold and a stone door socket.



*Fig. 10 – The remains of Staircase 1013, from the northwest. In the foreground, Wall 976 (right) and the large flat stones (left) of the Middle Uruk Fortress foundations (Level 4a).*

The staircase (1013) was a segment of a complex and elegant walkway system. In fact, outside the building, west of the façade (976), there was a carefully arranged pattern of walkways. Four main stone-paved sidewalks (994, 823, 818, and 819) ran respectively alongside the façade (Wall 976), along the wall (almost not preserved at all) that closed the north side of the large courtyard of the complex, along the southern edge of the complex (833), and in between (Fig. 11, left). Since the first two sidewalks (994 and 818) were perpendicular (as the walls they flanked), the central sidewalk (819), in an intermediate position, formed a 45° angle with both. These three passages had approximately the same width and thickness, were carefully paved with homogeneously sized flat stones, and intersected in front of the southern door of the complex. On the other hand, close of the northern door of the complex, Sidewalk 994 turned westwards forming a 90° angle between two portions of stone-paved passageways (828 and 823). In continuity with the westwards-oriented sidewalk 823, on the western side of Wall 636 an almost 1 m large stone paved sidewalk (637) was built (incorporating the remains of Wall 691 of



Level 4a). After another 90° angle to the south, another walkway (831) led, in the Space 686, to a solid stone staircase (690). Staircase 690 constitutes another segment of this walkway system. From the west slope of the tell and through a door across Wall 656, this staircase made it possible to enter the eastern part of the complex allowing to climb up the difference in altitude on this side of the hill across Wall 636. The latter did not actually support a roof and was in fact a parapet. The whole space 686 was a sort of atrium of the large courtyard delimited by two low parapets: 671 to the south and 636 to the east. The relevance of this atrium (686) and its ostentatious role are evident from the transformations it has undergone over time. In an early stage of the Level 3c complex, access was via staircase 690, which raised in the middle of a flat stone pavement that covered the entire atrium 686. In this first phase, stairway 690 turned south and, through a high brick-based platform (831), it allowed a passage (830) through parapet 636, opening towards the intermediate pavement of the large courtyard (819). Later on, in the late 3c phase, the vestibule was remodeled. To overcome the difference in height represented by the parapets 671 and 636, some debris were accumulated against 671 and 636 and a new pavement was built. This time, the new paved floor was not flat, but rather sloping and adapted to the east-west gradient of the hillside. Staircase 690 was buried and covered by the construction of this new, higher pavement (673), with more sizable slabs than before. In place of the now disused staircase 690, another north-south oriented staircase (2016), accessible from the door of the atrium 686 and flanking the west wall 656, allowed access to the sidewalk 637 and, therefore, to the whole system of walkways of the court. As before, even in this second phase, the atrium had no roof and the 671 and 636 parapets were now just low benches delimitating the paved area giving access to the courtyard. In both phases, once crossed the parapet 636, the closest door was to the north sector of the building (989). This door was located right in front of the stone Staircase 690 (in use during the early phase of the complex) and was the first entrance accessible through the north walkway (during the late stage). From the northern door 989, Staircase 1013 allowed to descend to another external walkway on the north slope). Elsewhere, once crossed Parapet 636, it was possible to walk to the south, reaching the southern door through the sidewalk 819.



*Fig. 11 – Left: Sidewalks 994, 819 and 818, from the east. Right: Southern sector of the complex bordered by the double wall 1069-1068. The door socket is visible at the foot of the section, north of wall 1070.*

From the southern intersection of the three sidewalks (994, 818 and 819) it was possible to access not only the central part of the building (through door 996), but also the southern wing of the complex. Just as the northern wing north of Wall 977, the southern wing south of Wall 833 was separated from the central portion. Two quadrangular rooms of roughly the same size were located south of Wall 833: they were separated by Wall 1064 but communicating with each other through a door. Although oriented like the rest of the building and connected to the central wing by a door (1099), these two rooms and their annexes (space 1096 and 1097) were conceived as a different part of the edifice, south of Wall 833, which constituted a major partition of the whole complex. In fact, Wall 1064, perpendicular to Wall 833, was not built in continuity with the façade of the main wing (Wall 976).

Furthermore, the westernmost structures of this south wing (1066 and 1096) were jutting out from the rest of the main building. Room 1066 was the vestibule of this south wing. It was accessed through two doors: a first door to the north traversed Wall 833 near the crossroads of sidewalks 818, 819 and 994, while another door, to the west, allowed access through an inclined, paved path or staircase (2002), which overlapped the highest part of the staircase of the south access to the fortress on Level 3d. In front of the entrance to room 1066, this paved sloping path was crossed by a drainage channel that, across the base of Wall 833, allowed the evacuation of rainwater from the large central courtyard of the complex. Further south, space 1066 is very poorly preserved due to the slope of the hillside, but initially had a quadrangular plan like the other compartments of the south wing.

In this southern sector, there have been visible modifications during a late 3c occupation. The wall 1067, which bordered the cells south of wall 833, doubled in thickness for the construction of wall 1068. At the same time, the construction of two thin walls (1069 and 1070) redefined the plan of space 1096, which became triangular or trapezoidal, probably to conform to the shape of the hill on this side. The layout of a door socket north of Wall 1070, in connection with floor 1096, indicates a passage to other rooms south of the main building (Fig.11, right). During this late architectural reorganization, the central room of the building has been partitioned by little walls (991, 992), as well as by a longitudinal wall (983, a poorly preserved fragment of which continued north of 977) parallel to 976. The northern wing also underwent a late renovation. The staircase (1013) that climbed up to door 989 fell into disuse, the steps were buried, and the room was completely filled with earth up to the same level as the floor of the central hall. Therefore, this north wing, previously lower in altitude than the rest of the complex, ended up having a very high floor, causing the need to evacuate the water towards the large courtyard to the west. For this purpose, an underground ceramic duct was installed under the floor of the entire northern area, but rather than pierce the facade of the building (976), the duct, oriented towards the courtyard with a slight downward inclination, passed through door 989.

The very regular and sophisticated system of walkways around the large courtyard and in continuity with each other through doors, staircases and passages reveals an extreme care in both the planning and construction. Likewise, the very successful integration between the stairways to go up and down the northern and southern slopes of the site, as well as the separation of the central area of the building from both the northern and southern wings are extremely elegant solutions clearly linked to very specific functions. All these features suggest that, in Level 3c, the entire area on the top of Logardan was transformed into a remarkable residential and probably administrative complex.

### LEVEL 3B

Later, during transition ED IIIb/Akkad and Akkad period, Level 3b is represented by a generalized reuse of previous ruins of Level 4 and 3d-c to build a huge workshop for firing ceramics (Fig.12). In 2016-2018 campaigns, several firing structures were identified. They were aligned along the exterior sides of the ruined buildings of Levels 4 and 3d-c. (see Baldi, Naccaro et al., 2018, p. 47-52). The western and central sector of the trench were not affected by recent works and this season did not produced additional data on Kilns 664/665, 666, 667, 678, 679 and the production units around the stone-paved room 673. To the north, even if badly damaged, several furnaces were part of the same unit of Kiln 668. Kiln 984 was stuck in the corner of the ancient sidewalk (823) on the northern courtyard of the edifice of Level 3c, while two furnaces (936 and 937) of the same size were lying respectively on the remains of Walls 681 and 822 of Level 3d. This emplacement determined a partial reconstruction of these walls to use them as banquets close to the chambers of the kilns.



*Fig. 12 – Plan of Level 3b.*

South of this workspace, in the central portion of the excavated area, another battery of kilns (847, 848, 849, 882, 903 and the partially excavated 881, 968 and 969) reveals the presence of another production unit. The main firing structure (847) was equipped with a north-west oriented smoke outlet. The floor of the entire area (844) was carefully paved in mudbricks and the bottom of the combustion chambers of Furnaces 882 and 845 was laid on stone structures of previous levels (respectively Walls 821 and 685 of Level 3d), which were also used as working benches. Further east, a roughly north-south-oriented step along the axis of the ancient wall 820 (Level 3d) allowed the work area to adapt to the topography of the site. In the higher sector of the workshop, two closely connected production units were located on both sides of the ancient Wall 976 (reused according to its 3c Level orientation). On its western side, several kilns (957, 961, 966, 960, 967 and 970, that was equipped with a chimney) had masonries intertwined with each other and were therefore built at the same time. All these structures were double-chamber up-drought kilns (with the smaller furnaces 966 and 970 used both to connect the larger ones and as major chimneys), while about 2 m west of them there was a battery of single-chamber little kilns (959, 960, 1095). The southern portion of the unit was occupied by a mud-brick floor connecting the row of the double-chamber kilns to the battery of the single-chamber ones.

On the eastern side of Wall 976 the firing structures respected the same organizational framework. Double-chamber Kilns 951-954, 963, 964, 972, 973, 980, and 975 were arranged on a north-south row, next to the single-chamber Furnaces 962, 965, 971, 974 and 979. These two rows of firing structures were not only connected by a work platform made of mud-bricks (which also incorporated the top of the ancient Wall 976 making it a long banquet), but also by a series of pipes for the transmission of heat and the evacuation of smokes. These ducts ran along the two parallel rows according to their north-south orientation. In order to allow these connections, in the northern portion of the unit, the recurrent maintenance of the pipes (even those connecting some kilns on an east-west axis, as 980 and 976) led to a series of renovations of the brick platform, as evidenced by the different orientation of the mud-bricks to the north. Moreover, these same pipes constitute a fundamental physical link between the production units on both sides of Wall 976. In the southern portion of it, the brick platform completely covered the stones, setting up a worktop joining the two units. They were also connected by smoke evacuation channels which, through a double-chamber structure (952), single-chamber furnaces (955, 956 and 953) and vertical chimneys (built upon the walls of the kilns), ensured a permanent connection between these two areas. These intricate connections are entirely understandable if one considers the very high degree of similarity of the ceramic techniques used in these two units. However, the two areas did not have a relationship based on mutual dependence, but rather on the possibility of sharing common spaces and structures. Each of them could be used independently from the other, but, when they were in function at the same time, they shared banquets, evacuation channels and heat transmission systems, to ration the consumption of fuel.

A completely different relation existed with another production unit, located to the north, further down the slope. Again, the battery of kilns was located to the east of what remained of Wall 976 of Level 3c. But due to the inclination of the slope, the wall here could not be used as a bench and was an actual separation from another production unit installed on the north side of the hill, to the west of the same wall (around Kilns 668 and 984). The firing structures of this north-eastern unit exploited the gradient of the ground to deeply recess the lower chambers in the filling of the space that, at the beginning of the previous 3c phase, was occupied by a staircase. Some furnaces (1007, 1005 and 1009) were embedded so deep that they damaged the remains of the stone foundation of the Middle Uruk fortress (Fig. 13, left). Other kilns, partially excavated in the eastern section of the trench (1010, 1011, 1012), used the slope of the hillside to facilitate the draught thanks to stepped chambers (Fig. 13, right).

On the opposite side of the hill, south of the two central units, the remains of the ancient wall 833 delimited another cluster of kilns. This was structured in the same way as the two central units, namely with a line of medium-sized double chamber furnaces (1-1.5 m in diameter - Kilns 1048, 1049, 1050, 1053, 1063, 2001, 1089), some smaller single chamber structures (1052, 1051, 1054, 1055, 1056, 1057) and several vertical chimneys often placed between the walls of different furnaces. This whole area was carefully paved with mudbricks arranged in a different orientation from the brick paving the floor of the central units. In addition, this production unit was equipped with a large platform (1060) paved with perfectly regular square baked bricks (40x40 cm) (Fig. 14). This surface, bounded to the west by a border of smaller mudbricks and completed to the south by square unbaked bricks of the same size as the baked bricks, was probably used for both shaping and drying the pots. This remarkable platform continues east, beyond the limit of the trench, so there is no certainty about its shape and extension, but it seems that it did not continue north of Wall 833, which defined the limit of this cluster of kilns. South of the paved area that characterizes this unit, further down the southern slope of the hill, the workshop included other kilns with stepped chambers, identified on the basis of some badly preserved and eroded traces (1093, 1094, 2000).





*Fig. 13 – Left: Remains of Kilns 1007, 1005, and 1009, against the masonry of Wall 976.  
Right: Kiln 1010 leaning against Wall 1098.*



*Fig. 14 – Fired brick Platform 1060, from the west.*

Although they were installed in the ruins of the previous Level, the eight production units identified so far in Level 3b share many features (Fig. 12). They were adapted to the configuration of the Tell by being arranged on different steps, with four units at the bottom close to the northern and western slopes, one on an intermediate step and three units at the top. Their main firing structures were always

double-chamber up-drought kilns<sup>3</sup>, but each of them had at least one single-chamber furnace.<sup>4</sup> These single-chamber installations were used to burn the fuel as if they were some kind of external firing chambers. Likewise, they generally had mud-brick floors, but they also used stone platforms or walls from previous levels as worktops. Each unit was composed by a space dedicated to the manufacture and by another one used for firing vessels. Moreover, in each unit, a spatial distinction existed within the area devoted to the activities preceding the firing: a portion of it was occupied by stone surfaces, while brick platforms or floors represented another portion. This seems to correspond to a functional difference. Indeed, several potter's tools – especially scrapers, spherical stone pestles and shells – come from the beaten earth or the mud-brick floors and platforms, while some little complete or well-preserved vessels come from stone-paved spaces. This could suggest that mud-brick platforms or floors were used for operations inherent to the shaping, while stone-paved spaces were rather dedicated to finish, dry, decorate and pre-fire the pottery. The stone's ability to accumulate and progressively release the heat emitted by the furnaces during the firing cycles could have facilitated the drying and pre-firing of pots accumulated on the stone surfaces. In this sense, it is reasonable to imagine that the production unit around the north-western Room 673 – the only one without workbenches and where there was no clear spatial distinction between in-situ potter's tools and well-preserved vessels – was entirely paved to make it a worktop on its whole surface, in order to dry and store the pottery produced there. Lastly, the dimensional difference between the kilns of the two westernmost units and those of the other clusters is due to the possibilities offered by the topography of the hill. The slope on the western edge is much gentler than elsewhere. This allowed to build larger kilns without having to recess them in the slope (obtaining a better isolation, but by digging very deep) and without occupying spaces where the ruins of the previous levels offered optimal working areas for shaping, decorating and drying the pots. Furthermore, although the kilns of the western units were much larger, they were also less numerous compared to the other clusters. In fact, the average area of double chamber kilns (that were used not simply to burn fuel, but to fire the pots) in all the units seems to be very homogeneous, around 18-21 square meters per unit.

### LEVEL 3A2

This level was largely excavated in the 2016 and 2018 campaigns (Baldi, Naccaro et al. 2018, p. 53-56). The 2019 fieldwork season made possible to identify another sector of this workshop southward. It presents a radical reconstruction of the workshop, dating from Late Akkadian period (Fig.15). The organizational criterion of the workshop at the time of its foundation in Level 3b is to exploit the ruins (on the hillsides) and flat spaces (on the top) to bring together essentially independent production units. Instead, starting from Level 3a2, the space is occupied in an increasingly dense way and the production units are more and more interconnected. At the moment of the reconstruction of the workshop in Level 3a2, the profile of the hill, determined by the accumulation of the previous structures of Levels 4 and 3d-c-b, was very sloping, both towards the north and the west, but with a much smaller amount of abrupt unevenness and steps than in the previous workshop of Level 3b. Instead of levelling the whole sector, artisans of Level 3a chosen to adapt their new workshop to the topography: they reused some parts of previous structures and built new kilns in accordance with the gradient of the slope.

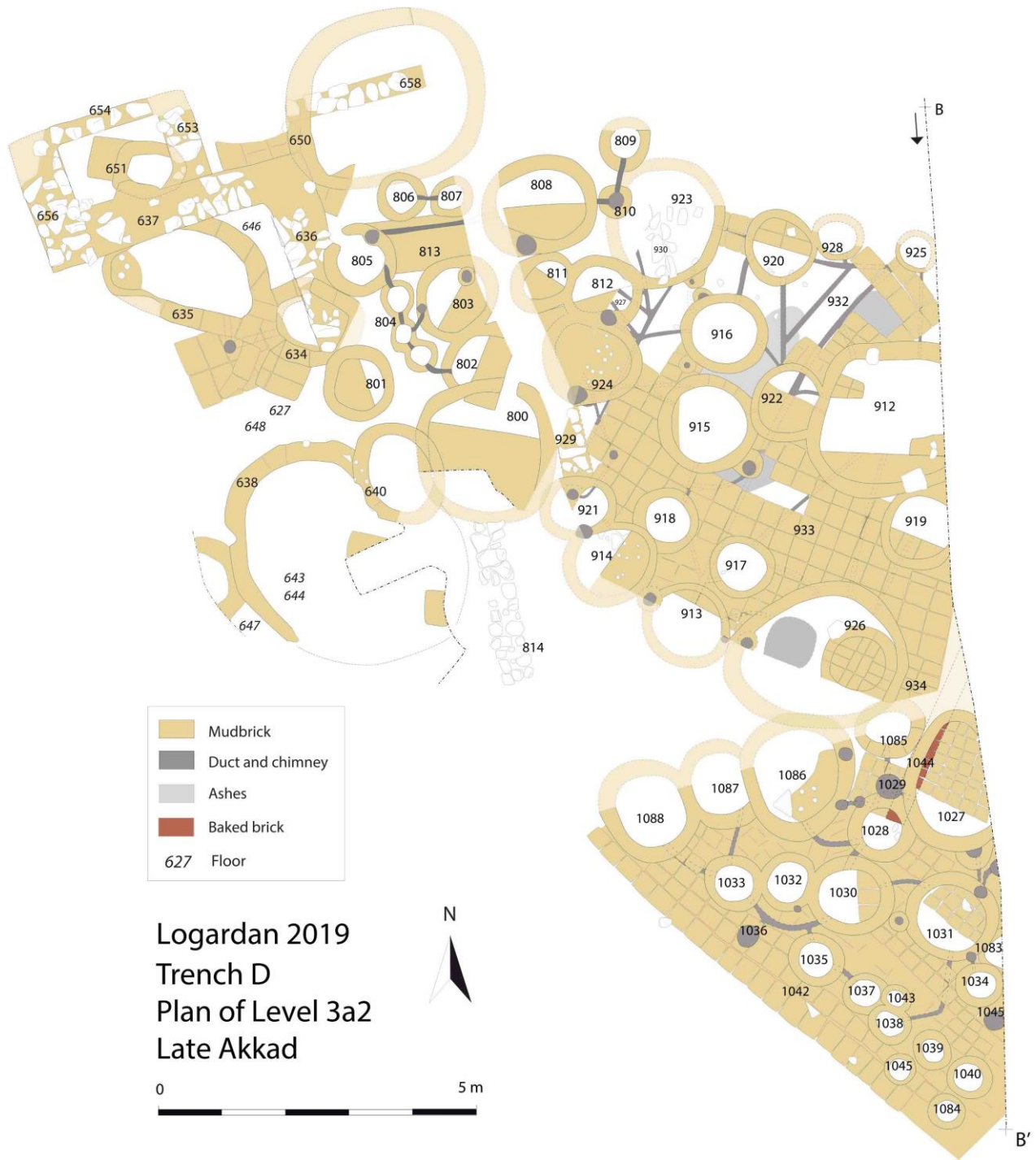
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<sup>3</sup> For Early-Dynastic Two-storey kilns see at Tell Hazna (Bader, Merpert and Munchaev 1997-98: fig. 6), Tell Banat (Porter and McClellan 1998: fig. 2-4), Uch-Tepe-Tell Razuk Level VB (Gibson 1981: pl. 27), Tell Madhhur (Killick and Roaf 1976: Abb 183), Khafaja (Delougaz 1940: plan IV, VII; Delougaz 1942: plan VII, fig. 17.i; Delougaz 1967: plan. VII, 8, 9), Abu Salabikh (Postgate and Moon 1981: fig. 7), Tell Barri (Pecorella 2004: fig. p.18).

<sup>4</sup> For Early-Dynastic one chamber kilns see for instance at Tell Banat (Porter and McClellan 1998: fig. 5), Tell Chuera (Moorgat and Moorgat-Correns 1976: Abb. 27), Khafaja (Delougaz 1942: fig. 21.a-b), Tell Barri (Pecorella 2004: fig. p.15).



North of the workshop, on the eastern side of the thick mud-brick bench of 812 lied Kiln 924, which shared a vertical chimney (stuck in the walls of both structures where they intersected) with the oven 812. The chamber of Furnace 924 was crossed by a long northeast-southwest oriented duct, flowing at its northern end into the large chamber (more than 3 meters in diameter) of Furnace 923. The bottom of this one was very ashy and badly damaged by the system of ducts for the evacuation of fumes. The walls of the chamber of Kiln 923 intersected those of the structures 809 and 812 and incorporated 810, connecting all the kilns and chimneys of the northern portion of this sector.



*Fig. 15 – Plan of Level 3a2.*

To the south, the pipeline connecting Kilns 924, 812 and 923, reached a system of vertical chimneys, located where the chamber of the large Furnace 800 was in contact with that of the small Kiln 921. The latter constituted the western edge of a battery of firing structures arranged along a roughly east-west

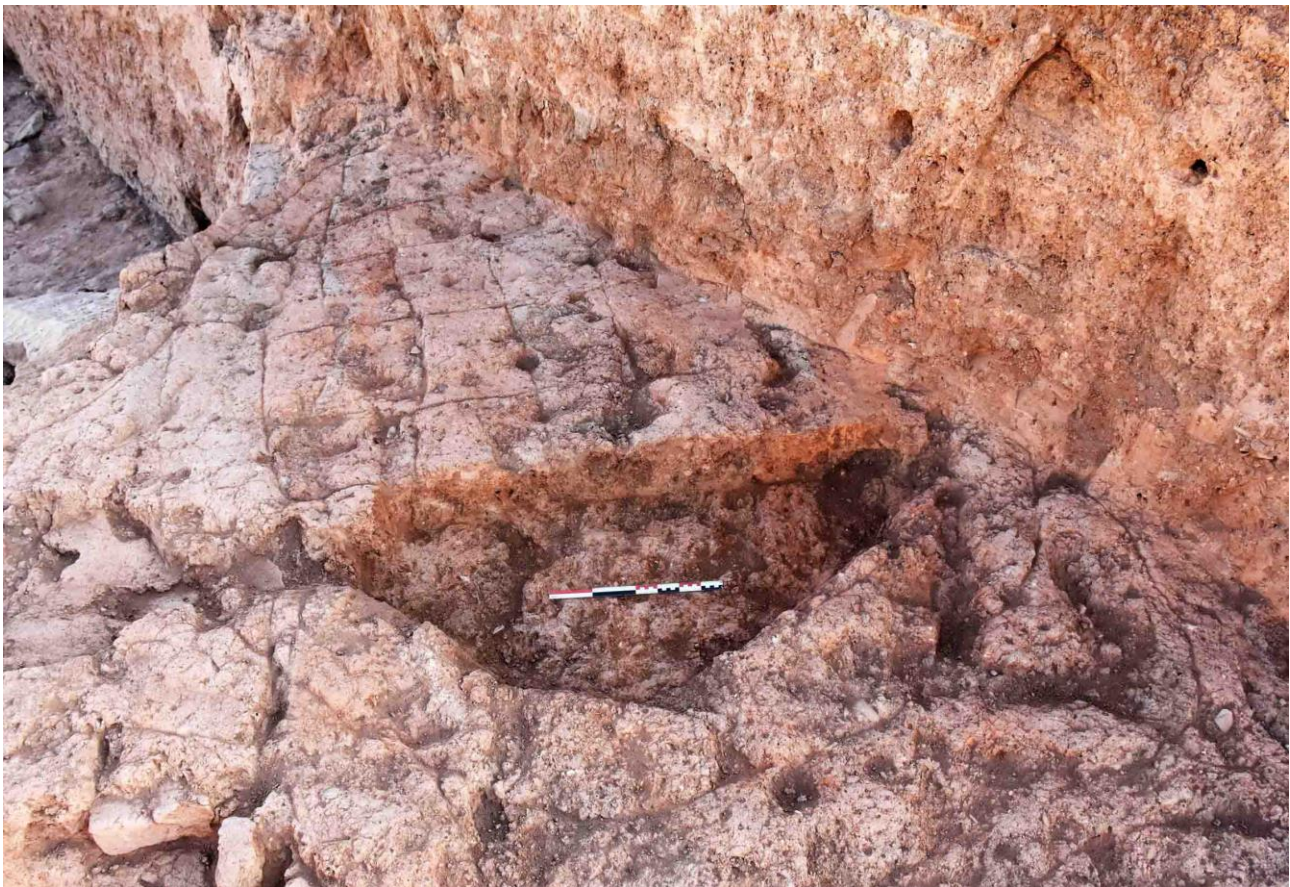


oriented axe (914, 918, 917, 913 and 926). Other kilns of this same cluster (1085, 1086, 1087 and 1088) were located further south and identified during this season. This cluster was structured according to the same architectural and technological rules. Masonries of the walls were often intertwined, testifying that the furnaces had all been built together. The firing spaces were arranged in steps to facilitate a horizontal internal draught. For the same reason, the external mud-brick benches extended inside some structures and constituted the shelf on which vessels were arranged to fire; the evacuation of the fumes was ensured by multi-branch ducts connected to vertical chimneys located at the junctions between several furnaces (between 921 and 914, 914 and 913, 913 and 926). As in the other clusters, exceptionally large dimensions (more than 3.5 m of diameter) characterized the main firing structure (926). The only peculiarity of Kiln 926 was represented by its eastern internal banquet. As in all other cases, it was the continuation of an external brick worktop (the massive 934 bench, with bricks arranged on the side). This internal shelf is remarkable for its circular shape, probably determined by the fact that, as suggested by a large ashy patch inside 926, many pipes for the transmission of heat (both north-south and east-west oriented) converged under the platform.

The entire area north of this cluster is carefully paved (933) in square mudbricks (about 40x40 cm). Since this area, higher than the sector located on the western slope of the Tell, was quite flat, the flooring made it possible to homogenize the base of the various structures by joining furnaces and workbenches. The cluster of kilns in this north-eastern sector (919, 912, 922, 915, 916, 920, 928 and 925) respected the same principles in terms of morphology and spatial organization of the structures. The furnaces closest to each other had walls that intersected or shared vertical chimneys collecting fumes from the outlet ducts (919, 912, 922, 915 and 916) while some other more peripheral furnaces (920, 928 and 925) were still connected by ventilation ducts. Despite the presence of a regular flooring, workbenches were conceived as in the rest of the workshop, namely as massive blocks of bricks. Sometimes their mudbricks were vertically arranged and little in size, as in the bench next to Kilns 912 and 922, which had approximately the same size as the elements of the northern portion of the southern bench 934. In other cases, bricks were horizontal (like for the bench next to Kiln 925) and had the same size as those used on the western slope for the benches associated to Kilns 634 and 635. As in the other clusters, several firing structures (919, 912, 922 and 920) were equipped with internal shelves to facilitate the horizontal draught and large dimensions, with a diameter of about 3.5 m, characterized the main kiln (912). Once again, this cluster was not isolated from the other ones: on the contrary, it was closely connected to them by the sharing of the same flooring, by common benches (as between the Furnaces 920 and 923) or by a dense network of ventilation and evacuation channels.

The same type of organizational principles can be observed on the south side of the hill, where an entire production unit was brought to light during this season. The large main kiln of this cluster (1027) was equipped with a sizable internal bench (Fig. 16), it was surrounded by medium-sized secondary installations (1030, 1031, 1028) also equipped with internal brick shelves, and by smaller simple one-chamber furnaces (1032, 1033, 1034, 1083, 1085). All these structures shared parts of their perimeter walls. They were connected to each other by a dense network of underground ducts and numerous vertical chimneys (some of which, such as 1029 and 1045, of considerable size) placed between the walls of several furnaces. The whole area is flat and paved with smaller (about 35 x 35 cm) mudbricks arranged in a different orientation than those of the production unit further north. Many fragmentary bricks indicate restoration works on the pavement following the maintenance of the underground ducts between the various kilns. On the southern side of this cluster, along the edge of the southern slope of the hill, a row of small firing structures joined to each other and to the rest of the production unit by a duct (1035, 1037, 1043, 1038, 1039, 1040, 1045 and 1084) probably served to connect this cluster with another unit further south. They seem to play the same role as similar installations (804) of the cluster ouest of Wall 929. On the other hand, the southern cluster was also connected to the other

production units, as shown by the large furnaces 1086, 1087 and 1088, which were part of the same unit as the furnaces 921, 914, 913 and 926 a little further north.



*Fig. 16 – Kiln 1027 with internal bench (1.5m in diameter), from the southwest.*

More in general, the entire workshop is constituted of interdependent firing structures, built together and, in most cases, also intended for working together. The intricate and apparently chaotic chain of firing chambers, external work platforms, internal benches, funnels, and chimneys composes a workshop where some sets of firing installations can be recognized. Their structures can work separately even if they are all interconnected. On the north-western side (1), the complex Furnace 635-634-801 is connected to Kiln 805. To the south (2), the large structure 638 constituted a single system with 640, 800, 802 and 803. On the northern side (3), the huge kiln 650 was functionally connected to Installations 806-807-808-809-810. Similarly, in the middle of the trench (4), Kilns 811-812 were part of a cluster including 924 and, above all, the large kiln 923. Two other clusters occupied the eastern portion of the trench: the one (5) around the large Kiln 912 to the north, and the one (6) dominated by Furnace 926 to the south. Finally, an additional cluster (7) is located to the south, around the large Kiln 1027. All these different clusters of firing structures present the same architectural and technical features. They have external platforms where pots were probably placed for the drying and pre-firing, using the heat released by the chambers during the firing cycles. Internal benches that enabled the horizontal draught of the heat characterize them. They are built in accordance with the slope of the site to facilitate the draught, and they are all interconnected through chimneys, smoke outlets, aeration ducts and pipes for the transmission of heat. Actually, the apparently disordered design of the workshop is the product of an extremely complex and well-planned set of structures integrated to each other.

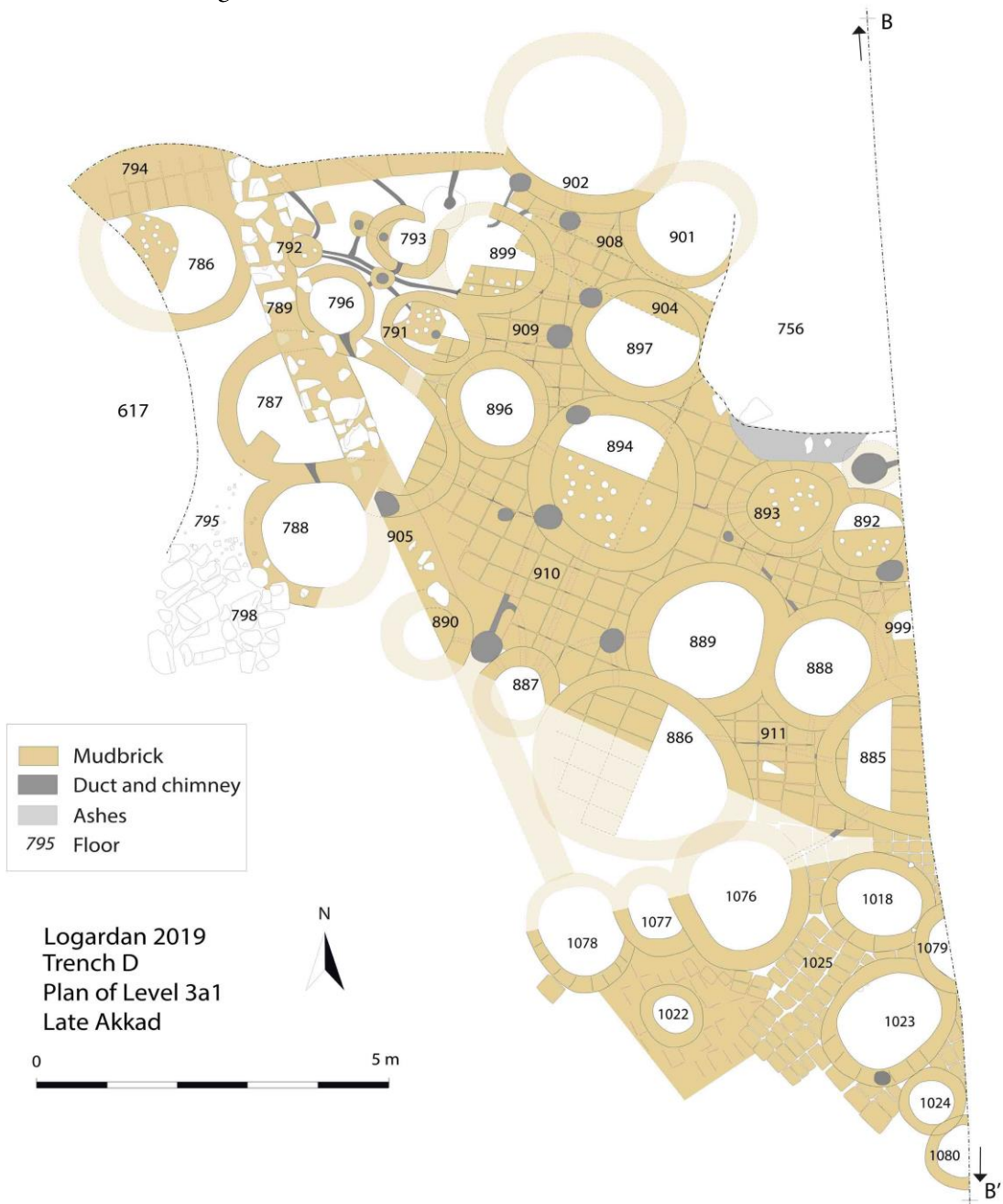
Horizontal-draught kilns are documented in Mesopotamia since the Halaf-Ubaid transition at Tell Ziyada (Buccellati and Buia 1991: fig. 6), but they represent a very rare typology and become better



documented since the 2<sup>nd</sup> millennium BC<sup>5</sup>. Therefore, the kilns of Level 3a2 in Trench D offer a unique documentation about the evolution of this firing technology and allow filling the absence of any archaeological record for the mid and late 3<sup>rd</sup> millennium BC<sup>6</sup>.

### LEVEL 3A1

In Level 3a1, dating from Late Akkadian period, a later phase of this workshop has been identified (Fig. 17). The 2019 campaign made possible to find the firing structures of this workshop southward. Despite the large-scale reconstruction of the workshop, there is a certain principle of continuity with some installations, both kilns and tiled floors, exactly superimposed on other previous structures (such as Kilns 919 and 892 – Fig. 2).



*Fig. 17 – Plan of Level 3a1.*

<sup>5</sup> See for instance at Qatna (Middle Bronze I Furnaces SU1574-1576, or Middle Bronze II furnace in area J – Morandi Bonacossi 2003: fig. 5, fig. 11), Tell Barri (Mitannian Kiln 470 – Pecorella 1998: fig. pag. 81).

<sup>6</sup> The only early 3<sup>rd</sup> millennium sample of horizontal-draught kiln is documented at Tell Karrana 3 (Wilhelm and Zaccagnini 1993: fig. 16).



The long 789 bench is a fundamental axis in the architectural organization of the work area. On its north-eastern side, the cluster identified in 2017 (Baldi, Naccaro and Bridey 2017, p. 31-32) is now better understood as for its architectural and functional features. The main firing installation of this sector is Kiln 899, whose perimeter partially intersects 791 and 793. As in the previous Level 3a2, the eastern sector of the workshop was carefully paved in mudbricks. This solution was adopted in this second phase of the workshop in a more consistent and extensive way than during the first stage: even the area close to the northern slope of the tell was brick tiled. The size of the bricks is quite homogeneous: their differences indicate activities of restoration (to repair the ducts under the floor), presence of benches joining different furnaces, or distinctions between specific work units. Within the central paved workspace, three clusters can be recognized.

The 3m large central Kiln 894 dominates a battery of installations composed by Furnaces 897, 901 and 902, while Kiln 896 was shared with the other two western production units. The connection with the north unit was also ensured by a portion of floor characterized by a different orientation of the tiles (909), as well as by a bench (904) joining Kilns 897 (which used this workbench as internal shelf), 901, 902 and 899.

To the south, Kiln 886 dominated another cluster. The change in the size of the bricks of floor (910) and benches south of Kiln 894 (no longer square modules as east and west of 894, but rather rectangular tiles) is due to the juxtaposition of different production units. Kiln 886 initially constituted the southern one (with an internal shelf in rectangular bricks), that intersects the walls of 887 and 889. Kiln 886 was connected to three installations aligned further south (1076, 1077 and 1078). The fact that these three furnaces were reconstructed in exactly the same position and with the same dimensions observed for three kilns of the previous level (1086, 1087, 1088) clearly shows the continuity with regard to both the organization of this unit and its connections with other clusters. The subsequent addition, to the east, of furnace 888 (with a masonry overlapping with 889) and 885 implied the rebuilding of the floor (911) with differently oriented tiles in the space delimited by this cluster. At the western edge of this battery, Kiln 887 constituted a node of connection with other units, both westward (through a shared chimney with Kiln 890 of the western cluster), and northwards through pipes running under the floor towards the large Kiln 894.

Eventually, despite the large modern pit occupying the north-eastern portion of the trench, another cluster can be recognized at the eastern edge of the excavation. Kilns 892 and 893 were connected to Furnace 894 (through underground pipes), and they were linked to the south-eastern, unit (by a bench and other pipes). Nevertheless, the change in module of the floor surrounding them, as well as their connections northwards and eastwards suggest that they were part of a distinct unit.

At the southern end of the trench, some kilns with overlapping walls (1023, 1018, 1024, 1079 and 1080) form a cluster identified this season (Fig. 18). Also in this case, the orientation of the brick paving, significantly different from the other units, distinguishes the cluster, which in any case is not at all conceived as isolated. The reconstruction of this area involves a simplification of its organization compared to the previous Level 3a2. Furnaces are larger than before, in order to ration the use of connecting devices as underground ducts and pipes (certainly useful, but difficult to maintain and repair). However, the functional principle remains the same as in the previous level, with all the installations interconnected by underground ducts and with intermediate structures (1022, 1018) linking this cluster to the other units. The circulation of the heat (namely the main reason to join the firing structures to each other) and the evacuation of the smokes (channeled towards the outside) were the functional problems to which, in this period, the artisans of Logardan responded by developing the interconnection between groups of structures. These clusters were even more and better connected than in the previous stage of the workshop, but, nonetheless, they remained separate. In fact, furnaces of Level 3a1 appear organized according to the same rule observed in Level 3a2.



*Fig. 18 – Kilns 1076, 1077 and 1078 being excavated, from the north west.*

In total, seven distinct units can be identified (Fig. 17): (1) 890-788-787 around the southern portion (905) of Wall 789 (paved on its upper portion to be used as a workbench); (2) Kiln 786, part of a unit located further west and destroyed by the structures of the later levels; (3) Kiln 899 and its annexes; (4) Furnaces 894-897-901-902; (5) south-eastern Kilns 886-887-889-888-885-1076-1078; (6) the group obliterated by the modern pit, of which Kilns 892-893 remain; and (7) the south-eastern unit 1023-1018-1024-1080-1079. Even if all these units were connected by a horizontal draught system, some furnaces (at least one kiln in each unit) were vertical up-draught structures (887, 788, 1077, 892, 893, 888, 894, 899, 791, 1080, 1077 or 786) equipped with a perforated floor between the two chambers. As a whole, the system is much more homogeneous than in the previous phase: the dimensions of furnaces and chimneys are similar, some structures (896, 1022) play a role of major junctions shared by several units and the system of ventilation and heat transmission is more rational and linear than before.

## LEVEL 2

This phase is clearly separated from Level 3 by a thick and regular clay floor (629, visible in section – Fig. 2) laying on the ashy destruction of the previous structures. Once again, this level is represented by a ceramic workshop for firing vessels dating from late 3<sup>rd</sup> millennium (Fig. 19). The excavated area (about 220 m<sup>2</sup>) constitutes a little portion of a much larger complex, as suggested by the dimensions of some firing structures, as well as by kilns of the same period identified in Trench E (*infra*, this volume). During the previous seasons, the western and southern parts of this workshop were cleared (Baldi, Naccaro et al., 2018, p. 59-63). In 2019, the system recognized to the west (around the massive 617 furnace) revealed east and south extensions and annexes.





857) transmitted heat and fumes to two other clusters of furnaces. At the eastern edge of the system was located a row of roughly north-south oriented furnaces of well standardized size (852, 854 and 855). According to the structure of such an intricate system, these three homogeneous kilns were not isolated, but their underground connections (to the north, south, east, as well as towards the shared chimney 878) no longer respected the essentially rectilinear framework that had its origin in the gigantic Furnace 617. Other clues in this sense are offered by the fact a wall (840) separated Kilns 854, 855 and 852 from a northern unit, while two workbenches, respectively on their southern and eastern sides, delimited these three modular furnaces, constituting a connection (and, at the same time, also a separation) with respect to other production units. On both sides there were furnaces (778 and 850) equipped with smokestacks, organically connected to other structures by different ducts. Nevertheless, these ducts did not follow the organization of the system located in the middle of the trench. Furthermore, the roughly square shape of the bricks used for floors and benches in the central area is radically different from the bricks of the northern unit (rectangular and laid sideways), as well as from the (smaller) tiles used in the southern sector. Indeed, in the southern sector brought to light in 2019, a brick platform was used to allow the workshop to adapt to the slope by levelling a surface slightly further down than the flat sector on top of the hill. Although weathering erosion (and intrusive pits and Late Bronze kilns such as 1081-1082 – Fig. 2) have damaged the side of the hill, three kilns (2007, 2008 and 2009) clearly illustrate the particular structure of this sector. These three furnaces had a stepped arrangement, with the lower chamber of 2009 excavated deeper, that of 2008 at an intermediate depth, and that of 2007 slightly recessed in the ground. This arrangement was well suited to the sloping topography of the hillside. Moreover, the platform progressively thickened on the slope creating a 1m thick mudbrick terrace, to incorporate the lower chambers of the furnaces and, at the same time, expanding on the top the flat surface used for shaping, decorating and drying the vases.



*Fig. 20 – Aerial view of kilns 865, 864 and 856, south of Platform 877.*

It is quite probable that the same expedient was used on the north slope, where, unfortunately, a huge recent pit dug by looters has cut away most of the structures of Level 2. However, a huge kiln (753) about 4m in diameter, probably equipped with a *prae-furnium* on its western side, dominates the remaining structures. This very large furnace was a double-chamber up-draught kiln separated from the production unit in the middle of the trench by a small wall (840). The latter was part of the lower chamber of Kiln 753 and supported an internal shelf along the whole perimeter in order to sustain the perforated platform. To the west, this huge furnace was reinforced by a massive platform (877) of pinkish rectangular bricks, laid on their side-edge with yellow mortar joints. The platform was crossed by north-south and west-east oriented ducts connecting the huge Kiln 753 to other firing installations. In particular, 869 and 871 were laid on the platform and built using the same brick layout. Further west, two larger structures (867 and 868), partially preserved because of the erosion of the western slope, were also connected to heat pipes. Albeit clearly separate from the other clusters of firing structures because of its walls and distinctive sideways laid bricks, this northern unit is not isolate. Indeed, ducts connecting the big Furnace 753 to Kiln 856 cross Wall 840. Likewise, the massive platform in rowlock bricks is carefully built to be crossed by (and therefore to protect and isolate) north-south oriented ducts connected to the main system of the workshop, coming out from the mega-kiln 617.

From a typological point of view, several structures of the workshop, as Kilns 615, 778, 761, 753 (and even Kilns 613 and 774, if considered as isolated furnaces) are up-draught two-storey firing installations, a well-known kind of kilns since the Halaf period in the 6<sup>th</sup> millennium BC (Hansen Streily 2000)<sup>7</sup>. Kilns with one chamber used both for fuel and for vessels (as 617 or 783) are well documented in this period<sup>8</sup>. However, the system constituted by kilns 617-613-865-864-858 and their annexes is rather a cross draught (or horizontal draught) kiln, where air flowed horizontally, from Kiln 617 through the duct 626-612 and Kiln 613 towards the rest of the network. Given the enormous dimensions of Kiln 617 (more than adequate for a brick kiln)<sup>9</sup>, able to contain hundreds of pots, the draught was not provided by a fan. On the contrary, the air movement was caused by the draught created by the chimneys and by the slight slope towards the north and the east. In this sense, the firing system of Level 2 offers a unique perspective on a firing technology that was not documented until now for the 3<sup>rd</sup> millennium BC.

## LEVEL 1

The most recent phase is represented by a renovation of the workshop dating from the very end of 3<sup>rd</sup> millennium BC (Fig. 21). Level 1 was not affected by our activities in 2019, except for a small sector on the southern slope. Nevertheless, our understanding of this phase has improved, and we highlight here some organizational aspects of the workshop.<sup>10</sup>

In the western sector of the excavated area, the main system of firing structures, constituted since Level 2 by the huge Kiln 617 and its close appendix 613, was still in function in Level 1 (Fig. 22). Around these structures, the entire area was reorganized in order to define a 3.6m large workspace (611) delimited by three walls: 602, 603 and 703/614. The entire space was carefully built. Walls 602 and 603 were reinforced by internal buttresses (604 and 605) probably used as benches for drying and pre-

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<sup>7</sup> During the second half of the 3<sup>rd</sup> millennium BC, similar two-storey kilns are widely attested, as at Tell Jigan (Kiln k3 – Fuji 1985: fig. 5), Tell Brak Area FS (Oates, Oates and McDonalds 2001: 64), Tell Bi'a-Tuttul (Strommenger and Kohlmeyer 2000: Taf. 76.1-76.2).

<sup>8</sup> See for instance at Tell Barri (Kiln 1140 – Pecorella 2004: fig. p.20), Tell Jigan (Kiln 2 – Fuji 1985: fig. 5), Tell Bi'a-Tuttul (Strommenger and Kohlmeyer 2000: Taf. 50.3-50.4)

<sup>9</sup> Nevertheless, the entire area yielded exclusively large amounts of ceramic slags. Moreover, the rarity of burnt bricks in this period makes it unlikely the hypothesis that 617 was a brick kiln.

<sup>10</sup> For images, see previous reports (Baldi, Naccaro et Rahoof, 2016, fig. 21, 22 et 24; Baldi, Naccaro and Bridey, 2017, fig. 29-31; Baldi, Naccaro et al. 2018, p. 63-66).

firing vessels during the firing cycles, when the temperature inside the workspace 611 was certainly very high. Both walls 603 and 703 were clay-coated on their inner face up to the ground and Wall 603 was well plastered on the exterior side. Indeed, to the north, the thick layer of green clay plaster applied to Wall 603 and the poorly preserved floor 609 suggest the existence of an open area, where an external buttress (606, corresponding to the inner buttress 605) defines two different working spaces (608 and 607). Kilns of which no trace remains due to the weathering erosion of the very steep slope possibly occupied them. On the opposite side, the absence of plaster on the southern face of Wall 703 suggests that there was another closed room, south of the workspace 611. The masonries of 602, 603 and 614 were joined together, built as a single structure. Because of their crucial function for the spatial organization, in a later moment, Walls 602, 603 and 703-614 have been rebuilt. The latter, whose first stage (Level 2) was in baked bricks, was rebuilt in 49x35cm large mudbricks. Once again, the masonries of the three walls were embedded to each other. In the corner, Walls 602 and 603 are characterized by regular fillings of mortar between some bricks, according to the same technique used since Level 2 for the isolation of the aeration duct 626-612.



Fig. 21 – Plan of Level 1.





*Fig. 22 – Excavation of Furnace 613 and extern wall of furnace 617, in the background.*

This is a clear evidence for the presence of channels leading towards eastern kilns (namely 755-754, with their *prae-furnium* 770). The east-west pipes that ran inside Walls 602 and 603 were connected to the north-south oriented Duct 628 under Wall 603. Therefore, they were part of the horizontal-draught system that extended starting from the huge Kiln 617 and the “crossroad of chimneys” 613.

As already observed in Level 2, the eastern portion of the trench was carefully paved and occupied by massive mudbricks platforms. The thick mudbrick-made and well-insulated system of ducts connecting Furnace 617 to 613 continued east of Kiln 613 and reached another complex structure, composed by a *prae-furnium* intended for centralize the incandescent smokes (775) and by a kiln equipped with two large chimneys (774). This multiple firing installation worked similarly to Kiln 613. The *prae-furnium* (775) was an antechamber collecting smokes and heat that were conveyed through the Ducts 626 and 612, while the two-storey up-draught Kiln 774 served both to fire pots exploiting the heat that was channeled there, and to evacuate smokes through its lateral chimneys. Just like Kiln 613, *Praefurnium* 775 distributed heat not only on an east-west axis (namely towards Furnace 774), but also northwards. To the north, the *Praefurnium* 775 was connected to a two-chamber (755-754) horizontal-draught kiln through an underground duct (similar to 628). This double structure (a third *prae-furnium*-chamber – 770 – has been added later) used the heat channeled through the underground ducts to enable the internal horizontal draught thanks to the little step between the two compartments, 755 and 754. In comparison with Level 2, the entire system becomes even more complex. A noticeable development is represented by the extension of the structure previously (in Level 2) composed by separate single-chamber kilns such as 871 and 869 and then (in Level 1) by the double horizontal kiln 755-754. In the very last phase of the workshop in Level 1, a workbench (752) is also built between Kiln 775-774 and this multiple installation, which becomes a triple structure. Its *prae-furnium* (770) worked according to the same mechanism as *Praefurnium* 775 (which was connected to the halfway chamber of this triple horizontal kiln). It collected heat and smokes conveyed from an underground duct running through

Wall 603 and re-injected incandescent gasses into the triple kiln (770-755-754) triggering a horizontal draught. One can observe this same mechanism north of Wall 603. At the northern edge of the workshop, where the erosion of the slope is too severe to identify any vestiges, Workplace 607 was an external space probably occupied by a kiln heated by gasses channeled through Duct 628. According to the general design of this kilns system, from Workspace 607, heat and smokes were conveyed eastwards, where two horizontal pipes (757 and 758) embedded in a brick platform and equipped with vertical chimneys led to Kiln 753, alongside the eastern limit of the excavation. The renovation of the platform in this area (with bricks no longer laid sideways, but with a simple stretcher orientation) was functional to the change of orientation of the pipes between the furnaces. In fact, in Level 2 the pipes embedded in the platform were mainly oriented towards furnaces located on the northern slope, while in Level 1 the main axis was east-west oriented, to connect the working space north of the Wall 603 and the large Furnace 753. Despite the presence of a large modern pit (756), the renovation of Furnace 753 is clearly recognizable. Its internal shelf along the entire perimeter was paved with a layer of flat stones, in order to better support the internal pierced platform and the roof of the upper chamber. The rubified walls of 753, as well as the many slags and overfired ceramics it yielded, leave no doubts about the high temperatures reached inside its chamber.

Albeit the erosion of the northern slope does not allow reconstructing the entire firing system, the functioning of these chains of kilns can be easily read, at least for the central part of the trench. The entire system – Kilns 617-613, Ducts 626-612 and 628, *Praefurnium* 774, vertical Kiln 775 and horizontal Kiln 755-754 – constituted a renovation and an enhancement of the previous similar system of Level 2, and was conceived as one huge structure, as demonstrated by the fact that masonries of kilns and channels were embedded to each other. The whole firing complex, and especially the whole set of all pipes and funnels, was built according with a very regular gradient northwards and eastwards, in order to facilitate the draught of heat and fumes of the huge Kiln 617. Kiln 617 was not only the heart of the system, but also the only place where fuel burned. The energetic input developed inside Kiln 617 was sufficient to power several other horizontal kilns (775-774, 770-755-754). Nevertheless, even this technical expedient was not enough to disperse the heat without it being destructive to the structures. This must have been a serious architectural problem and was certainly the reason that inspired all the solutions put in place to exploit the heat. This same problem also existed for the system running near the northern slope and dominated by the large Kiln 753.

From a structural point of view, a crucial measure during the renovation of Level 1 has been the construction of a series of mud-bricks platforms (Platform 776 south of triple Kiln 770-755-754, and Platform 759 north of this same installation) covering the whole area east of Wall 602. Indeed, in the very last phase of Level 1, 602 is no longer a wall: it is incorporated in the platform that plays both an architectural and a technical role. On the one hand, it constitutes a flat floor on the entire area and, on the other hand, it isolates the ducts conveying the heat between the different firing installations. All the platforms (759, 776 and the southern one close to Kiln 2007) were built to allow the passage of the ducts, while bricks were arranged to wrap and isolate them. This way, the floor, where pots were probably piled-up to dry, was not too hot for the workers. The extension of these platforms indicates the limits of the wide production unit constituted by the system of kilns around Furnace 617. It suggests that the renovation of the workshop in Level 1 implied a closer relation with the production unit in the northern portion of the trench (dominated by Kiln 753).

The eastern limit of the central production unit was represented by a roughly north-east – south-west oriented two-rows of bricks large wall (768). It represents a major partition within the workshop and a significant change compared to the previous phase, where this same unit extended about three metres further east. Because of a recent deep pit on the southern side of the workshop all the structures have

been there cut away or severely damaged, as the southern portions of Platform 776 and pit (or kiln) 782. Nevertheless, it is still possible to understand the organization of the workshop. Given the absence of southern pipes and ducts radiating from Kiln 617, the southern limit of its production unit (and therefore the southern limit of Platform 776) probably matched with Wall 614. Whereas, east of Wall 768, a distinct unit was equipped with some structures (as a banquette built against 768) which are clearly fragmentary: they indicate that this south-eastern production unit developed also southwards.

Close to the eastern edge of the trench, it was possible to identify a kiln (2007) whose construction dated back to Level 2 and which was restored in Level 1. The presence in this south-east sector of a solid brick platform suggests that the functioning of the system was quite similar to that in the central part of the workshop. Kilns were built in the middle of large platforms providing both flat surfaces for shaping, decorating and drying the vessels and a good isolation for the horizontal ducts interconnecting the kilns.

Some installations excavated in this sector have a quite important size (around 2-2.5m in diameter) and annexes. Kiln 767 had a large *praefurnium* on its eastern side<sup>11</sup>, while Kiln 769 (partly excavated along the berm) probably had the same structure, with a large external double chimney on its southern side (772). This cluster of firing installations is built close to the unit dependent from Furnace 617. A bench (751) related to Kiln 767 was built against another bench (752) belonging to installations 770-755-754 and 775-774. The two workbenches constituted a mud-bricks block shared by the two production units, as Wall 768. The latter incorporated in its-own masonry the perimeter walls of Kilns 774 and 767, which represents an additional proof that the entire workshop of Level 1 was planned and built as one single edifice, since kilns of different production units were built together. Nevertheless, this architectural integration between different production units does not imply a high degree of functional integration. On the contrary, Wall 768 represents a substantial separation. It was the same for Wall 840 (reconstructed in Level 1) and Platform 759, which defined the limits of the northern unit around Kiln 753. Just like in the production units to the west and to the north (the whole systems around Kilns 617 and 753), that worked according with a horizontal draught, the kilns of the unit east of Wall 768 (Kilns 767, 769 and 2007) were also connected by horizontal underground ducts. Nevertheless, on the western side of Wall 768, the floor was layered by a mud-brick platform, while on its eastern side large portions of the space between the kilns were simple clay floors and the southern brick platform was a solution to flatten a part of the slope. In the western unit, all the firing facilities were multiple composite installations, while in the eastern unit kilns are simple circular double-chamber structures with external chimneys. On the basis of these characteristics, it is evident that a more in-depth study of level 1 can provide valuable information on the organization of ceramic production at the end of the 3rd millennium BC.

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<sup>11</sup> The stones found in 2017 in the middle of Kiln 767 were actually part of a tomb (1001), dating from the Hellenistic period. The grave was very deep, dug in the filling of the kiln of Level 1, and partially went through the ruins of Level 2 (filling of furnace 858). It contained some small glazed ceramic jars. It is the only attestation of a more recent period in Trench D.



# LOGARDAN: SUMMARY REASSESSMENT OF STRATIGRAPHY AND ARCHITECTURE OF THE UPPER TERRACE

Johnny Samuele Baldi, Sidonia Obreja, Rateb al-Debs and Kamal Rahoof

**D**uring the 2019 campaign, only few relatively discontinuous archaeological activities took place in Trench E, focused on some targeted operation in some areas of the site (Fig. 1). The northern section has been an important source of information, some cells around the central courtyard have been reanalyzed, while the extension of the excavated area in the south-east sector was somewhat widened. In all these areas, the aim was not to continue the activities of previous fieldwork seasons, but rather to carry out stratigraphic tests and verifications, so that excavations could be extended in future campaigns, in order to define as soon as possible a shared stratigraphy between Trenches E and D, that is valid for the whole site of Logardan.



*Fig. 1 – Orthostatic view of Trench E (2019).*

On the other hand, an extension of the excavated surface was carried out to the south-west, in a sector previously outside Trench E. In this area, we started an extensive excavation agenda of the southern slope of the site. In the coming seasons, the aim is to open a new trench on this side of the citadel, to physically connect Trenches D and E and allow better discernibility of the structures and overall stratigraphy of the site.

The stratigraphic outlook presented here is the result of these re-analyses of some structures identified in past years. However, the description offered below of the various levels and their dating is deliberately summary because, in order to complete the stratigraphic revision, in the next fieldwork season the presence of a 3<sup>rd</sup> millennium ceramic specialist will be necessary. Since this was not possible in 2019, all the pottery collected in Trench E (as well as in Trench D) has been recorded, photographed, drawn and stored waiting for the next campaign.

### URUK PHASE

The next seasons will allow us to determine if the levels of this phase actually correspond to those identified in Trench D, but for now everything leads to believe that they are the result of the same occupations.



*Fig. 2 – Plan of Levels IVB and IVA.*

### *Level IVB*

Although some structures had previously been attributed to this phase, and although in past years a not negligible amount of Early Uruk pottery has been collected in the Trench E, very few structures can be ascribed to Level IVB with certainty (Fig. 2).



Stratigraphic tests carried out in 2019 have shown that, in the absence of floors associated with the base of the oldest walls, it is just hypothetical – and sometimes misleading – to attribute them to Level IVB. For example, at the eastern end of the trench, the base of the outer (eastern) wall of the long Room 2031 had been reached, but its first construction dates back to the Middle Uruk phase (Level IVA – Fig. 3). For the moment, the only structure that it seems reasonable to attribute to an Early Uruk phase is Wall 2129, between Gates 2214 and 2264. In fact, in this sector all the structures certainly dated to the next level have been added to Wall 2129. This suggests that since the Early Uruk Level IVB the acropolis of the site was accessible through gates from this sector.



*Fig. 3 – Level IVA (Middle Uruk): foundation of Wall 2080, from the east.*

### ***Level IVA***

Compared to previous seasons, in 2019 it was possible to ascertain that many of the structures previously attributed to later phases belong to this level (Fig. 2). In fact, in Level III most of the structures of Level IVA were rebuilt or only slightly modified, but their construction dates back to this time. This is not surprising given the large amount of pottery dating back to the beginning of the Middle Uruk period that was collected in the Trench E in the 2016-2018 seasons. Since this level, the whole complex was organized around a large central court with a series of cells around it. This space was accessed by paths along its northern and southern sides, and not by an axial direction, since to the east the long north-south oriented Room 2031, which was accessible via a door to the northeast, but had no doors on the central court at this stage, delimited the court. The southern portion of the complex was composed of two portions. To the east, several kilns connected to each other constituted a large production unit of a ceramic workshop partially brought to light in 2018 (Sauvage et al. 2018: fig. 9). On the other hand, the southwestern sector of the trench has been investigated in 2019. Walls 2083, 2206-2317 and 2318 define a very large area south of an entrance of the citadel (2214). For the time being, this portion of the trench seems to have been a large indistinct space. However, although it was certainly an open area, it seems unlikely that it was completely clear of constructions. Instead, it is



probable that some vestiges of this level were destroyed by the domestic structures and, above all, by the kilns of the later phases, which created thick deposits of ash and debris on the southern slope of the site east of Wall 2206-2317. In fact, under these later accumulations, some small portions of the passageway were identified. To the south, the path ran along the little wall 2318, which was located at the same altitude as the stone basement-walkway of the Middle Uruk fortifications in Level 4a of the D Trench. The angle between walls 2318 and 2317-2206 marked a turning northwards, following an ascending path with low steps and flat cobbled parts (2319), some remains of which were visible at the base of wall 2206. The walkway then turned westwards flanking Wall 2083, along which it was possible to identify the remains of other stone steps leading to the stone paving 2152 and 2114 (once again slightly sloping), which were the access to the citadel. This paved serpentine access flanked a quadrangular structure (2127, delimited by walls 2116 and 2126). Stepped and low sloping accesses are also documented in the Middle Uruk Level 4a of Trench D. Another clear correspondence with the architectural features of Log D Level 4a was observed further north, where between the two entrances of the stronghold (2214 and 2264), Wall 2189 was doubled in this phase thanks to the construction of Wall 2110. During the last season, it was possible to verify that the masonry of the latter, although thick and suitable for a defensive function, was embedded with to the masonry of Walls 2136, 2126 and 2130 (Fig. 4).



*Fig. 4 – Level IVA: late little partition Wall 2150 of cells 2137 and 2134, from the north. In the right background, interconnected masonries of Walls 2130 and 2110.*

This space outside the fortifications was therefore built at the same time as the thickening and strengthening measures of the fortress, which suggests that the cells on the inner perimeter of the large courtyard have been part of the complex since its first conception. In fact, at the base of the walls that delimited this room (2136, 2110, 2130, 2126) were identified the remains of a floor used during the initial stage of Level IVA. In a later moment (late Level IVA), a little intermediate north-south-oriented wall was built to separate the room into two square cells (Fig. 4), both used to accommodate ceramic

kilns, belonging to a production unit other than that occupying the southern part of the trench. Further north, access to gate 2264 followed a pattern similar to that described for the southern access, with a stepped path on the northern edge of the courtyard and a paved area at the entrance.

### EARLY BRONZE PHASE

This phase is represented by several levels, showing the occupation of the site during most of the 3<sup>rd</sup> millennium BC, from its second quarter until its final centuries.



*Fig. 5 – Plan of Level III E.*

### *Level III E*

It corresponds to ancient Level III (Sauvage et al. 2018: fig. 23). The general layout remained the same (Fig. 5), with the reuse and reconstruction of Middle Uruk structures throughout the southern portion of the trench. As in the previous phase, a large courtyard occupied the central sector of the excavated area, bordered by small cells and closed to the east by a long room (2031). The latter was narrower than in the previous phase, since its western limit was a wall built on the eastern side the former Middle Uruk wall. Room 2031 communicated with the court through a door on the southwest side, where a stone-paved floor covered with ceramics was brought to light in 2019 (Fig. 6).





*Fig. 6 – Level III E: the stone and sherds-paved floor of the central courtyard, from the west.*

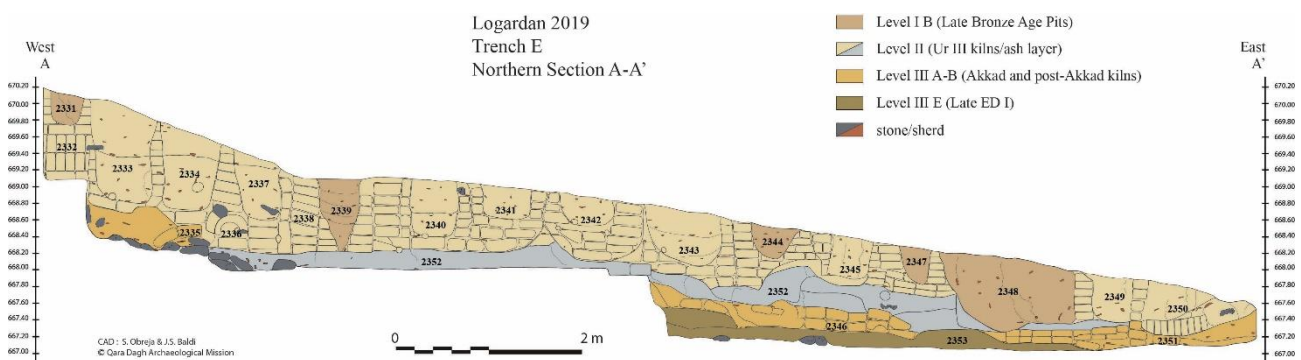
South of Room 2031 and Wall 2161, the area previously occupied by Middle Uruk kilns was transformed into a domestic sector: a low bench was built against wall 2161 to store bowls and jars (discovered on it in their primary deposition), while the floor was progressively raised (Sauvage et al. 2018: 72 and fig. 7-8). This domestic area was connected to another domestic space further east through a door with a large door socket (Fig. 7).



*Fig. 7 – Level III E: Wall 2317, door socket and thresholds 2272 and 2312, from the south.*



Next to the door socket there was another low bench against a wall (2317), interrupted by a door equipped with external and an internal thresholds (respectively 2272 and 2312). This door allowed north-south access to a small room, where some kitchen pots were found around the hearth on the floor (2309). On the north, on the other hand, another door (2314, slightly offset further east than 2272-2312) allowed to exit the complex and reach the outside area, east of Wall 2080 of Room 2031. On the southern portion of the trench, the citadel was accessible through the same serpentine path of the previous period. Nevertheless, if the reconstruction included the entire Middle Uruk Wall 2083, the small quadrangular space 2127 and the associated cells in the central courtyard, only the northern half of the north-south oriented wall 2066 was rebuilt on this level. Between the south entrance (2214) and the north entrance (2254), the double wall 2129-2110 was rebuilt and reused in this phase, while the small wall separating cells 2137 and 2134 fell into disuse and the two small rooms became a single space again (as at the beginning of the Middle Uruk occupation). In general, the plan of Level III E is largely similar to the Middle Uruk level, whose structures were very often rebuilt. But compared to Level IVA, different expedients were used to overcome the west-east oriented slope of the whole area. If in the Middle Uruk the access paths to the citadel implied the use of steps and ramps, at this stage stopovers, gradient pavements and sloping floors were preferred, as one can see both in the southern area and in the central courtyard. In fact, the remains of the ovens preserved at the base of the northern section (Fig. 8) are at a higher altitude than the west door of the long Room 2031.



*Fig. 8 – Trench E northern section.*

### **Level IIID**

It is composed of structures that are not yet fully readable, but that reuse walls (2110, 2129 and the walls delimiting the space 2127) as well as accesses (2264, 2214) from previous phases of the gate (Fig. 9). However, some structures were newly built in this level. On the southern side of access 2214, a thick wall (2157) probably represented a segment of the defensive perimeter that did not reuse previous remains, as ancient walls 2129 and 2110 did further north, on the side of access 2264. The latter, however, was raised and was accessible by a stairway, which steps are little preserved (2149). The newly built Wall 2148 represented the southern side of this climbing path. At its eastern end, the long slab 2127 constituted the last step of a flight of stairs using space 2008 as an intermediate landing, to then turn left and go up towards the access 2264. The presence of turning stairs, raised accesses, doubled and thick walls, as well as the frequent reuse of previous structures could suggest a correspondence between this level and Level 3d of Trench D.

### **Level IIIC**

It consists essentially of the structures inherent to the renovation of the large access gate of the citadel and to the massive ramparts (Fig. 9). Compared to the structures already identified in previous seasons, targeted investigations in 2019 revealed that access was not axial at this stage. In fact, the door with the monolithic threshold between the two bastions (2202) was reached by climbing up a narrow zing-zag staircase, which reused portions of the access paths of the previous phases. In particular, some ancient

walls were reused as a base to support the quadrangular ramparts. However, Wall 2129 to the north and the small walls (now filled with earth and used as a support box for the southern bastion) delimitating the little space 2127 to the south, were partly rebuilt to flank the staircase that climbed up the serpentine path towards Gate 2202.



*Fig. 9 – Plans of Levels IIID and IIIC.*

### *Levels IIIB-A*

No ceramic kiln of the workshop occupying the area in these levels were identified in 2019. But some of these facilities are known from previous seasons (ancient Level IIB and IIA - Sauvage et al. 2018: fig. 22). A reanalysis of the remains of some furnaces built inside the ruins of the southern bastion (Kilns 2249 and 2226-2227 – Sauvage et al. 2018: fig. 22), as well as of other furnaces built at the base of the ancient citadel gate (Kilns 2028, 2029, 2030 – Sauvage et al. 2018: fig. 25) has shown that structures were reconstructed in two distinct levels, respectively IIIB and IIIA. Different firing facilities did use the same brick platforms but were superimposed on one another. They represent, therefore, at least two phases of the same ceramic workshop, probably corresponding to Levels 3b and 3a2-3a1 in Trench D (Fig. 9). These features are confirmed by the traces of this phase recorded in the north section of the Trench (Fig. 8). Some remains of mudbrick platforms and kilns (2335, 2346, and 2351) indicate that for the first time the working area adapted to the topography of this sector of the site, according to a layout going up the slope towards the ancient citadel gate. In the following phases, this climbing configuration was resumed by the subsequent reconstructions of the workshop.





the trench (Sauvage et al. 2018: Fig. 32 p. 53 – are these constructions Ur III structures or rather remains belonging to the previous Level IIIA-B?). This will be a priority in the coming seasons.

### LATE BRONZE PHASE

In recent years, a preliminary analysis of the pottery has shown that this phase of occupation corresponds to a relatively short interval, during the transition between Middle and Late Bronze Age, or at the very beginning of the Late Bronze Age. However, in terms of stratigraphy, two levels can be distinguished, characterized by a completely different use of the site (Fig. 11).



*Fig. 11 – Plan of Levels IB and IA, and Hellenistic tombs ('Phase 0').*

### Level IB

A huge number of pits and food installations represents this level. Some of these pits contained large underground jars; others were probably silos, while others consisted of semi-underground circular ovens. No trace of domestic architecture has yet been identified at this level, which suggests that the whole sector was a large working area, or that inhabitants were nomadic living in tents, or not permanent occupants of the site. However, the whole area was clearly used for intensive food processing activities, probably for the production of specific food commodities. Chemical and carpological analyses are expected in the coming campaigns, but the high quantity of large storage jars and small beakers could suggest the production of liquid substances. In some areas the installations were particularly dense, such as in the eastern Room 2031, which in Level IB had a door on its western side (Fig. 12) and contained little ovens, large jars and many glasses (one of which was found intact inside a jar in 2016).



*Fig. 12 – Western door of Room 2031, used in Level IB and closed in Level IA.*

### ***Level IA***

It is constituted by another exceptionally large ceramic workshop (Fig. 11). Kilns have been identified in the whole trench during the past seasons, but a very representative example of the reorganization of the whole area can be observed in the southeast sector of the trench, excavated this year. The west door of Room 2020 was closed, while in the southern portion of this same room a small wall was built to delimit the space for a circular furnace. At the same time, further south, a sizeable mudbrick platform-bench (2234) was built to demarcate other production unit. During the 2018 campaign, this structure (2234) was considered to be older (Sauvage et al 2018: fig. 9), but the tests carried out during this season showed that 2234 covers food pits of Level IB and therefore belongs to the Level IA workshop.

### **HELLENISTIC TOMBS**

This phase cannot be properly defined as an occupation in the history of the site. The graves that punctuate the surface (Sauvage et al. 2018: fig. 11) show that the area was frequented during the Hellenistic period. Nevertheless, not a single fragment of pottery dating from this period has been identified during surveys in recent years, suggesting that Logardan was just a small cemetery, probably that of the contemporary installation in Girdi Qala.







## ETHNOGRAPHIC STUDY: EXPLOITATION OF THE NATURAL RESOURCES IN THE TAVUQ ÇAY VALLEY

Carolyne Douché and Claire Padovani

**T**his short study examines the modern rural village of Pyriadi and its surrounding, in the Tavuq Çay valley northwest of the djebel Qara Dagh. Pyriadi is part of the small town of Shorsh, close to Chemchemical, in the Suleymaniah governorate of the Iraqi Kurdistan. The ethnographic research has been developed in the context of the excavations at Girdi Qala and Logardan, located beside the village. It aims to contribute to the understanding and interpretation of past plant economies on one side and clay sampling for ancient pottery workshop on the other. Interviews of local farmers and artisans have been led in October 2019, thanks to the help of Kamal Rahoof Aziz (SBAH) and Jamal Jalal Mohammed.



*Fig. 1 – Left: example of a cultivated land in the rural village of Shorsh (owner: Ahmad Juma Hussein). It is divided into three parts: the part for vegetables in the foreground, for alfalfa cultivation in the middle and a small field of barley in the background. Right: Ahmad in his field of alfalfa (*Medicago sativa*).*

## LAND ACTIVITIES

We visited a place situated between the modern village and the archaeological sites. There is a mosaic of small-cultivated lands such as the one of Ahmad Juma Hussein.

### *The small land of Ahmad*

The land is approximately 8m x 50 m and has been divided into three spaces (Fig. 1, left):

- A small area dedicated to the cultivation of bell peppers and next to it, onions and raddish have been sown in squares
- A larger stand were *alfalfa* was growing
- A large stand dedicated to barley cultivation

Small-cultivated lands are dedicated to the cultivation of vegetables, commonly used in the traditional Kurdish cuisine. These are cucumbers, tomatoes, radishes, tumbleweed (*Gundelia tournefortii*), potatoes, peppers, onions, salads and many herbs (aneth, persil, rocket). Despite their importance in the daily life, pulses (lentil, chickpea, bean) are very rarely cultivated in the region. Sometimes, during spring chickpea is sown in small quantities. Usually, local people eat and (re)use (to feed animals for example), what they have. Assy Hussein, Shorsh's counselor, said "*Here people use what they have. They are not thinking in a commercial way. Doesn't matter the quality of the grain: even if it is good, if people need to feed animals, they won't sell the good one to buy a bad one for animals, they will just use what they already have*". Interestingly, apart from vegetables most plants cultivated by Ahmad and villagers are dedicated to animal feeding.

Alfalfa (or Alfafa) is now very common in this area because it grows easily and continuously during seven years without doing anything (Fig. 1, right). Once it has been harvested, it grows again, without any break. Barley, which is cultivated at the end of the field, is harvested green (only 15-20 days after sowing). Sometimes, animals are directly brought into the field for grazing. Barley is cultivated alternatively with pumpkins.



*Fig. 2 – Left: wadi running from Pyriadi to the Tavuk Cay river. Right: channel irrigating Ahmad vegetable garden.*

The farmer to irrigate the land dug channels (Fig. 2). They are fed partly by the wasted water coming from the village, and partly by a wadi. Irrigation system is used all the year except during winter, when rainfalls are sufficient. The dike located close to the road is breached, the water fills channels and the flood is controlled.

Before sowing, the soil is usually ploughed manually (with shovels) but sometimes, when the surface is too large, they use a mechanical plough and then the shovel. It has been noted that the small squares



where radishes and onions have been sown were recovered by animal dung produced by Ahmad's cows (Fig. 3). Before cultivating the land, the farmer removed the top soil, because animals have stamped it for a long time and it is very hard.



*Fig. 3 – Left: small squares where onions and radishes have been sown. Right: detail of the animal dung spread in the square to increase soil fertility.*

After having collected dung from the barn, it is stored for a year to operate natural organic processes and then, it is spread into the field to increase soil fertility (nutrient supply such as azote). Another method that has been practiced by local farmers around the archaeological sites is the slash-and-burnt farming. This method, consisting in burning the land after harvesting is new (did not exist five years ago) and is controversial. Some farmers do it in order to clean the field, in particular when it is so much invaded by weeds, some believe that it makes the soil easier to plough and some others do it to increase the fertility of the soil. However, in Pyriadi and Shorsh, most villagers believe that it is harmful for the ecosystem, considering that the fire kills all plants and insects living in the fields.

Sowing seeds such as alfalfa is made by broadcasting. Weeds are removed by hand but in addition, a chemical product is regularly used, especially along the fence where most ruderals grow. In some cases, when weeds are too invasive, farmers collect any unwanted plants and burn them outside the field. Harvest of alfalfa is made manually with a modern iron sickle (Fig. 4), usually early in the morning to keep the plant very fresh to be sold later in the market. Preparation of the soil and sowing requires six workers.



*Fig. 4 – Ahmad harvesting alfalfa with an iron sickle.*



### *The extensive field of Ahmad*

Apart from this 'small land', Ahmad is the owner of extensive fields dedicated to the cultivation of cereals: bread wheat and barley. While a part of wheat is used for human consumption -wheat is mostly sold to the Iraqi government-, the other part and barley are used to feed animals and a part of the harvest is kept to be sown the following year. Wheat and barley are cultivated alternatively during eight years and then the field is fallowed during a year. Grains are sown between mid-October and 20 November. Barley is harvested around 20 may and wheat is harvested a month later.

These fields are settled closed to the Tavuk Çay River (below the archaeological Tells). The winter rainy season usually begins around mid-October. From the beginning of October, farmers regularly check the sky. When they are sure that rain is coming, they plough the fields and sow cereals. When rain is late, farmers use channels to irrigate the fields with the water deriving from the river. Machines now assist weeding and harvesting.

### *Note on the political field management*

In Iraq and Iraqi Kurdistan, lands belong to the government, which attributes lands to farmers by an agreement. Most lands are exploited for domestic needs. However, farmers can choose to sell the product directly to local markets (with low prices but paid directly), or to the Ministry of Agriculture with higher prices but with a long payment period. Acting as a social entity, the government redistributes crops to people (to feed animals) or sometimes sell it with low prices.

Despite this agreement with the government, lands are hereditary goods; Ahmad's lands for example come from his father and grandfather. He will be allow to give them to its sons or to sell them and keep the returned money. Nonetheless, the government can decide to take them back at any time. In certain cases, probably due to a very old agreement, some farmers are the owner of their fields.



*Fig. 5 – Products kept in Ahmad storage: barley (*H. vulgare* subsp. *Distichum*, left), straw (center), dung cakes (right).*

## HOUSE ACTIVITIES

### *Storing the grain*

After harvesting, cereal grains (naked wheat and barley) are brought home and stored separately (barley is stored hulled) in a storage place. This room, without windows, includes bags of barley grains, bags of wheat grains, bags of straw, bags of dried dung (Fig. 5) and wood. Straw and grains are mixed together “to make it delicious for animals” said Ahmad. As they are dedicated to animal feeding, cereal stocks have not been cleaned and contain a large quantity of weeds. A sample has been taken in order to analyze the weed composition associated to crops.

When the crop is used for the family consumption, cereals are cleaned. Usually, they are put into water to let the lightest elements (weeds and chaff) coming up and be separated. Then cereals are dried and sieved to remove heavier undesirable elements. Before cooking, a final stage of cleaning is applied by women, checking and sorting grains.



*Fig. 6 – Left: ashy layer (wood and dung) in the bottom of the traditional tannur. Right: traditional tannur, made by an artisan in Shorsh.*

### *Cooking with the tannur*

Ahmad says that in the past, people were using dung as fuel, especially for tannur because these features are always located outside the house and the smell resulting from the dung burning is not good. Ahmad's family has two tannur, an old one in front of the house, built in clay and fed by wood and dung (Fig. 6, left) and a modern metallic one, situated on the roof and fed by gaz.

In Shorsh, we also had the opportunity to visit an artisan that continues to make traditional tannur with clay collected in the surrounding environment (Fig. 6, right). He uses the hand building technique of coil construction (made with clay, chopped straw and animal hairs). Nowadays, people feed tannur with wood, wastes such as papers and sometimes even with modern charcoal (Fig. 7, left). However, the artisan explained that in the past, they first placed straw in the bottom, then a layer of animal dung fragments, above it some twigs and finally wood pieces. Sometimes, people just gathered what they can find around including twigs and herbs (Fig. 7, right).



*Fig. 7 – Left: preparing the tannur (burning wood and papers) before cooking bread. Right: indeterminate wild grass collected in the surrounding environment to be used as a starter for the tannur.*

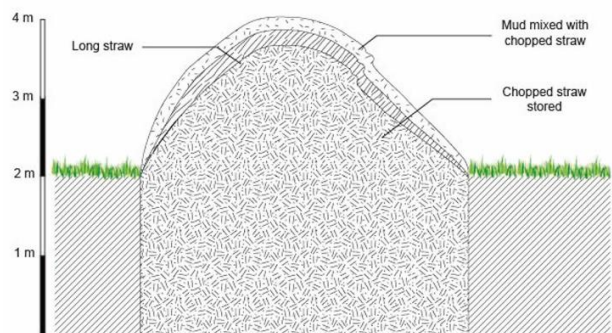




*Fig. 8 – Farm in the rural village of Kurata having two ‘storage mounds’ containing chopped straw.*

### ***Storing the straw***

During this campaign, we also had the opportunity to visit the small village of Kurata, located 2.1 km to the northeast from the archaeological site of Logardan. While the area is famous for its sources of clay, shepherds living there still use traditional way of storing straw. Around one of the farms, two ‘clay mounds’ have been observed (Fig. 8). They were built by a shepherd family to store wheat straw used to feed their sheep. Each mound contains a volume of straw from approximately three fields. Each mound is round, with a diameter of *c.* 3.5 to 4 m (Fig. 9). It is partly subterranean (*c.* 2 m deep) and emerging from *c.* 2 m.



*Fig. 9 – ‘Storage mound’ (left) and scheme of the construction of the system (right).*



A round structure has been excavated; the chopped straw has been put inside after the harvesting period (in June-July). A layer of long straw has been placed on it to make the distinction and then a layer of mixed mud and chopped straw has been applied to cover the mound (Fig. 10). Nowadays, villagers use to put plastic sheeting between the layer of long straw and the stored chopped straw in order to protect it from the rain. But the shepherd said they used to just put a thicker layer of mud and chopped straw. Apart from these two ‘storage mounds’, the family possesses another direct straw storage room located next to the sheep pen. Once the stock is over, shepherds open one of the ‘mounds’ on its side. Thanks to these three storage places, the family can feed its 300 sheeps during one year, until the next harvesting time.



*Fig. 10 – Detail of the external layer composed by mud and chopped straw, covering the mound.*

## CRAFT ACTIVITIES

### *Sampling clay for artefact fabrication*

As mentioned, we learnt by local crafters that Kurata is famous in the region of Chamchamal for its sources of clay. It is gathered by local inhabitants and used in the making of tannur and traditional pots. We explored the site in order to locate the sources and take some sample of clay for comparative analysis with the ceramics of Logardan and Girdi Qala.

Kurata is located in a small alluvial plain east of the Tavuk Çay River (Fig. 11). The actual area between Logardan/Kurata and the Slemani-Kirkuk highway is the only one in the region not to be extensively cultivated but dedicated to sheep farming. Actually, this pattern allows the artisans to access the sources of clay. Nevertheless, some of them prefer to choose outcrops more easily reachable. On the road to Kurata, in Gulguey area, we saw several families collecting soil in clay outcrops along the highway. We also noticed that a brick factory was established just behind one of them. The marks of power shovel on the outcrop revealed that it was using this clay as raw material (Fig. 12). We took a sample to compare with the clay of the proper locality of Kurata in order to verify the composition variability of gathering points distant of several kilometers in the same alluvial plain.





*Fig. 11 – View of Kurata Village from the northeast, with the site of Logardan in the background.*



*Fig. 12 – One of the Gulguey clay deposits along the highway.*



Nowadays, the hamlet of Kurata is located at the end of a small track whose junction with the Slemani-Kirkuk highway is in front of the modern brick factory. Nevertheless, it was before connected straight to Shorsh by an ancient road passing by Logardan.



*Fig. 13 – Mud brick wall with stone foundations in Kurata hamlet.*

The hamlet is composed of three farmhouses, which are mostly constructed with mud bricks walls, sometimes plastered, resting on stone foundations (Fig. 13). The local farmers don't make mud brick anymore but prefer cement bricks. However, many mudbrick walls are still standing and have probably been maintain for several decades. We could notice numerous clay outcrops on the plateau and they showed us three sampling sources: for tannur and pottery fabrication as well as for mudbricks.



*Fig. 14 – Sampled Kurata's clay outcrops, for tannur and pottery fabrication (left) and for mud bricks (right).*



The clay outcrop used for tannur and pottery is just outside the hamlet. It presents a very red and fine clay (Fig. 14, left). The clay outcrop for bricks is in the work area of the hamlet. The composition of the soil is very different: coarser, with big stone inclusions, which make it harder to work but more resistant (Fig. 14, right).

Close to the brick clay, we found gypsum outcrops used by the farmers for plaster fabrication. The gypsum is collected and placed in a big circular structure made of stones, open and half-buried (Fig. 15). It is sprayed with petrol, covered with soil and burnt intensely for several hours. After the cooling of the kiln, a very fine and white plaster is collected to be used on the farm walls or sold in Shorsh market. It is interesting to note that gypsum has also been found in some kilns of Logardan.



*Fig. 15 – Gypsum kiln of Kurata.*

Today, clay crafting is becoming increasingly rare as pottery is replaced by plastic, mud bricks by cement bricks and traditional tannur by oil barrel. Besides, some traces of those ancient activities remain and stand as the indicator of practices and technology integrated in the *longue durée*. Indeed, Kurata area appears as an important source of raw material for craft activities. The quality of some clay outcrops as well as its proximity (and ancient road connection) with the archaeological site of Logardan suggest that it may have been used by the potters of the 3<sup>rd</sup> and 2<sup>nd</sup> millennium BC workshops and could have been one of the motivations of their installation on the site. Future comparative chemical analyzes may help support this hypothesis.



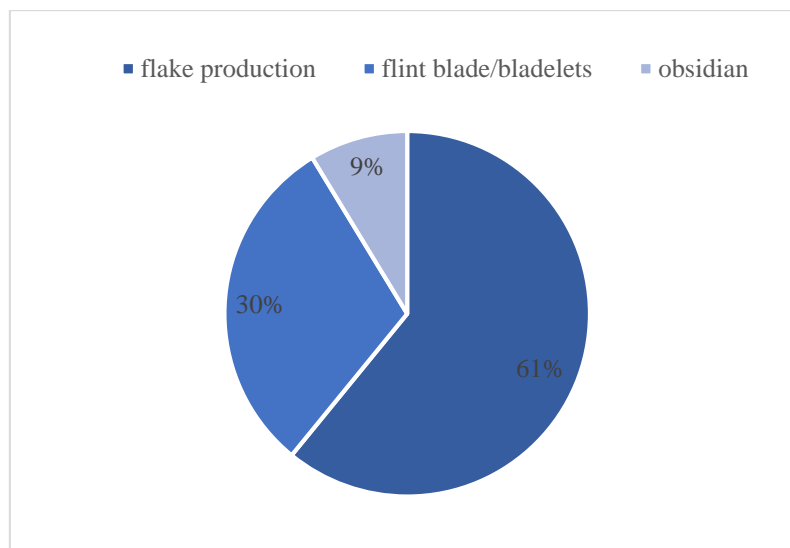
# THE LITHIC ASSEMBLAGES OF GIRDI QALA AND LOGARDAN: PRELIMINARY OBSERVATIONS

Francesca Manclossi

**D**uring the 2019 campaign, the chipped stone collections recorded in 2016 and 2018 at Girdi Qala Trench D and Logardan Trench D were the subject of a detailed analysis. The aim of the study, which will continue in the next years, is to offer a better understanding of an important component of 4<sup>th</sup> -3<sup>rd</sup> millennia BCE archaeological records. Traditionally considered as a heritage of prehistoric times and poorly considered, protohistoric chipped stone tools can offer important insights on aspects not available from other realms of the material culture.

## GIRDI QALA NORTH MOUND (TRENCH D)

The chipped stone collection from Girdi Qala Trench D counts 253 artifacts, which, according to the stratigraphy of the mound, are dated to the Middle Uruk (LC3-early LC 4). Even if the assemblage is quite small, its precise chronological horizon represents a good case study for a first characterization of the lithic industries that, for the period, are still poorly known.



*Fig. 1 – The composition of the lithic assemblage of Girdi Qala Trench D.*

The chipped stone assemblage can be divided in three main components (Fig. 1). Quantitatively, the better represented is a simple flake-oriented industry, the second is a production of flint blade/bladelets, while the third is a characterized by obsidian artifacts. Beside techno-typological differences, each industry reflects a specific socioeconomic structure, which can offer important information of the organization of ancient societies.



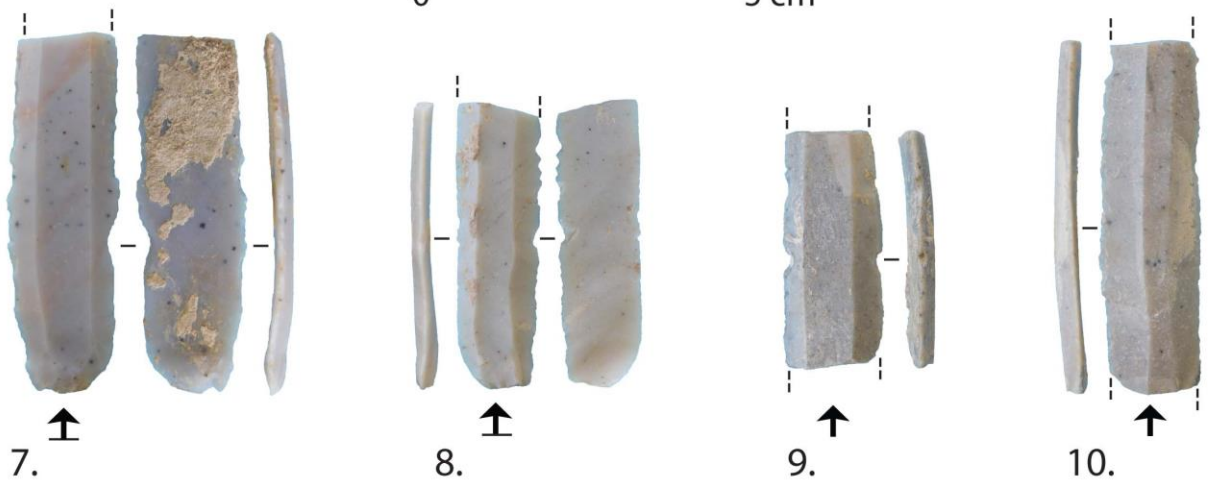
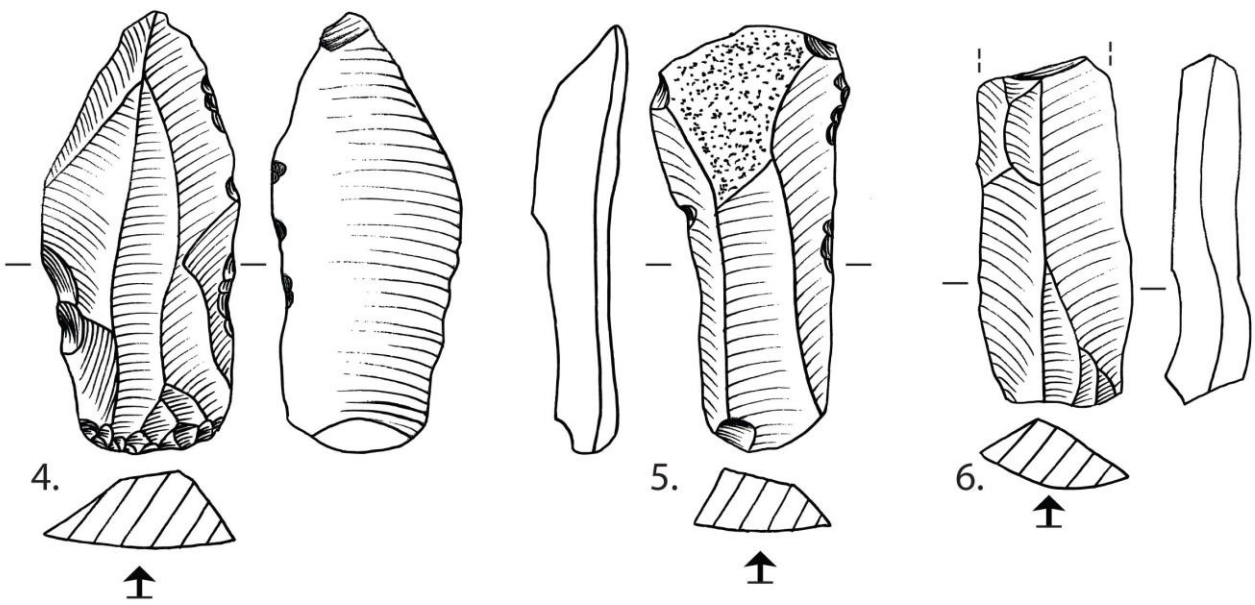
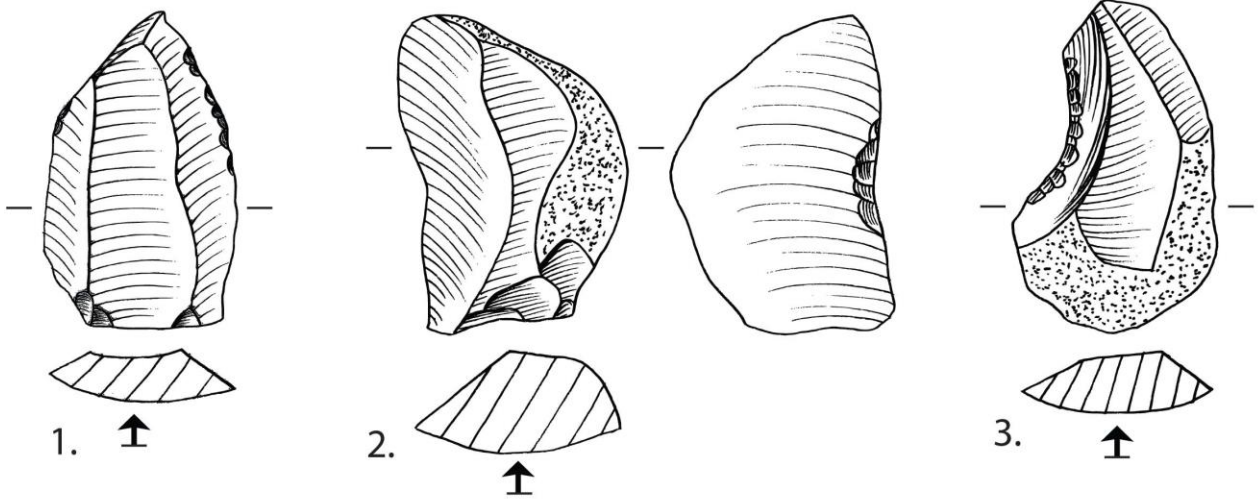


Plate I

### *The flake industry*

Non-diagnostic ad hoc tools characterize the dominant component of the lithic assemblage (Pl. I: 1-3). This industry exhibits all the stages of the chaîne opératoire which tools, debitage, waste, and cores (Table 1).

**Table 1.** Composition of the ad hoc industry

	<i>N</i>	<i>%</i>
<i>Core</i>	5	3.3
<i>Waste</i>	77	50.7
<i>Core-trimming element (CTE)</i>	2	1.3
<i>Un-retouched flake</i>	41	27
<i>Retouched flake</i>	27	17.8
<i>Total</i>	152	100.0

As indicated by the presence of damaged cortex, un-standardized flakes were manufactured by exploiting river cobbles of medium-small size. Given the use of secondary deposits, it is not surprising that raw materials are heterogeneous and vary from fine-grained translucent flint to a less fine-grained brown/grey, and to coarser and multi-colored materials: grey, white, beige and brown, light or dark. The analysis of the texture of the ad hoc products and cores shows a clear dominance of fine/medium-grained flint, and coarse-grained flint is very rare. This suggests that not all the available cobbles were collected, but only the flint with texture appropriate to knapping was selected as raw material. Nevertheless, a fine/medium-grained texture does not automatically mean good quality, and other elements such as fissures, cracks, and inclusions may compromise production. The high frequency of internal irregularities may indicate that the selection of raw material was not strictly limited to specific materials and that the inner homogeneity of the flint was not considered necessary to obtain the desired products and tools.

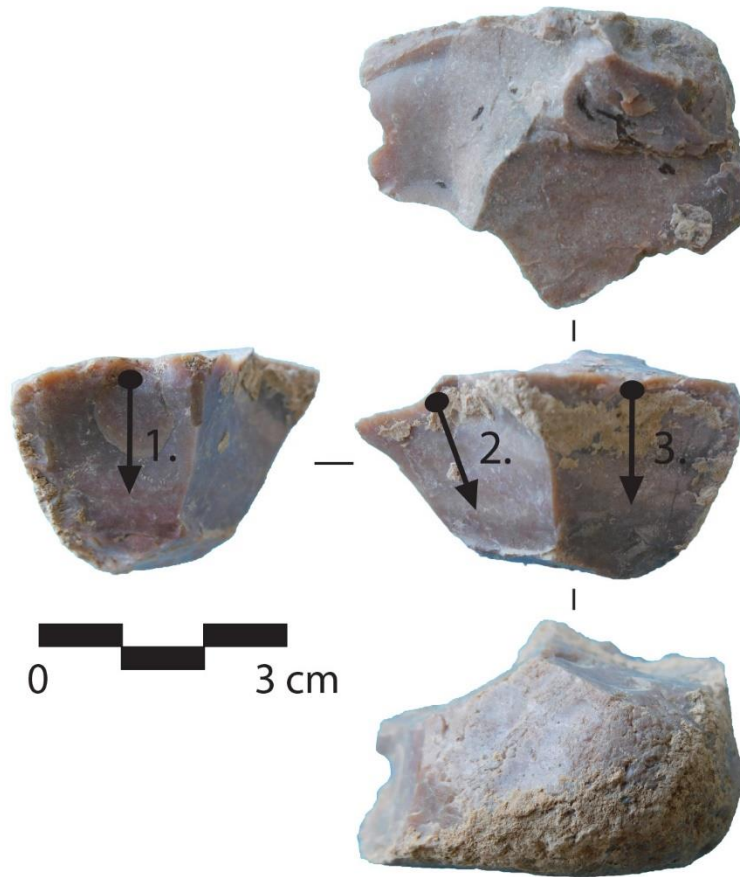
The cores show only minimal technological investment, as indicated by the presence of only two flakes clearly detached with the intent to remove highly hinged surfaces. The detachment of blanks was conducted after the creation of a simple striking platform, or directly from cortical surfaces, without other adjustments. The same conclusions are supported by the analysis of all detached flakes, unmodified and retouched, which have plain or cortical butts. The observation of preserved proximal ends permits identification of several attributes, which indicate the use of the direct percussion technique. The big platforms, the pronounced bulbs and the well-marked impact points inside the striking platform suggest the utilization of hard stone hammers. The elevated incidence of flaking mistakes, notably hinged fractures, indicates poor control of the force exerted for detaching the flakes, and it is another clue indicating the use of generally unskilled hard hammer direct percussion.

Despite the simple technology, it is possible to recognize some recurrent patterns in the organization of the reduction sequence. The direction of the negatives visible on the cores, the dorsal patterns of all flaked products, and their relation with the knapping axis indicate that flakes are detached in short series of contiguous removals sharing the same striking platform (Fig. 2).

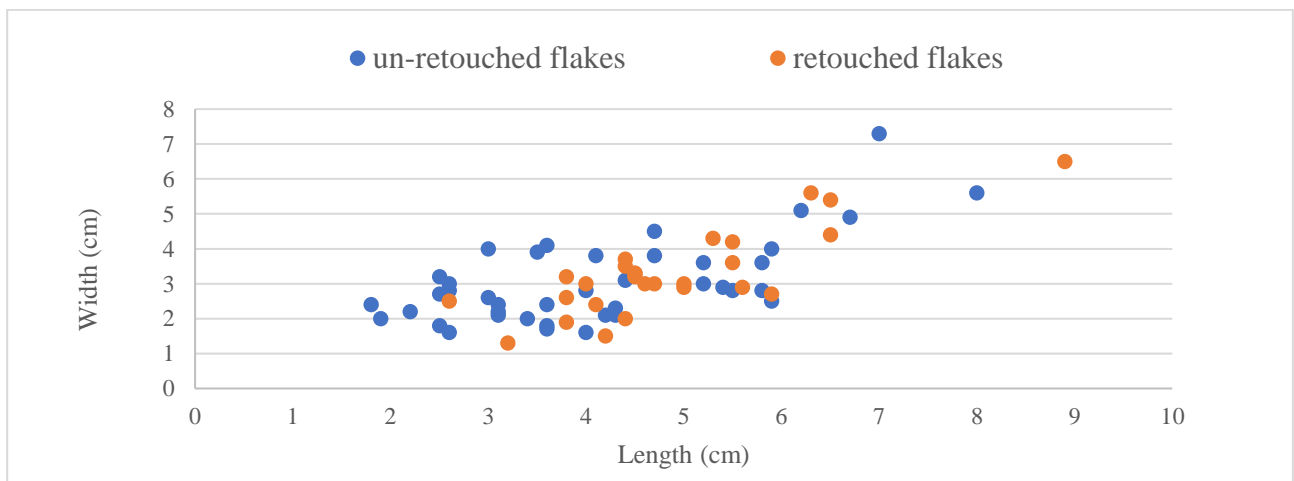
Once one sequence is completed, the block of flint seems to be regarded as a new core and the knapping continues with a new series on the surface where the technical criteria permit detachment of new flakes, generally without previous modifications. The majority of the flakes have unidirectional dorsal scars, usually aligned with the knapping axis. This seems to suggest that most of the series present on the cores were completely independent between them. The presence of unidirectional, perpendicular and multidirectional dorsal patterns, however, indicates that in several cases, subsequent series could share the same knapping surface. These other patterns are often associated with hinged fractures or



irregularities in the flint that do not allow continuation of the sequence, and require changing the striking platforms.



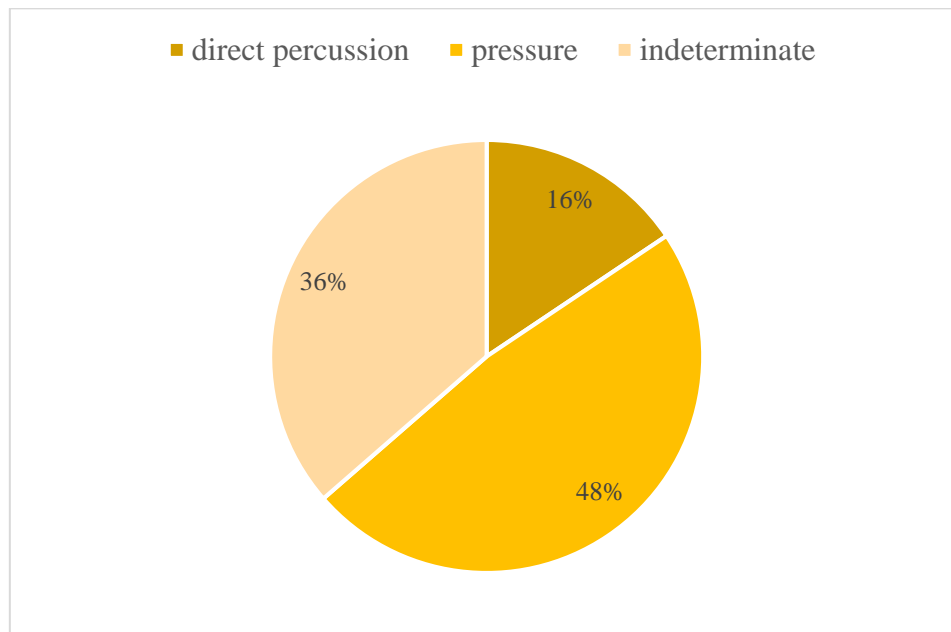
*Fig. 2 – Ad hoc core made on a small pebble.*



Among the retouched flakes, only a few items can be classified following typological lists as scrapers (N=5) and notches (N=3). Most of the tools, indeed, show simple retouch varying in delineation, extent, distribution and position, and they can be defined only as retouched flakes. In general, the retouch did not significantly modify the original blanks, and it is present on the more suitable edges that required little transformations. For example, the cortical lateral edges and plunging terminations are rarely retouched. In contrast, natural sharp edges or portions of them were commonly modified. The tool category counts only the artifacts showing intentional retouch that creates specific shapes and edge delineations, and does not include unmodified flakes that, although used, do not show retouch (e.g., Bailly 2006). The high percentage of flakes without intentional retouch might indicate that this group composed the majority of flakes effectively used. As suggested in other studies, the retouch was not the first intent of the knapper producing ad hoc tools; it was employed only when necessary to create suitable edges if they were not automatically created in the production of blanks (Manicacci and Rosen 2019a).

### *The blade/bladelet industry*

The second component of the lithic assemblage is composed by blades/ bladelets, which, according to their technological features can be divided in two main groups: (1) regular blades produced by pressure, and (2) irregular blades produced by direct percussion. In many cases, however, the knapping technique used for detaching regular blades is not well recognizable, especially for the shortest segments, and they might be detached either by pressure or by indirect percussion (Fig. 4).



*Fig. 3 – Technological composition of the blade/bladelet industry.*

With regard to the raw materials, blades/bladelets are usually made on fine-grained and homogeneous flint, which differs from that used in the production of ad hoc tools. Different varieties seem to have been exploited, but among the flint used for pressured-blade/ bladelets it is possible to recognize a characteristic light grey-colored chert with small dark inclusions, which do not alter the high quality of the flint.

Blades/bladelets detached by pressure (N= 41) can be recognized by their parallel edges and regular dorsal ridges, which in many cases are perfectly rectilinear; their profiles are almost straight, except for the curved and sharp distal end, and their sections are relatively thin (Pl. I: 7-10; Pl. II: 1-3).



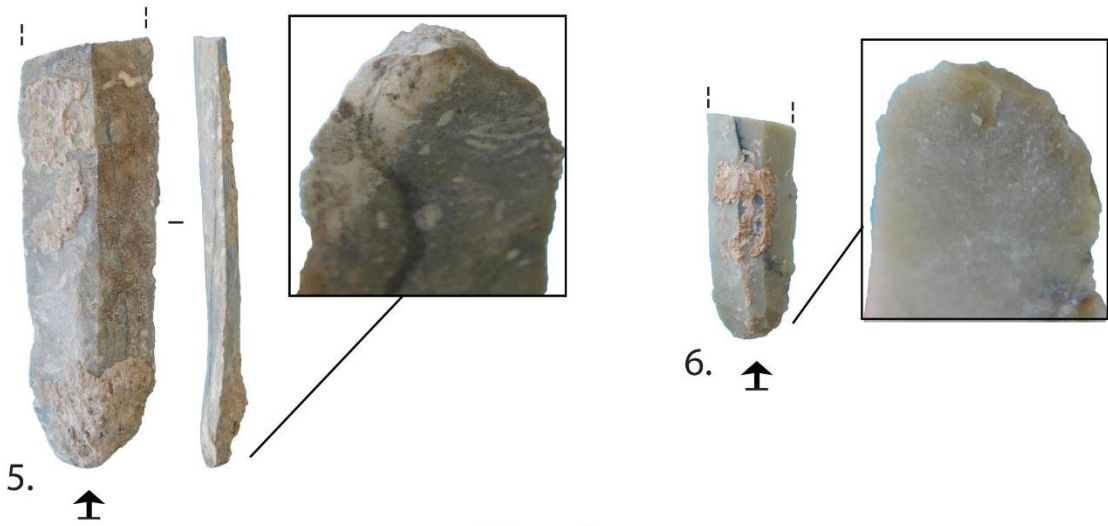
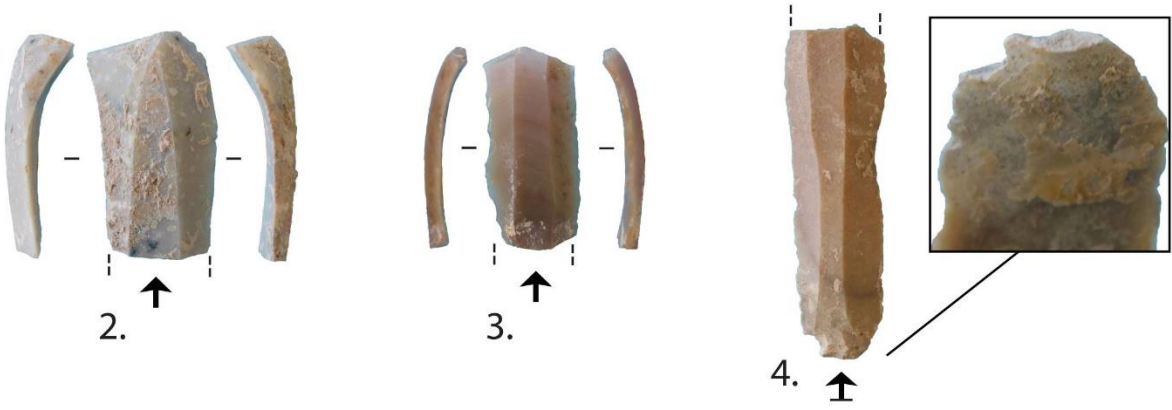
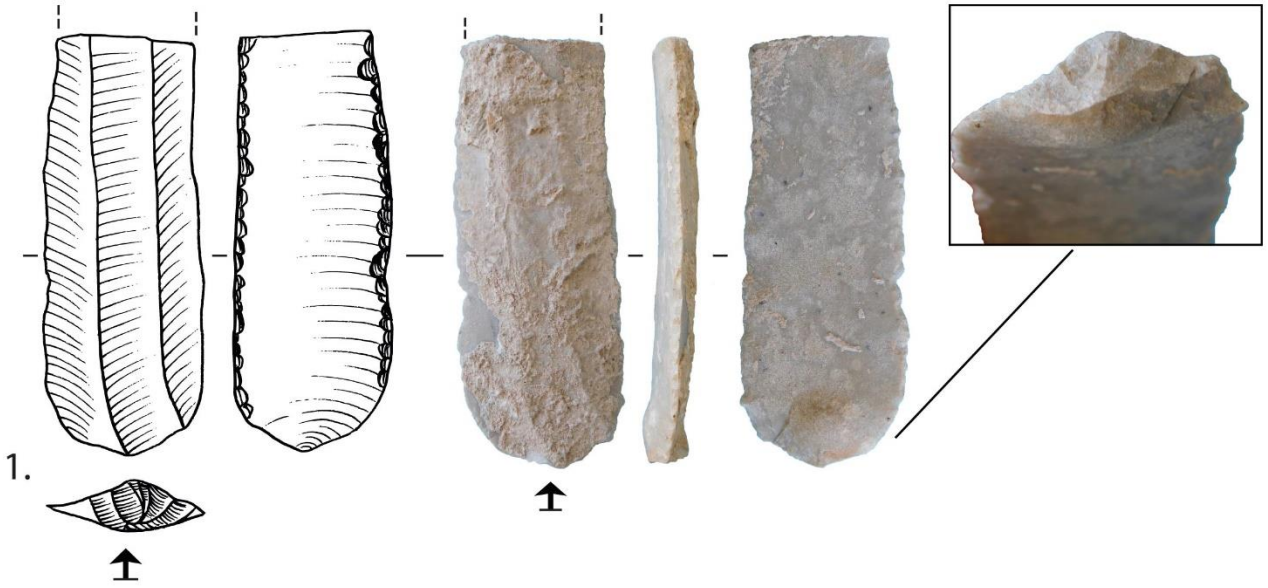
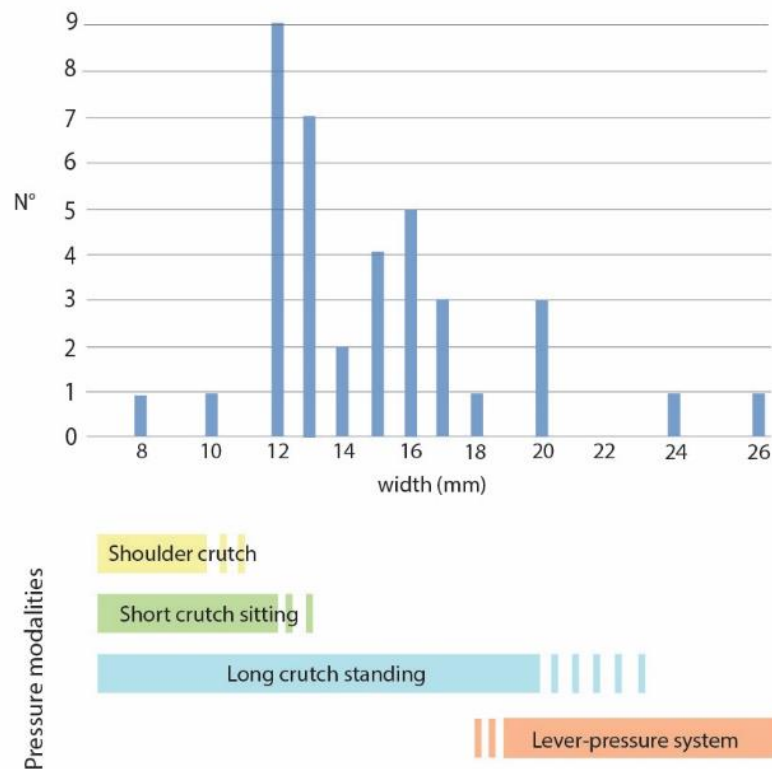


Plate II

In addition to the morphological parameters, some technical attributes (such as the platform preparation and features determined by the detachment process itself) can also be used as arguments for the recognition of the pressure technique and especially for the identification of the pressure stick (Pelegrin 2006). Examining the nine proximal ends recovered in the collection, bulbs are thick, high and short. The butts are small, plain (N=7) or punctiform (N=1). The platform is usually prepared through delicate abrasion, but in one case it is possible to recognize a faceting (Pl. II: 1). The presence of lipped-butts (N= 3) suggests the use of antler pressure sticks (Pl. II: 4-5). In one case, however, a marked crack on the bulb seems to indicate that copper points could be employed (Pl. II: 6). Blades/bladelets have usually a trapezoidal cross-section (ca. 88.9%) although in some cases it is triangular.

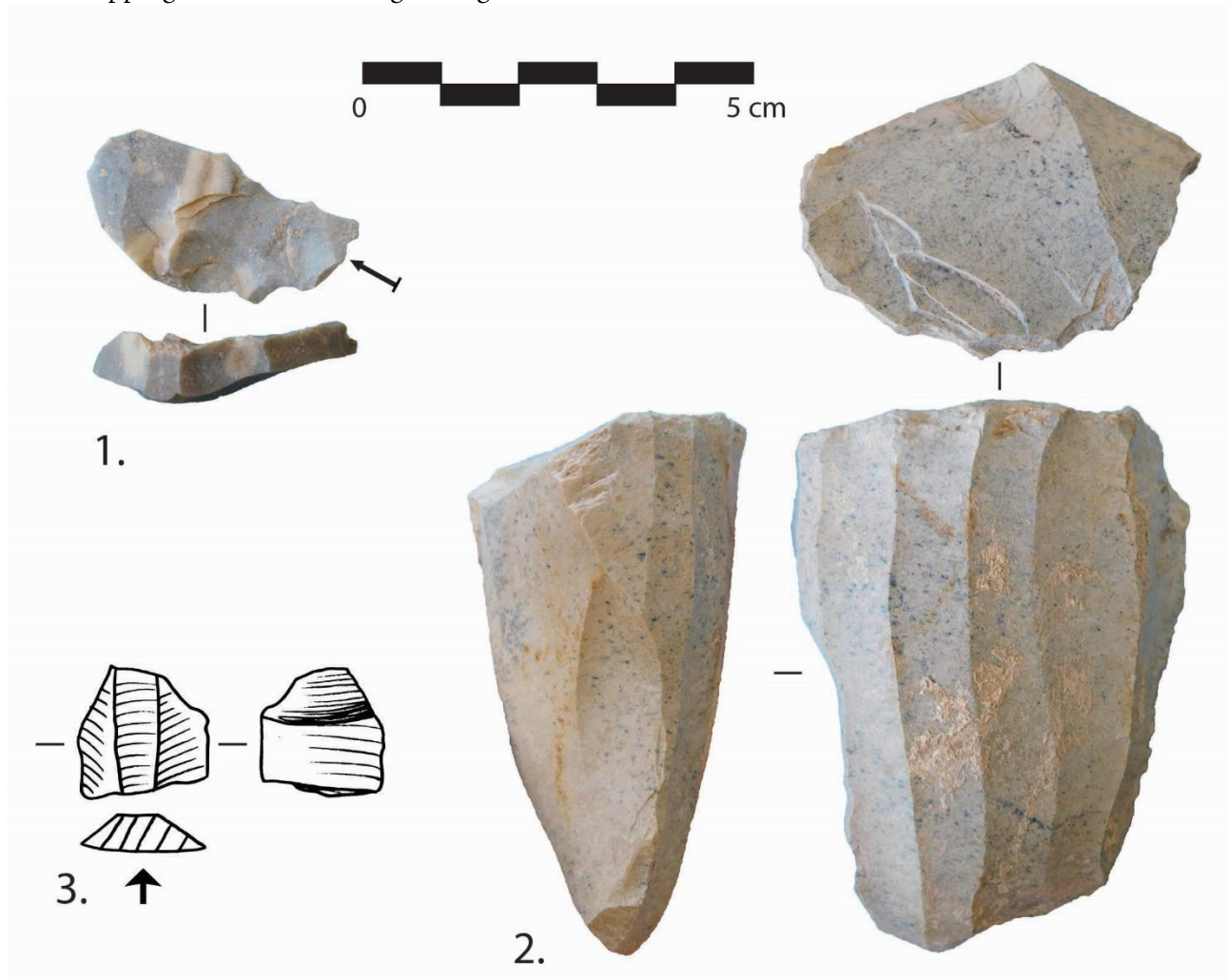


*Fig. 5 – Pressure modalities for blade/ bladelet production.*

Metric analysis can be only partial because of the high frequency of breakage: 46% of the blades are mesial segments with both the extremities fractured (average  $L= 4\pm 1.5$  cm,  $W= 2.4\pm 1.3$ cm,  $T= 0.8\pm 0.6$  cm), 31% are proximal segments (average  $L= 4.1\pm 1.5$  cm,  $W= 2.4\pm 1.2$  cm,  $T= 0.9\pm 0.6$  cm), while 21% are distal fragments (average  $L= 3.3\pm 1.1$  cm,  $W= 1.5\pm 0.3$  cm,  $T= 0.4\pm 0.2$ cm). Nevertheless, width frequency informs us about the pressure modes employed for the detachment of blades (Fig. 5). Their width comprised between 8 and 25 mm suggests that at least two different modalities were used, the pressure with long crutch in a standing position and the lever-pressure system, the last one necessary for producing blades larger than 23 mm (Pelegrin 2012). The presence of narrow blades/bladelets, however, does not permit to exclude that simpler pressure modalities, such as those exploiting short or shoulder crutches, were also in use.

In the assemblage, there is a core-tablet showing the negatives of regular and parallel detachments, which suggests that knapping activities related to the production of pressured-blades occurred on-site (Fig. 6.1). A core that, however, has been found on the surface and cannot be related to any clear archaeological context supports this hypothesis. This core has parallel and regular negatives, and the pressure technique is indicated by the orthogonal angle between the striking platform and the knapping surface that is perfectly straight, and the presence of the deep negatives corresponding to high, short and thick bulbs (Fig. 6.2). The size of the core and of its negatives well correspond to the pressure technique

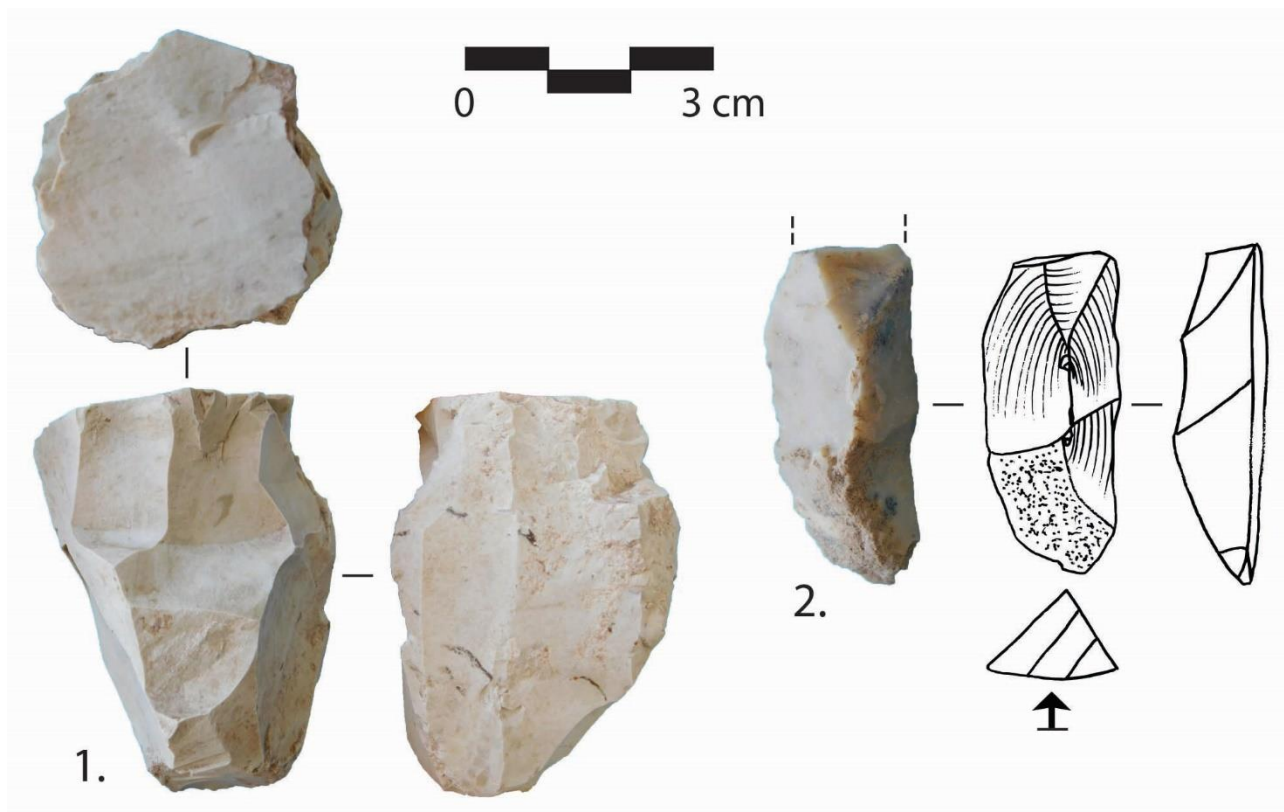
exerted with long crutches in a standing position. Finally, another element which might indicate on-site production is a blade fragment showing a typical pop out-fracture (Fig. 6.3), which is usually associated with knapping mistakes occurring during the detachment of blades (Manclossi et al. 2019).



*Fig. 6 – Diagnostic elements indicating the use of the pressure technique: 1. Core-tablet removing a portion of the striking platform and knapping surface, 2. Pyramidal core with parallel and regular nervures, 3. Pop out-fracture visible on a broken blade.*

Most of the blades of the assemblage (N= 28), however, present morphological traits which are not enough for recognizing the use of the pressure technique. These blades show sometimes more irregular edges and dorsal arris. Moreover, their profile is not always perfectly rectilinear but slightly twisted. These features might indicate the use of indirect percussion. However, as shown by experimental replications, less regular blades can be detached also using the pressure technique (Pelegrin 2006, 2012). A small group of blades (N=12) show more irregular profiles and delineations. They are the products of direct percussion and they can be considered as part of the ad hoc production that, sometimes, allows detachment of longer flakes (Pl. I: 4-5). The discovery of a few blade-cores (Fig. 7:1) on the surface of the site, however, seems to indicate that irregular blades might be the products of a specific reduction sequence specifically oriented to the production of long blanks (Pl. I: 6; Pl. III: 1-3). This hypothesis seems supported by the presence of a fragmented crested-blade (Fig. 7: 2).





*Fig. 7 – Irregular blade detached by direct percussion: 1. Blade-core, 2. Crested-blade.*

Intentional retouch and/or clear evidence of utilization are attested on 42.2 % of the blade assemblage (N=32). Typologically, these tools can be divided in two main groups: the glossy elements and the retouched blades. In the collection, there are nine glossy blades, identified by the presence of shiny luster on one or both the working edges (Pl. III: 4-6). Glossy pieces, manufactured on truncated or fragmented blades, have triangular or rectangular cross-sections. Their working edges are retouched and the retouch varies from nibble to serration. The intensity of gloss is usually low. Some of the blades preserve traces of adhesive, probably bitumen (Pl. III: 7-8), used for fixing the flint elements in the haft of composite tools. All other blade tools are simple retouched blades (N= 23). They are usually made on fractured or truncated blanks, and the edges present different types of retouch which, usually straight, vary in extent (from marginal to long), position (direct or indirect), and distribution (from partial to total). In many cases, the edges show also marginal damaged edge linked to their use.

### *The obsidian industry*

In the assemblage there are 22 obsidian artifacts, for a total weight of 43.5 g. Excluding one retouched flake (Fig. 8:1) and nine small fragments, which might suggest the presence of on-site knapping activities, the collection is composed of 12 small blades/ bladelets (Fig. 8: 2-4), most of them with visible damaged edges. All bladelets/blades have parallel edges and rectilinear dorsal ridges, their profile is perfectly straight and their sections are thin. These characters are diagnostic of the pressure technique. All the obsidian blades/ bladelets are broken at least at one extremity, allowing no detailed metric analysis of the original size. The range of width (from 6 to 17 mm) fits within different pressure modes, from the hand-held baguette to the long crutch in a standing position. Nevertheless, at this stage of the research, it is not possible to determine if and which different modalities of pressure coexisted. We cannot either rule out the possibility that all the blades/bladelets were the products of the pressure technique exerted with a short crutch in a sitting position, the narrowest and the largest blades representing the limits of this system (Pelegrin 2012).



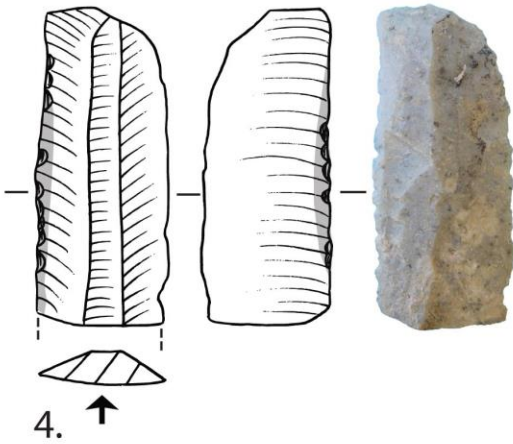
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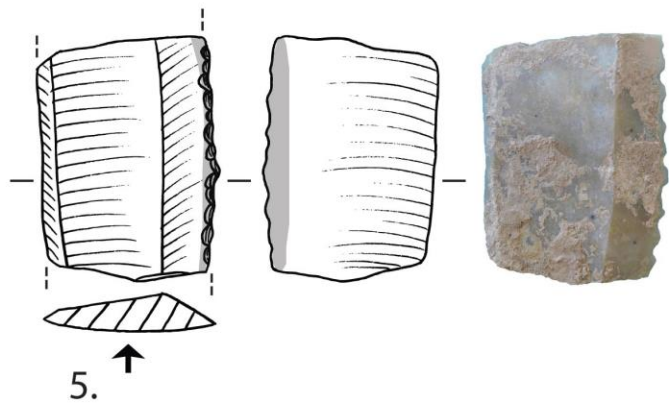
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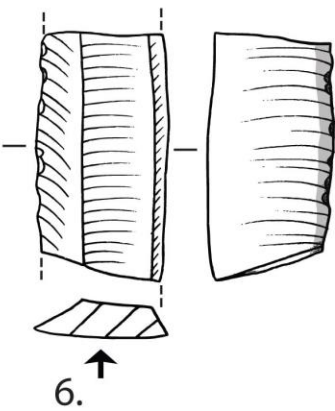
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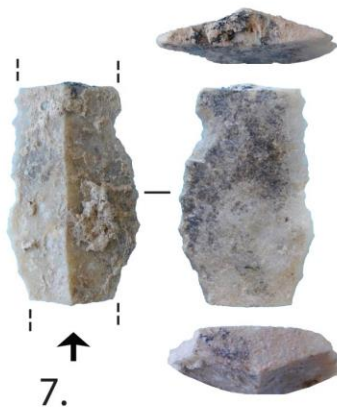
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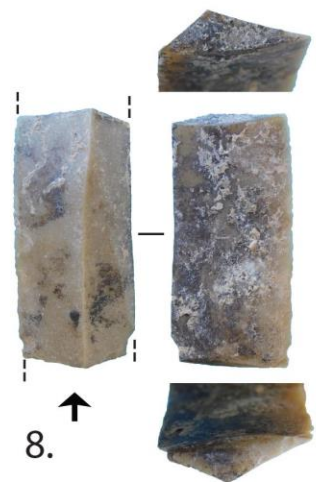
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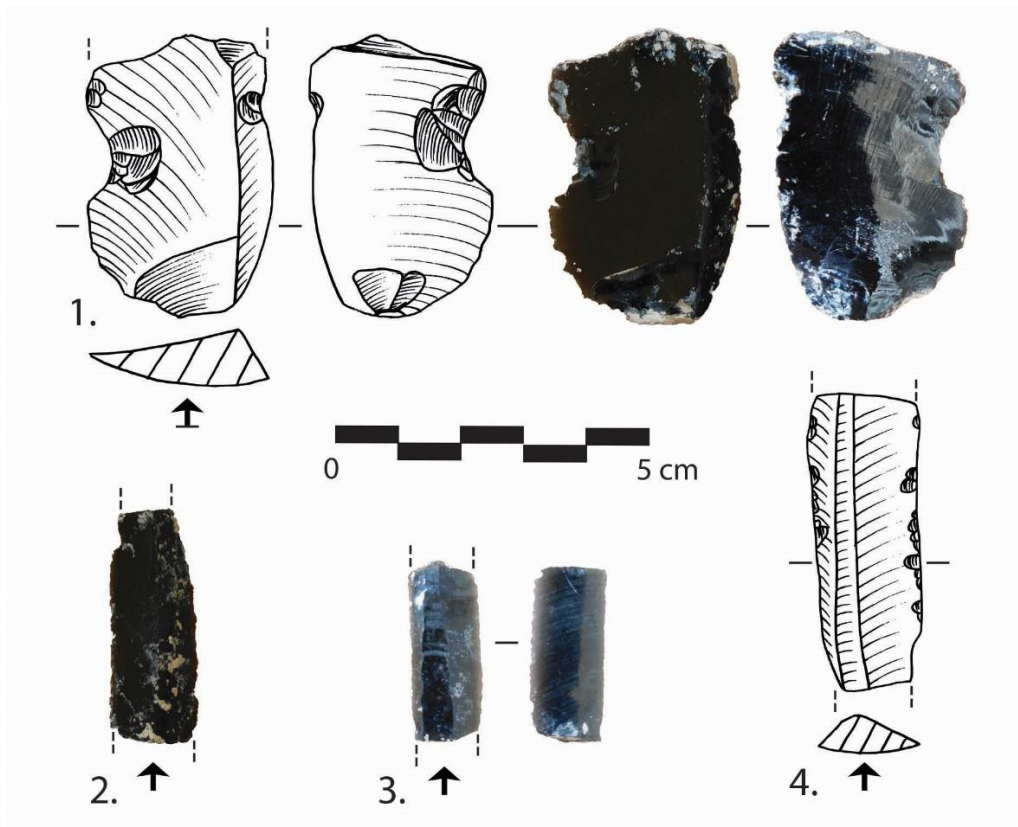


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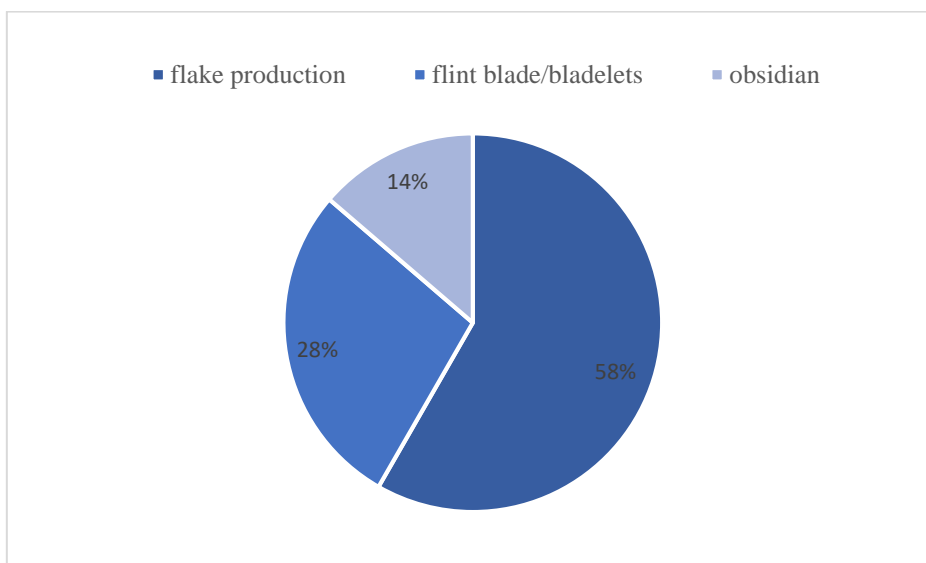
Plate III



*Fig. 8 – The obsidian industry at Girdi Qala.*

#### LOGARDAN – TRENCH D

The chipped-stone collection from Logardan Trench D is quite small and consists of 168 artifacts. Following the stratigraphy of the site, the assemblage can be ascribed from the end of the Early Uruk to the Ur III Period. Quantitatively, the most conspicuous component (ca. 70%) derives from contexts dated to the Akkadian Period (phase 3A-B). At this stage of the research, it is not possible to recognize any chronological trends that characterized the development of 4<sup>th</sup> and 3<sup>rd</sup> millennium BCE lithic industries. However, several observations can be made observing the composition of the assemblage that can be divided in three main components: (1) a simple flake-oriented industry, (2) a production of flint blade/ bladelets, and (3) obsidian artifacts (Fig. 9).



*Fig. 9 – The composition of the lithic assemblage of Logardan Trench D.*



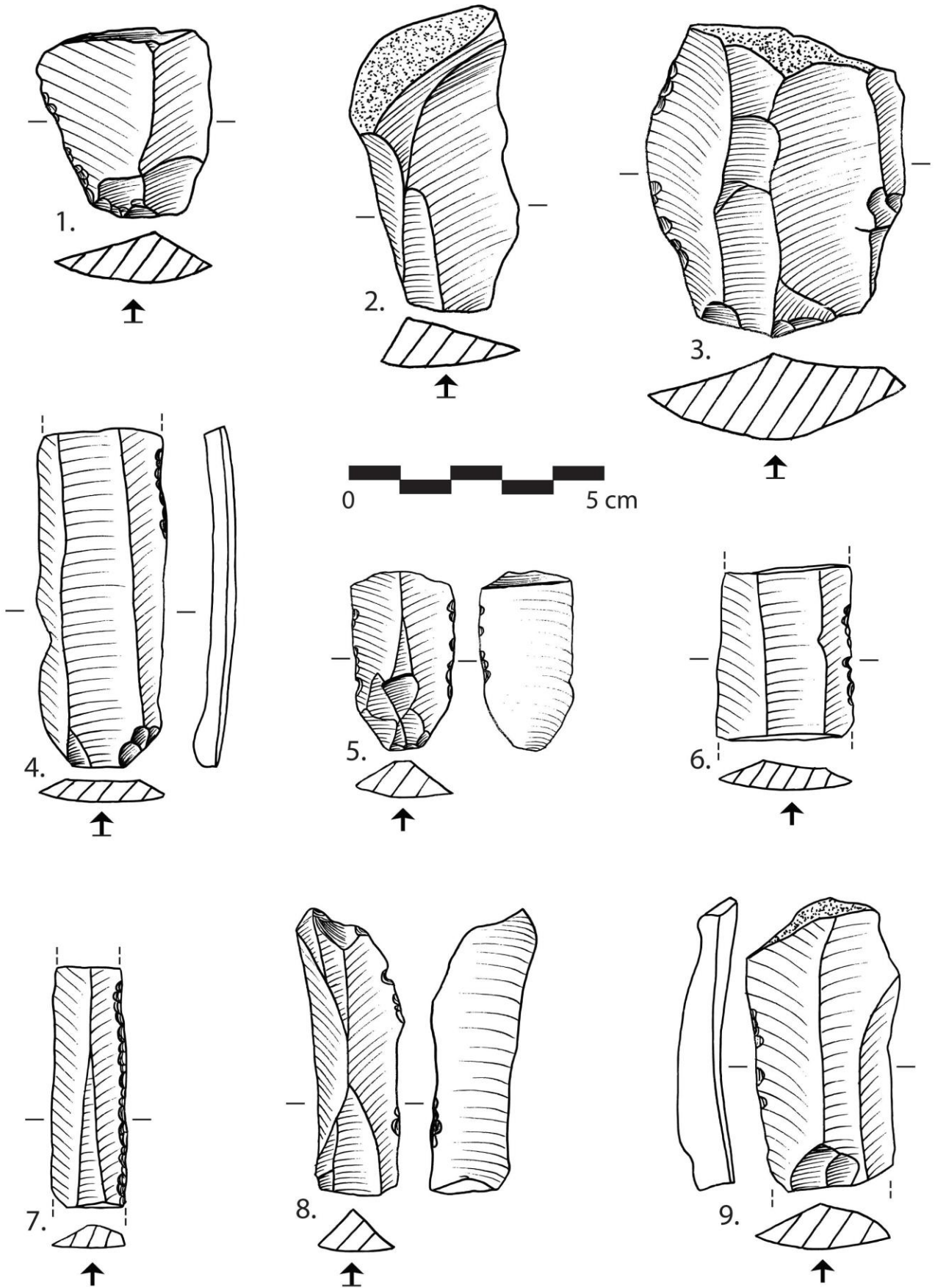


Plate IV

### *The flake industry*

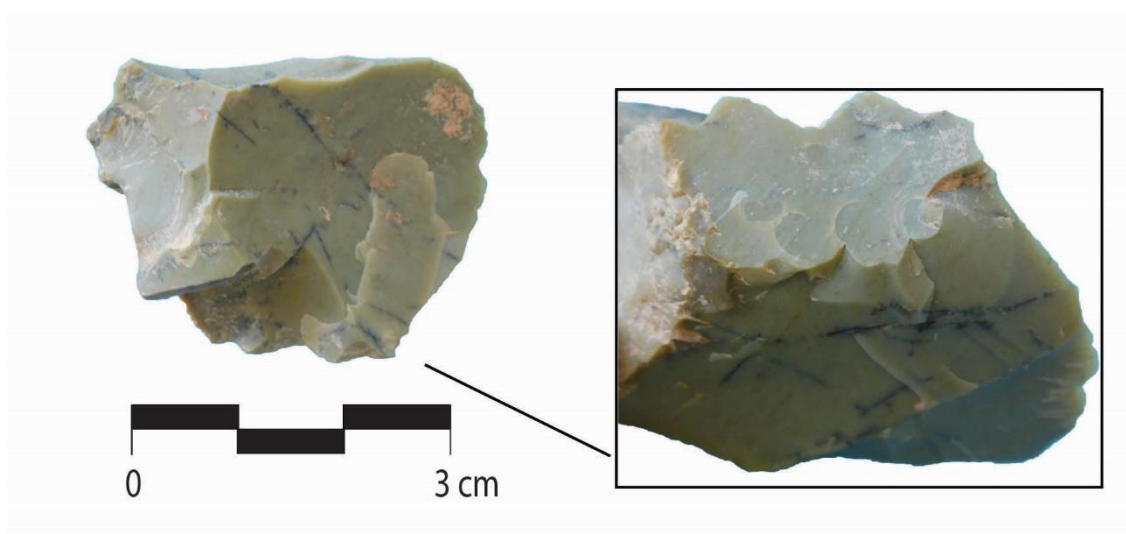
The dominant component of the lithic assemblage is characterized by non-diagnostic ad hoc tools (Pl. IV: 1-3) which exhibit all the stages of their chaîne opératoire (Table 2).

**Table 2.** Composition of the ad hoc industry

	<i>N</i>	<i>%</i>
<i>Core</i>	3	3.1
<i>Waste</i>	46	46.9
<i>Un-retouched flake</i>	29	29.6
<i>Retouched flake</i>	20	20.4
<i>Total</i>	98	100.0

Local river cobbles of medium-small size, easily available in proximity of the site, were used for detaching irregular blanks. Fine/medium-grained flint was preferred (ca. 95 %), and coarse-grained flint is rare; only one artefact made on limestone have been identified.

Flakes were produced by using a simple technology requiring little investment. The utilization of hard stone hammers, often not well mastered, is indicated by large platforms and pronounced bulbs, and the presence of marked impact points inside the striking platform (Fig. 10).



**Fig. 10** – Flake showing the marked impact point typical of poor control in knapping by using the direct percussion.

Flakes are small/ medium size, and average dimensions are  $4.2 \pm 1.4$  cm in length,  $3.1 \pm 0.9$  cm in width, and  $1.1 \pm 0.5$  cm in thickness. The examination of the dimensions of blanks and tools suggests that the size did not affected the selection of flakes subsequently retouched (Fig. 11).

Among the retouched flakes, there are scrapers (N=2), notches (N=1), and denticulates (N=1). Most of the tools, however cannot be classified following typological list, but are simple retouched flakes with retouch varying in delineation, extent, distribution and position.

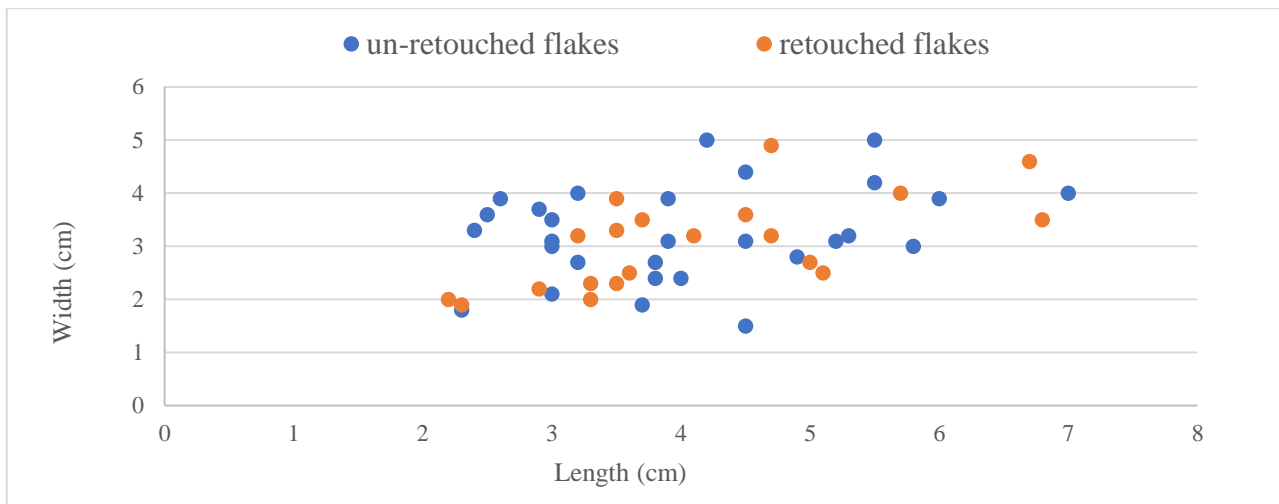


Fig. 11 – Ad hoc blank and tool size.

### The blad/bladelet industry

The second component of the lithic assemblage is composed by blades/bladelets, which, according to their technological features can be divided in three main groups: (1) blades produced by pressure, (2) blade produced by indirect percussion, and (3) blades detached by using the direct percussion. The fragmentary nature of the collections, which counts many broken pieces, does not always permit to distinguish between the different groups (Fig. 12). With regard to the raw materials, blades/bladelets are usually made on fine-grained flint. Different varieties seem to have been used, but available data do not permit any correlation between the type of flint and the knapping techniques.

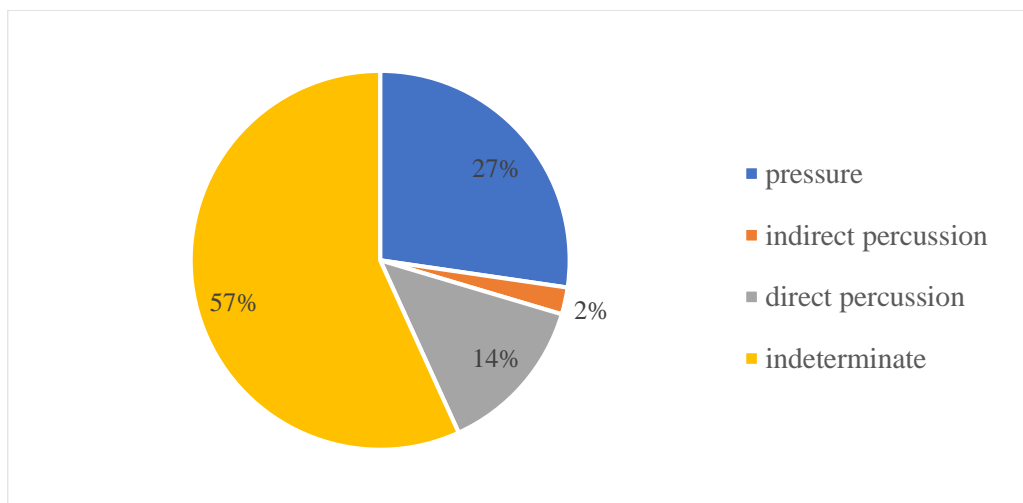


Fig. 12 – Technological composition of the blade/bladelet industry.

Blades/bladelets detached by pressure (N= 12) can be recognized by their parallel edges and regular dorsal ridges, which in many cases are perfectly rectilinear. Their profiles are almost straight, except for the curved distal end; and their sections are relatively thin (Pl. IV: 4-7, Pl. V: 1). These features are diagnostic for the pressure technique and both direct and indirect percussion can be ruled out. The bulbs are thick, high and short, the butts are smaller than the bodies (usually punctiform), and they are often prepared through small and delicate abrasion. The presence of lipped-butts (N= 2) suggests the use of antler pressure sticks. In one case, however, a marked crack on the bulb seems to indicate that copper points could be employed.



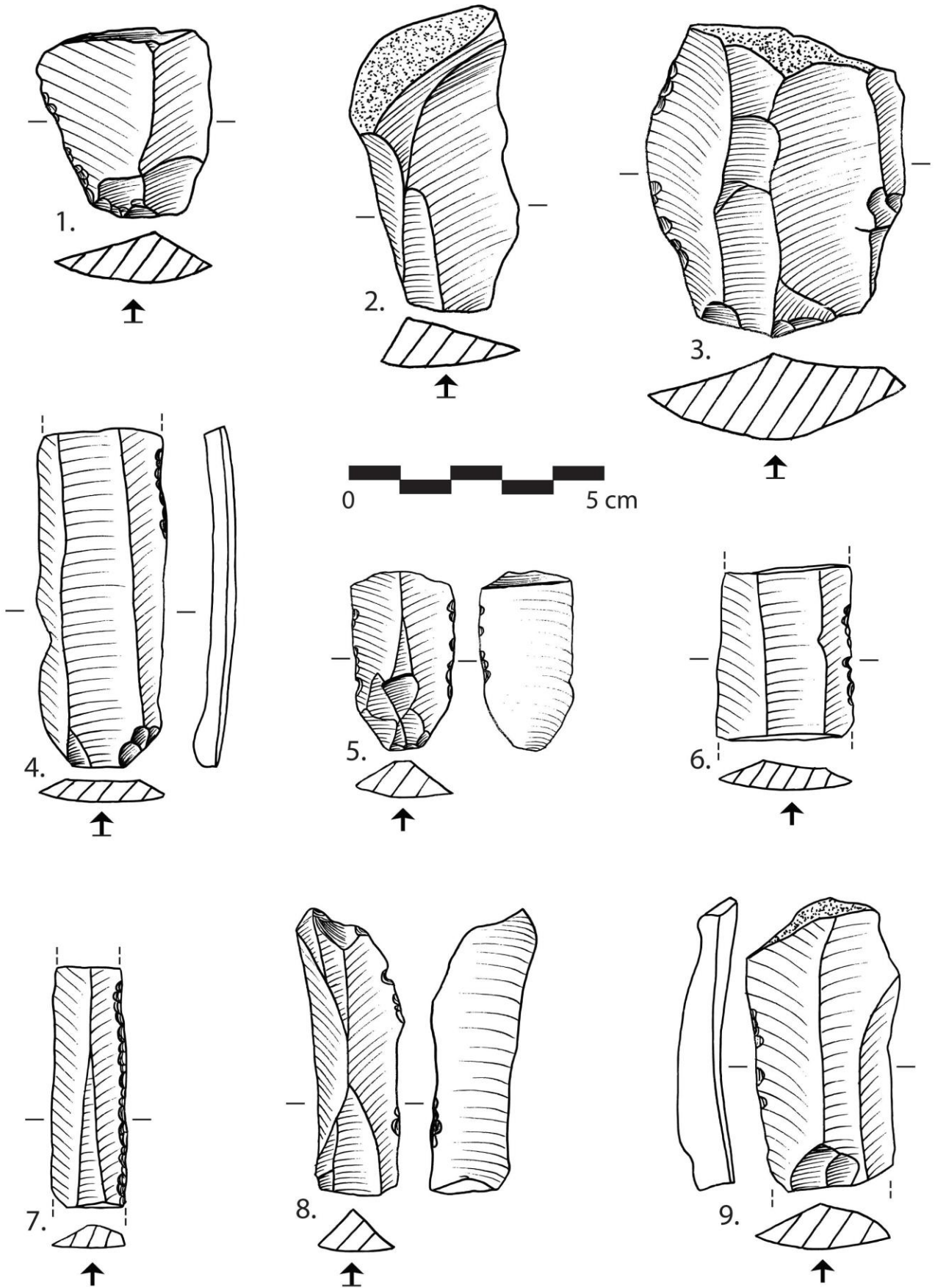


Plate IV

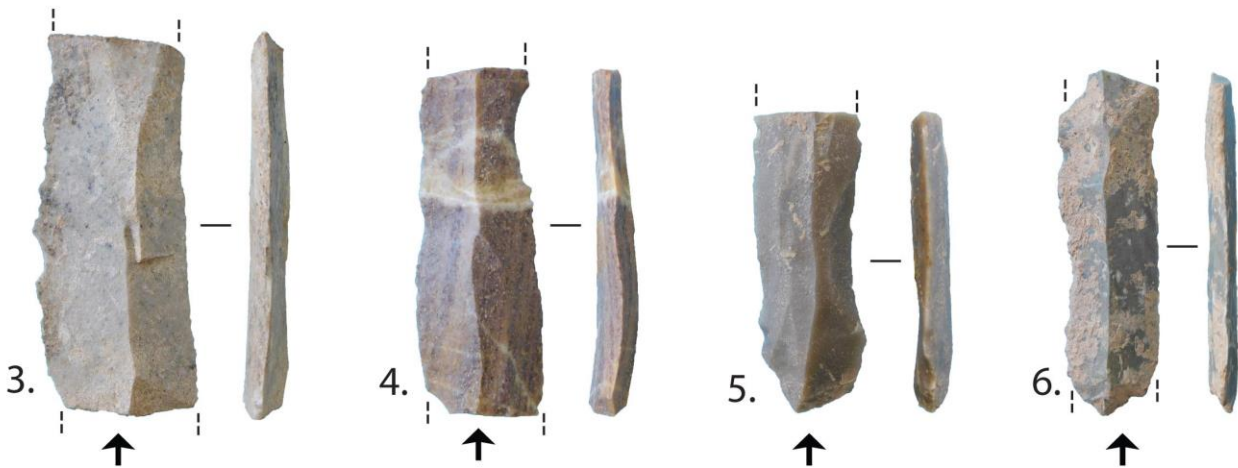
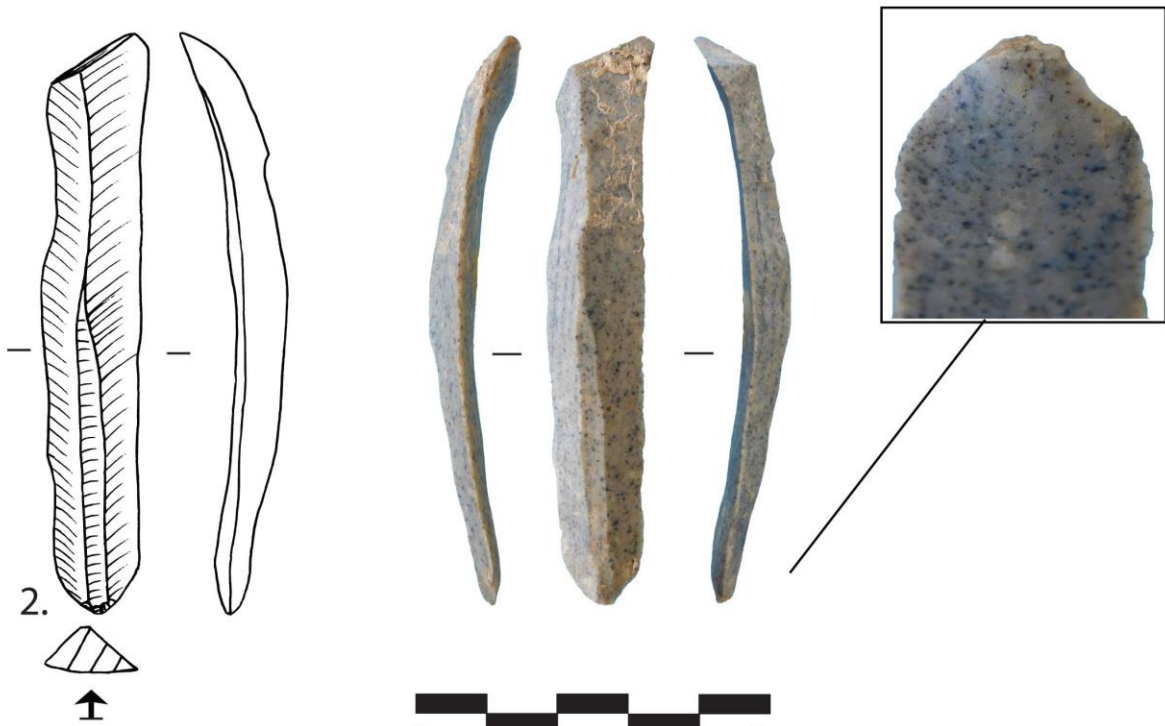
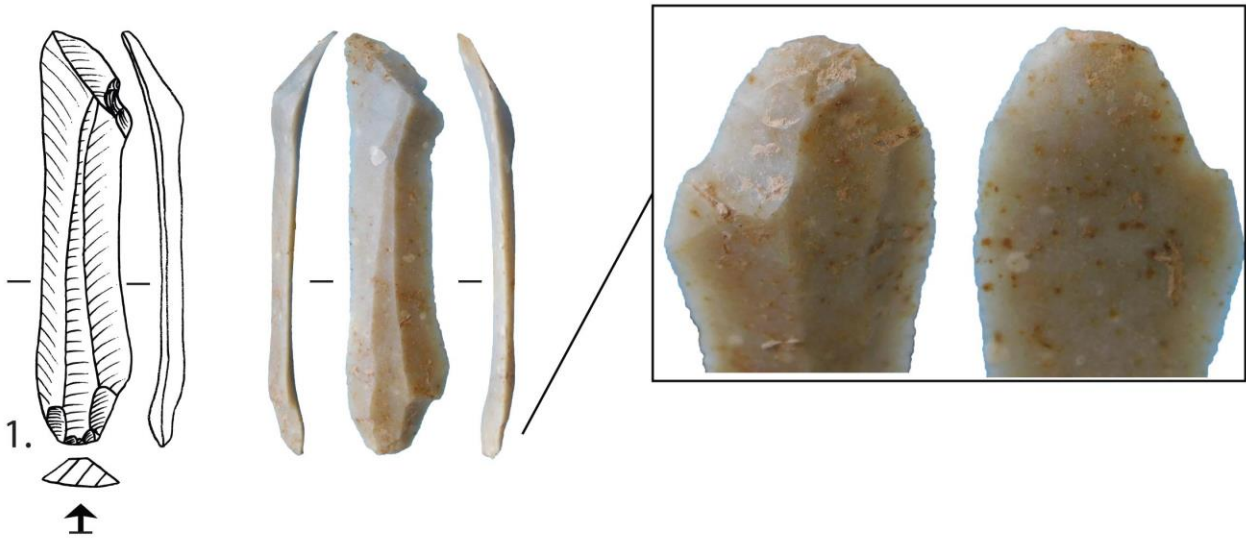
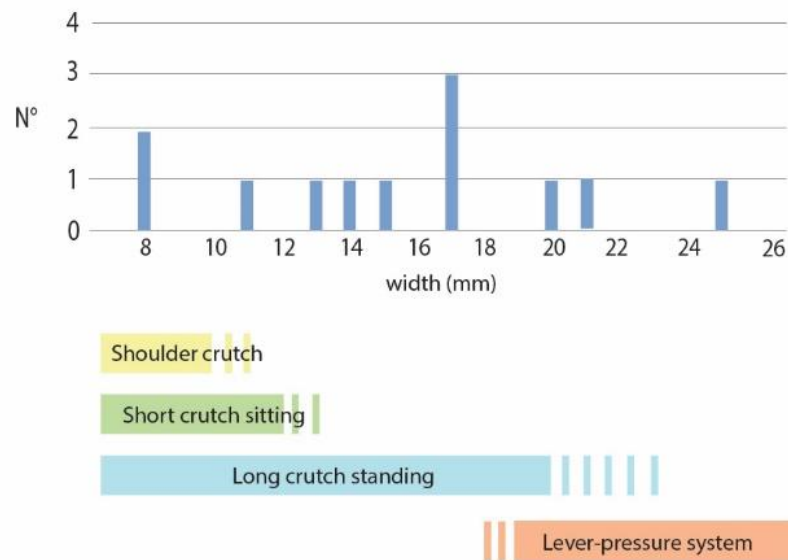


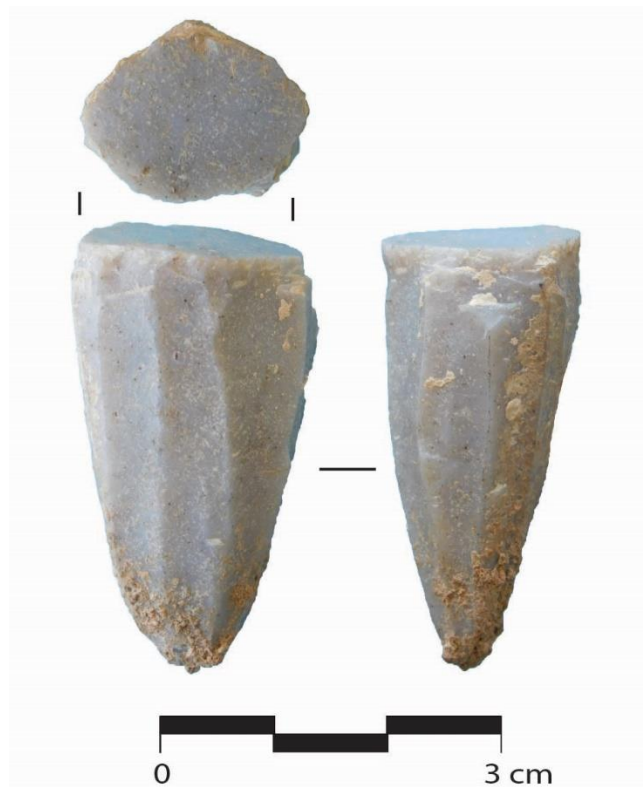
Plate V



*Fig. 13 – Pressure modalities for blade/bladelet production.*

Metric analysis can be only partial because of the high frequency of breakage (see below). Width frequency, however, informs us about the pressure modes employed for the detachment of blades (Fig. 13). Their width comprised between 8 and 25 mm suggests that at least two different modalities were used, the pressure with long crutch in a standing position and the lever-pressure system. The presence of narrow blades/bladelets (Pl. VI: 1-4), however, does not permit to exclude that simpler pressure modalities were also in use.

This possibility is supported by the discovery of an exhausted conical core exploited for the detachment of bladelets (Fig. 14). The size of the removals visible on the knapping surface indicates that pressure technique was exerted by using an abdominal short crutch, after the abrasion of the striking platform.



*Fig. 14 – Bladelet-core indicating the use of the pressure technique.*



The majority of the blades of the assemblage (N= 25), however, present morphological traits which are not enough for recognizing the use of the pressure technique. These blades show sometimes more irregular edges and dorsal arris. Moreover, their profile is not rectilinear but slightly twisted. These features might indicate the use of indirect percussion (Pl. V: 3-6). In the assemblage there is only one blade showing morphological features that match with those characterizing the use of the indirect percussion. This blade, which is one of the few complete blanks, has a curved profile that is not compatible with the pressure technique. It has a small, plain lipped-butts which suggests the use of antler point (Pl. V: 2). Finally, a small group of blades (N=6) show more irregular profiles and delineations. They are the products of direct percussion and they can be considered as part of the ad hoc production (Pl. IV: 8-9).

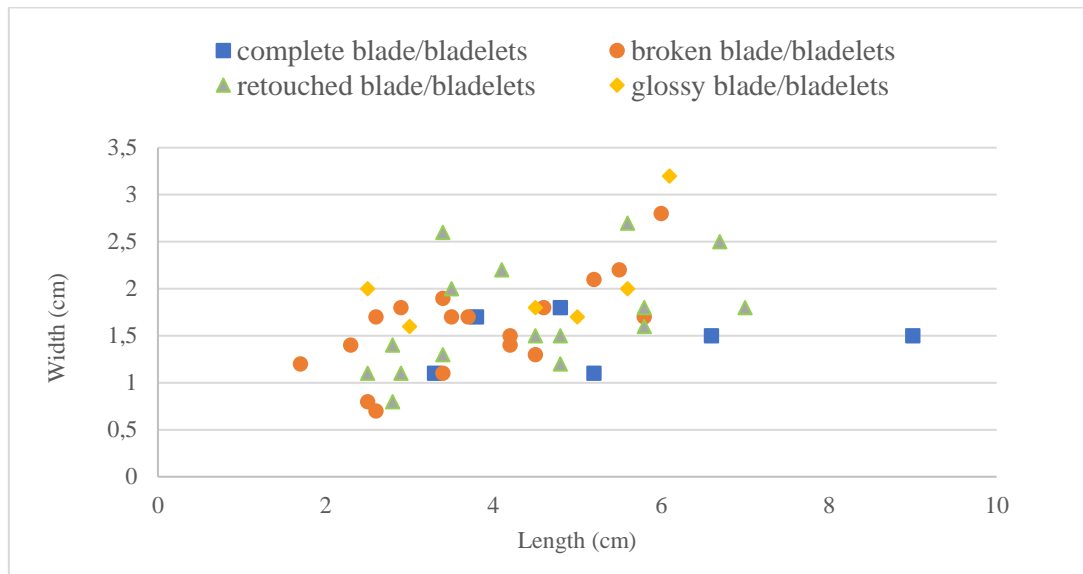


Fig. 15 – Blade/bladelets size.

With respect to the size of the blades, blanks and tools are characterized by a high incidence of fractures. Although the possibility of knapping mistakes cannot be ruled out (see Manclossi et al. 2019), not only the number of broken extremities, but also the features of the fracture themselves, suggest the intentional nature of the breakage. These broken extremities are usually rectilinear with an orthogonal angle between both the faces and the fractured surface (see Manclossi et al. 2016). The few complete blade/bladelets, which preserve both their proximal and distal natural extremities (N= 6), indicate that the original size of the blanks could change, and it probably deepened on the knapping strategy adopted and on the core dimensions. The length of segmented blanks and tools is comprised between 2 and 7 cm, and there is a marked overlap between unretouched, retouched and glossy blade/bladelets (Fig. 15). The only recognizable trend is a selection of larger blanks for the manufacture of glossy tools.

Typologically, blades can be divided in two main groups: the glossy elements and the retouched blades. In the assemblage, there are six glossy blades (Pl. VI: 6-8). Usually defined as sickle inserts, their use cannot be confirmed without use-wear analysis. Given the functional context of Logardan Trench D characterized by the presence of many kilns, the possibility that they have been used in the manufacture of pottery cannot be ruled out, as it has been observed in other assemblages (e.g., Groman-Yaroslavski et al. 2013). Glossy pieces, manufactured on truncated or fragmented blades, have triangular or rectangular shapes. They have retouched working edges that vary from nibble to heavy serration, and the intensity of the gloss can change from one item to another.

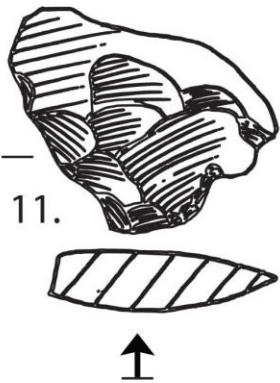
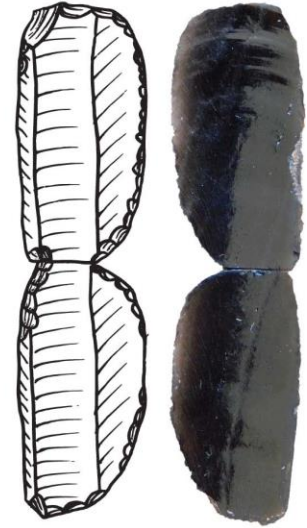
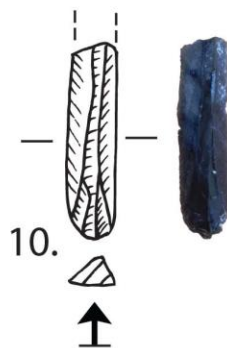
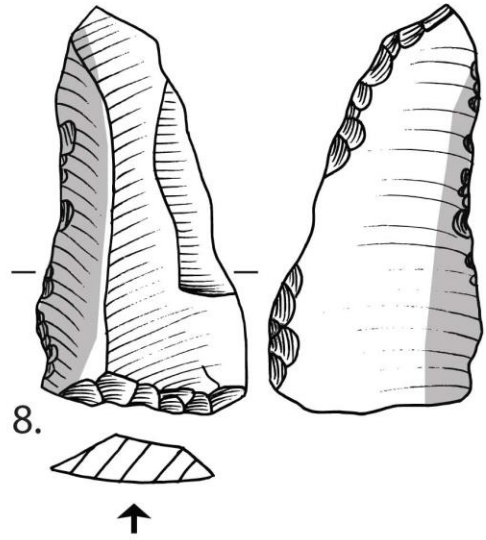
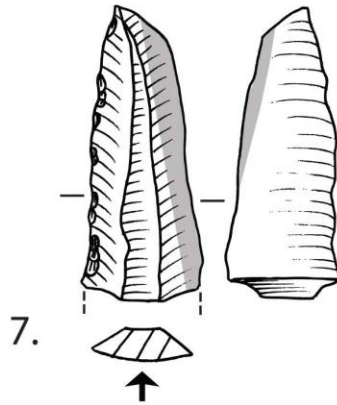
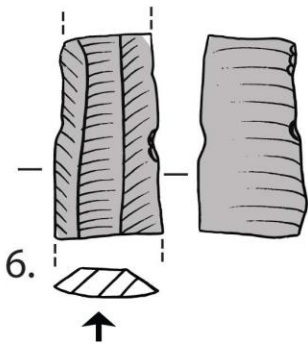
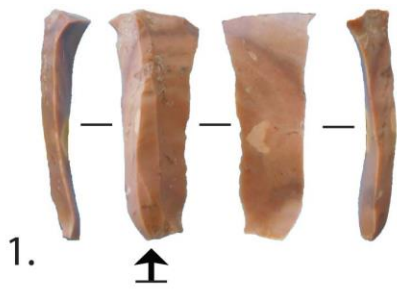


Plate VI



*Fig. 16 – Blades with residues of adhesive facilitating the hafting of the tools.*

All these differences might indicate various degree in the exploitation of the tools, which could be resharpened several times during their use. Although their function as sickles cannot be confirmed at this stage of the research, the existence of hafted tools is proved by the discovery of two fragments of blades that preserve traces of adhesive, probably bitumen (Fig. 16). These blades do not show visible gloss, but only marginal retouch on the edge opposite to the hafted one. These two items belong to the group of simple retouched blades, which count in total 16 tools. They are usually made on fractured or truncated blades, and the edges present varying type of retouch varying in extent (from marginal to long), position (direct or indirect), and distribution (from partial to total). In many cases, the edges show clear damaged edge linked to their use.

### *The obsidian industry*

At Logardan, 23 obsidian artifacts were recorded, for a total weight of 31.6 g. Excluding five flakes (Pl. VI: 11) and three small unidentifiable fragments, the assemblage is composed of 15 small blades/bladelets (Pl. VI: 9-10), most of them with visible damaged edges. Only four items show clear intentional retouch.

All bladelets/blades are detached by pressure, as indicated by their parallel edges and rectilinear dorsal ridges, the straight profile, the thin section, and the thick, high and short bulbs. All preserved proximal segments (N=7) are characterized by delicate abrasion which was carried out for preparing the pressure surface of the core. All the obsidian blades/ bladelets are broken at least at one extremity, allowing no detailed metric analysis of the original size (the shortest bladelets is 1.4 cm long, while the longest is 3 cm; average length is  $2.2 \pm 0.5$  cm). The range of width (from 5 to 15 mm) fits within different pressure modes, from the hand-held baguette to the long crutch in a standing position.

In absence of detailed use-wear analyses, the functions of the obsidian blades/bladelets cannot be identified. The lack of visible retouch on the majority of these items, however, seems to suggest that the blanks were employed without previous modifications. Of a particular interest there are two truncated and backed blades which were originally part of the same blade, subsequently fractured for creating two different tools, large 1.5 cm and long respectively 2.9 ad 3 cm (Pl. VI: 11-12). These two segments were found together within the fill of a pottery kiln in Locus 664, and they might be part of a composite tool.



## CONCLUSION

The study of the lithic assemblages of Girdi Qala and Logardan allows some preliminary observations. Observing the raw materials exploited, it is possible to recognize three different acquisition/production systems that were operating simultaneously.

Simple ad hoc tools compose the first one. Irregular flakes were produced on-site as indicated by the presence of cores and knapping waste. A simple knapping technology was used for detaching blanks from pebbles available in the proximity of the sites. The flakes were either directly used or little modified through retouch in order to adapt them to different tasks. People knowing only the most basic knapping principles and rules produced flakes for a wide range of domestic activities that required sharp cutting tools (e.g., Mc Couaghy 1979, 1980). It is probably that the knappers, also likely the users, detached short series of flakes and used them selecting the most appropriate for the particular task at hand. The limited number of retouched flakes and their morphometric variability may indicate that the knappers were focused more on the particulars of the working edge than on the shape of the entire implement. They produced blanks with natural sharp edges and used them without important modification of their volume and morphology. Once produced and used, the ad hoc tools were quickly discarded without any investment in maintenance for later use. This non-diagnostic lithic industry characterizes all protohistoric Near Eastern chipped-stone tool assemblages. The uniformity and stability of this system indicates the maintenance and sharing of common technical behavior reflecting a stable technological substrate. The low technical investment and the elementary production-consumption system represent domestic contexts, widespread within the society, which for millennia played a leading role in the daily life of ancient people. Within this system, we can also include the irregular blades found at Girdi Qala resulting from a simple reduction sequence specifically oriented to the production of long blanks.

The second component of the lithic assemblages is represented by regular blades/bladelets characterized by the use of a more complex knapping technology, the pressure technique exerted by long crutches and the lever-system. This industry reflects a specialized production, both from a technological and socioeconomic point of view (Manclossi et al. 2016). Available data are still incomplete, but the assemblages from the Qara Dagh are of particular interest and give us important insights about the emergence and adoption of the so-called “Canaanite blades” (e.g., Angevin 2018; Thomalski 2017; Manclossi and Rosen 2019b). In the analyzed assemblages, only a few items can be directly associated to this techno-type, notably the few blades wider than 23 mm and detached by using the lever-pressure system. The majority of blades/bladelets are narrower and result from the utilization of other simpler pressure-systems. Often ignored by the researchers more interested in the larger Canaanite blades, these “narrow” blades produced by pressure represent a fundamental link for understanding the processes of technological changes that occurred in late 5<sup>th</sup>-early 4<sup>th</sup> millennium BCE lithic assemblages.

At this stage, only preliminary observations can be made, but if we compare data from Girdi Qala and Logardan with other contemporaneous sites, we can recognize different patterns whose meaning will be the subject of further investigations. The most significant comparisons can be made with the assemblages from Helawa in the Erbil Plain, and Gird-i-Shamlu in the Sharizor Plain. At Helawa, “narrow” flint blades characterize the lithic assemblages of LC1-LC2 contexts. From the LC3, however, the situation changes and larger blades produced by the pressure-system replace the “narrow” blades (Moscone, comm. pers.). At Shamlu, instead, the scenario is different because “narrow” and large blades, which appear in LC3 contexts in large quantity, coexisted until the following EBA Period (Manclossi, forthcoming b). In the Qara Dagh, differently from the other sites, not only there are clues indicating a local production of “narrow” blades, but large Canaanite blades attested in Middle Uruk contexts are extremely few. At this stage of the research, it is not possible to establish if each pressure-

mode corresponded to a specific group of knappers. However, if we admit that the lever-pressure system was invented in Eastern Anatolia and Armenia and progressively spread through the movement of knappers toward east and south, data from Iraqi Kurdistan seems to suggest that the adoption of Canaanean blades was a complex phenomenon which took different trajectories. Especially during its initial stage, the adoption of the lever-pressure system was conditioned by the presence of preexisting lithic traditions and other transformations in the socioeconomic behaviors (Manccossi, forthcoming b).

The third component concerns the obsidian, a rock available only in volcanic areas, whose closest sources are several hundred kilometers away in eastern Anatolia and Armenia (e.g., Khalidi et al. 2009, 2016). Available data do not permit to establish how obsidian was imported into the sites, neither who were the people involved into this long-distance exchange network (e.g., Al Quntar et al. 2011). The presence of obsidian blade/bladelets is not unusual in the region (e.g., Renfrew et al. 1966), and this material is well attested in the previous periods (e.g., Cauvin and Chataigner 1998; Healey 2007). This persistence through time seems to indicate long-term relationships between distant areas (e.g., Bressy et al. 2005; Ortega et al. 2014; Ibáñez et al. 2016), with a privileged northwest-southeast axis. The small quantities of obsidian artifacts found at Girdi Qala and Logardan, however, suggests that this industry had only a marginal functional role within the chipped-stone tool assemblages.

The study of the lithic assemblages from Girdi Qala and Logardan offers interesting insights into the life of Late Chalcolithic/Early Bronze Age communities in the Qara Dagh. Chipped-stone tools were common objects used for various activities, notably in agriculture and other domestic tasks. However, the coexistence of different production-consumption systems, involving different raw materials and technologies, show that the sites were well integrated within a larger area. Available data are still too scarce to reconstruct the connections between Girdi Qala, Logardan and other sites, but further research might be able to offer other insights on socioeconomic and cultural dynamics acting during the 4<sup>th</sup> and 3<sup>rd</sup> millennium BCE, a crucial period for the development of complex societies.



# ARCHAEOBOTANICAL REPORT

Carolyne Douché

**T**hanks to its favorable environmental conditions and its extensive land cultivation, Northern Iraq is considered as the ‘granary of Iraq’ (Pellett 2003). Local climate is Mediterranean, characterized by cold-rainy winters and warm-dry summers (Walter and Leith 1960). Mean annual rainfalls are *c.* 700 mm but are unequally distributed through time. The rainy period is concentrated during the winter while summers are particularly dried (Karim et al. 2014). This archaeobotanical study aims to provide information regarding agricultural tradition in the Qara Dagh since the IVth millennium BC.

During the 2019 fieldwork, archaeobotanical investigations carried out in 2018 continued. According to the fieldwork season, most samples come from Girdi Qala Trench B and Logardan Trench D. Few samples have been taken from Logardan Trench E (due to sporadic work) and some samples left last year have been processed during this campaign (from Girdi Qala D and Logardan E).

The charred macro-botanical remains (mostly seeds, fruits and chaff) provide evidence of past environmental conditions and subsistence strategies (plant production, processing and consumption), as well as possible evolution through time. The archaeobotanical dataset may give chronological and spatial information that may complete or reinforce archaeological interpretations. Moreover, they will provide material for radiocarbon dating ( $^{14}\text{C}$  or AMS), in parallel to animal bones dating (protein component).

## ARCHAEOBOTANICAL METHODOLOGY

### *Systematic sampling*

During the 2019 field season, 59 sediment samples were collected (Fig. 1a) from both sites in various archaeological contexts, including pits, floor, tannur, kilns, ashy layers and potteries. Attempts were made to restrict their volume to a maximum of 30 liters. In total, 732.5 liters of bulk soil samples were collected.



*Fig. 1 – a) Bags containing sediment sampled on the site and managed according to site and trench. b) Flotation machine composed by three tanks with a water closed system. Charred remains have a lighter density than water and float in the first tank. Thanks to running water, they are recovered in the 0.3 mm mesh, settled between tank 1 and tank 2. Floating remains are called Light Residues (LR) while those kept in the 1 mm bottom mesh settled in tank 1 are called Heavy Residues (HR). c) Light residues recovered in the 0.3 mm mesh.*



Systematic sampling is important for several reasons. The first one is that despite good eyes, archaeobotanical remains are not always visible (especially small size remains such as wild taxa) and archaeologists can miss them. The second reason is related to contexts. Thanks to the aspect of their filling sediment (ashy, dark-grey color) and their presumed function, some contexts or features such as tannur and kilns provide evidence for on-site burning. But others such as floors or pits do not necessary show clear signs of charring. Nonetheless, once submitted to flotation, the sediment can reveal large quantities of grains related to primary or secondary context activities. The last important reason requiring systematic sampling is that it can provide information regarding spatial organization and chronological evolution. This has been one of the important aims, especially at Logardan Trench D. Indeed, Levels 3a1, 3a2 and 3b correspond to successive occupations, each one characterized by numerous pottery kilns settlement, corresponding to a craft area dedicated to intensive pottery production. For that reason, archaeobotanical analysis associated to kiln analysis may give information on the evolution of these workshop areas and in particular the possible change of fuel used to maintain fire. Indirectly, this may reflect potential vegetation and/or animal husbandry changes and differential resources exploitations.

Moreover, various morphologies (shape, size, interior design) and positions (including relationship with others structures) of kilns from a same level have been noted. The relationship between the structure (kiln), the fuel and the pottery types recovered inside may better highlight the function of each structure thanks to a possible spatial distinction.

### *Flotation Processing*

All samples were floated using the same York style flotation machine (built on-site by a local mechanic and under our control) used in 2018 and corresponding to three tanks with a water-closed system (Fig. 1b). A 1mm mesh bottom was set up in the first tank and a 0.3 mm mesh was set up between tanks 1 and 2, in order to recover the charred remains floated. To analyze the mean density, the volume of the sampled sediment was primary measured and then poured in the first tank. The material retained in the first mesh was called heavy residues (HR) whereas the material recovered in the second mesh - mostly charred remains floating - was called light residues (LR) (Fig. 1c). Both fractions were dried under the shadow to limit the breakness due to extreme temperature changes.

**Table 1:** Synthetic results of the flotation process including the volume of the bulk soil, of the light fraction, heavy fraction and total number of samples for each trench.

	<i>Flot. Vol.</i> <i>(L)</i>	<i>LR Vol.</i> <i>(ml)</i>	<i>HR Vol.</i> <i>(ml)</i>	<i>Nb of</i> <i>samples</i>
<i>Girdi Qala B</i>	199	874	16350	15
<i>Girdi Qala D</i>	4	40	100	1
<i>Logardan D</i>	429.5	1479	21850	35
<i>Logardan E</i>	100	212.5	9200	8
<i>Total</i>	732.5	2605.5	47500	59

### *Sorting Processing*

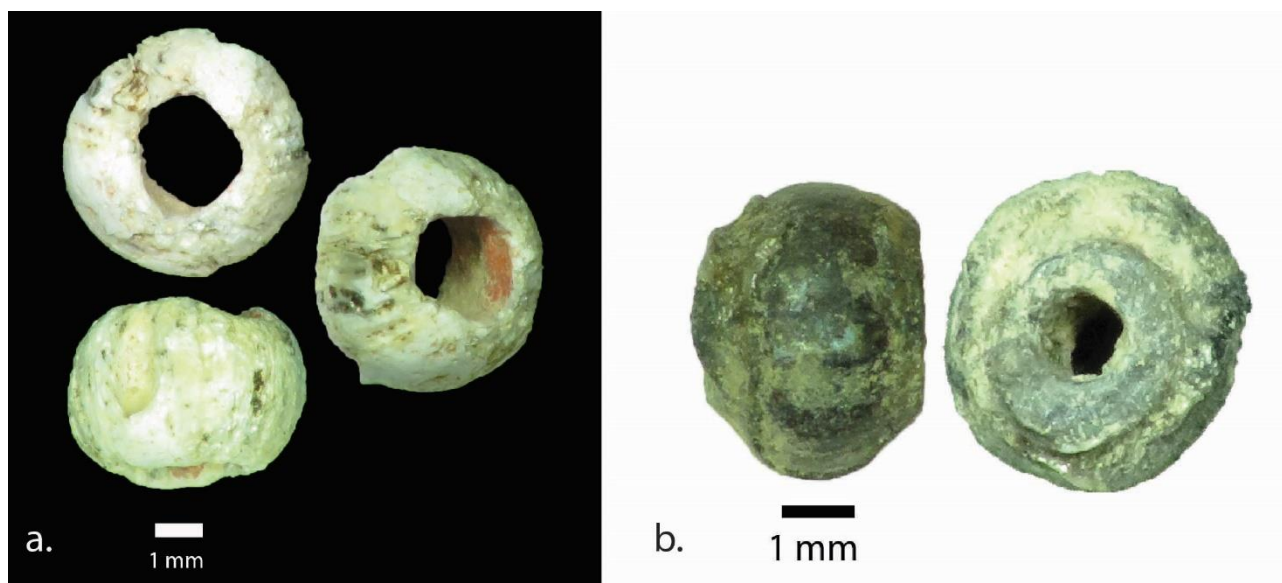
The 59 samples recovered consist in 732.5 liters of sediment, yielding 47.5 liters of heavy fraction (HR) and 26.05 liters of light fraction (LR) (Table 1). Among samples from Logardan Trench E, two have been collected in 2017 and four in 2018. At Girdi Qala, the single sample from Trench D has been collected in 2017.



*Fig. 2 – a) Sorting the Heavy Residues (HR). b) Material recovered in this 1 mm mesh consist in pottery sherds, shells, animal bones, slags, micro-charcoals, seeds and beads.*

Heavy residues were completely sorted by eyes by our assistant Sabah Rafoof Aziz Youssef (Fig. 2) in order to recover archaeological material that would have not floated. These are mainly pottery sherds, bones, shells, flint pieces, bitumen fragments, slags, beads (Fig. 3), metallic tools and heavy-dense macro-botanical remains like micro-charcoals, large pulses and cereal grains. The material recovered from the heavy residue fraction has been dispatched according to site, trench and excavated year in order to be analyzed by specialists (archaeozoologists, malacologists, archaeometallurgists, etc.) in the future. Objects such as beads and metallic tools have been recorded in the database and given to the Museum.

Of the 59 processed samples, only 32 LR fractions benefited of a preliminary analysis under a low-power microscope at Chamchamal and will benefit further studies. These will be necessary to analyze further samples, and help or precise identifications requiring the use of reference collections, manuals and SEM pictures (especially for amorphous residues containing seeds).



*Fig. 3 – Beads from Girdi Qala B pits, recovered by sorting the Heavy Residues. a) Very light white bead made in calcareous (shells?). The hole presents a red color, probably related to the string used to link all beads together. b) Grey-brown bead recovered from another pit. It is heavier and its shape and aspect looks like glass texture.*

## ARCHAEOBOTANICAL ANALYSIS

### *Preservation*

Except a few mineralized seeds (Papaveraceae) and floral parts (cereal awns), most archaeological plant remains were preserved by charring. As already noted last year, the preservation was not particularly good, especially for cereal grains that were mostly fragmented, twisted or even disaggregated. Nonetheless, the depth of the excavated layers seems to have an impact on this conservation. Indeed, at Girdi Qala Trench B, remains recovered in the Hellenistic occupation of Level 6 (by A. Devillers and L. Colonna d'Istria) presented a better aspect than those recovered in the upper Late Islamic occupation of Level 1 (by M.-O. Rousset), located just below the surface of the Tell<sup>12</sup>. Similarly, at Logardan Trench D archaeological remains recovered in deeper occupation layers such as Level 3d in the southeastern part (ex. Loc. 1015) delivered many remains in a quite good preservation state.

### *Richness*

Considering both sites, a total of 21688 items (n) including seed, fruit, chaff, floral parts and residues have been extracted from the Light Residues (LR). The mean density of remains (n/L) appears to be very high, D=54.8 (Table 2). A detailed analysis shows that the highest mean density value comes from Girdi Qala B (D=147.3).

**Table 2:** Presentation of the volume of the bulk soil, its corresponding number of macro-botanical remains (n) (including indeterminables and indeterminae) and the mean density (n/L) for each trench. For Girdi Qala B, numbers in brackets correspond to values once sample #FL.23 has been excluded.

	<i>Flot. Vol. (L)</i>	<i>Number of remains (n)</i>	<i>Mean Density (D)</i>
<i>Girdi Qala B</i>	199 (86)	17010 (1010)	147.3 (11.7)
<i>Girdi Qala D</i>	4	2	0.5
<i>Logardan D</i>	429.5	3441	20.7
<i>Logardan E</i>	100	1235	11.2
<i>Total</i>	732.5	21688	54.8

Nonetheless, this value is bias by the presence of one particular sample (#FL.23) which can be interpreted as a storage structure. By excluding this particular sample, the nature and the mean density (D) of each site/trench are comparable. Logardan D presents the highest value (D=20.7), Logardan E and Girdi Qala B have a similar mean density and Girdi Qala D the lowest value (but only a small single sample from 2017 has been floated). As already noted last year, despite the numerous firing structures (in particular the kilns from Logardan Trench D), very few micro-charcoal pieces have been recovered.

## RESULTS

### *Logardan Trench D*

The 35 samples recovered from Logardan Trench D come from Levels 3 (a1, a2, b, c and d) except one from Level 4b<sup>13</sup>. Among the 15 Light Residues (LR) analyzed this year, most come from Levels 3b and

<sup>12</sup> It should also be remind that last year, an important differential preservation state has been observed between remains recovered at Girdi Qala B (deep stratigraphy) and Girdi Qala D (close to the surface).

<sup>13</sup> The single sample from Level 4b corresponds to the internal floor of a building excavated in 2015 and 2016. Since at that time there was no archaeobotanist, no sample had been taken. Thus, this 2019 sample aims to recover charred remains for 14C-Dating.



3d. A total amount of 3441 remains, including crop grain and chaff remains, fruit akenes and nutshells, wild/weed taxa, amorphous residues, Poaceae culmnodes, floral parts such as pedicels, animal coprolites and indeterminate/indeterminable has been recovered (Table 3).

**Table 3:** List of plant remains identifications from Logardan D and E and Girdi Qala B and D based on the analysis of the 2019 samples. Girdi Qala B includes sample #FL.23 while Girdi Qala B\* excludes it.

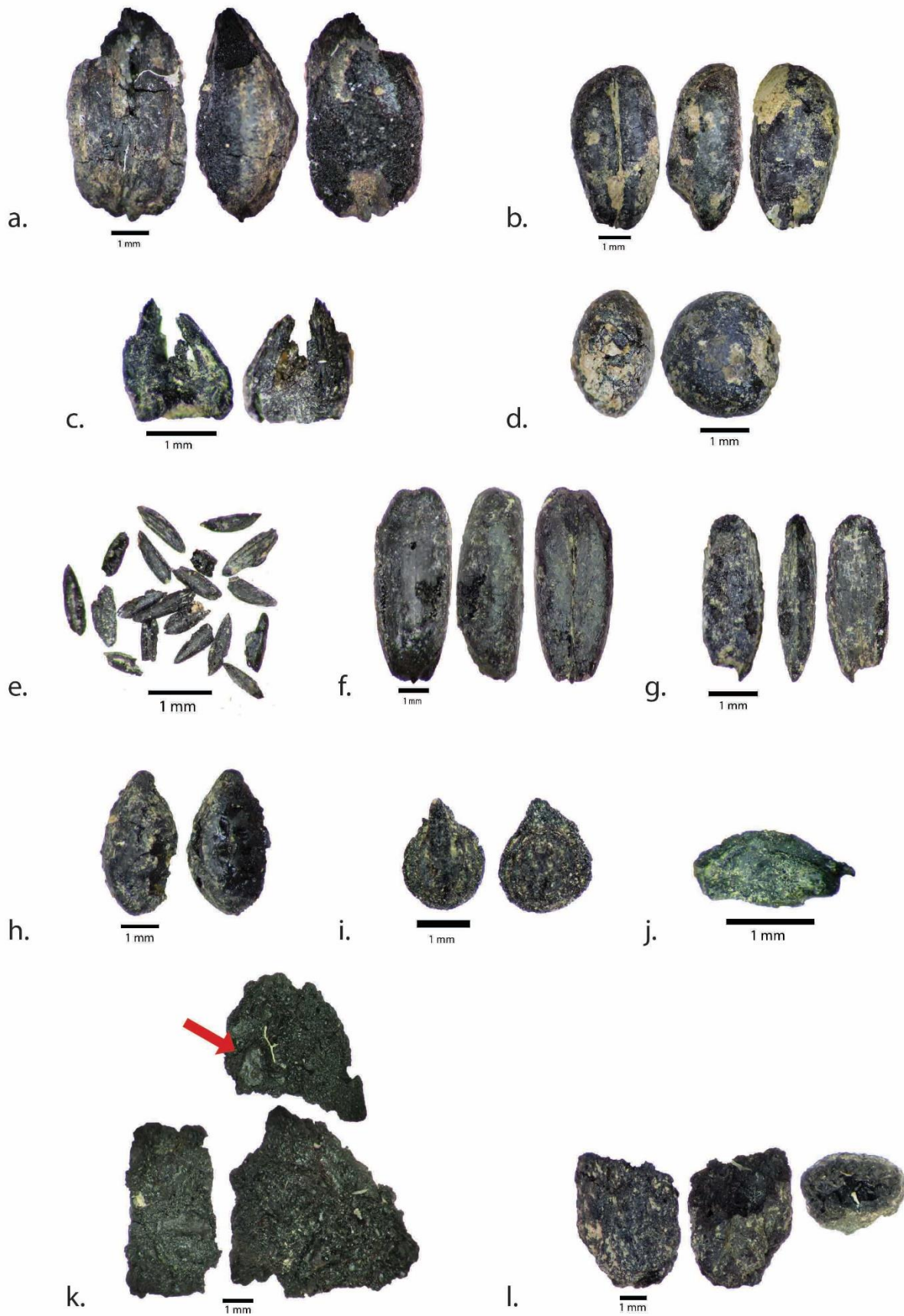
Site (2019)		LOG D n=3444	LOG E n=1239	GQ B n=17013	GQ B* n=1013	GQ D n=2
CEREAL GRAINS	Cerealia Gr	316	207	66	66	0
	<i>Hordeum vulgare</i> subsp. <i>spontaneum</i> Gr	10	0	16003	3	0
	<i>Hordeum vulgare</i> subsp. <i>vulgare</i> (2-row) Gr	61	41	42	42	1
	<i>Secale</i> type Gr	0	0	0	0	0
	<i>Triticum</i> sp. Gr	53	13	1	1	0
	<i>Triticum monococcum/dicoccum</i> Gr	10	0	1	1	0
	<i>Triticum turgidum</i> subsp. <i>dicoccum</i> Gr	42	4	1	1	0
	<i>Triticum monococcum</i> subsp. <i>monococcum</i> Gr	2	0	0	0	0
	<i>Triticum</i> cf. <i>spelta</i> Gr	0	0	0	0	0
	<i>Triticum aestivum/durum</i> Gr	7	1	21	21	0
CEREAL CHAFF	Cerealia spp. spk	31	3	1	1	0
	<i>Hordeum vulgare</i> subsp. <i>spontaneum</i> spk	0	0	0	0	0
	<i>Hordeum vulgare</i> subsp. <i>vulgare</i> spk	31	0	4	4	0
	<i>Triticum</i> sp. spk	35	2	0	0	0
	<i>Triticum boeoticum/dicoccoides</i> spk	0	0	0	0	0
	<i>Triticum monococcum/dicoccum</i> spk	21	0	0	0	0
	<i>Triticum turgidum</i> subsp. <i>dicoccum</i> spk	67	0	0	0	0
	<i>Triticum monococcum</i> subsp. <i>monococcum</i> spk	8	0	0	0	0
	<i>Triticum turgidum</i> subsp. <i>aestivum</i> spk	0	0	3	3	0
	<i>Triticum durum</i> spk	0	0	0	0	0
	<i>Triticum aestivum/durum</i> spk	18	0	13	13	0
SMALL GRASS GRAINS	<i>Aegilops</i> sp. Gr	20	0	1	1	0
	<i>Avena</i> type Gr	0	0	2	2	0
	<i>Avena fatua</i> type	0	0	0	0	0
	<i>Bromus</i> sp. Gr	2	0	1	1	0
	<i>Dinebra retroflexa</i> type	355	5	32	32	0
	<i>Echinaria</i> type	0	0	1	1	0
	<i>Hordeum</i> type	0	0	0	0	0
	<i>Hordeum murinum</i> Gr	38	0	0	0	0
	<i>Lolium</i> sp. Gr	22	2	0	0	0
	<i>Lolium</i> cf. <i>temulentum</i> Gr	7	0	0	0	0
	<i>Lolium</i> cf. <i>multiflorum</i>	3	0	2	2	0
	<i>Lolium</i> cf. <i>rigidum</i> Gr	0	0	0	0	0
	<i>Lolium</i> cf. <i>multiflorum/rigidum</i> Gr	0	0	0	0	0
	Panicoideae	0	0	0	0	0
	<i>Panicum</i> type	0	0	3	3	0
	<i>Phalaris</i> sp.	0	0	0	0	0
	<i>Poa bulbosa</i> type	1	0	0	0	0
	<i>Polypogon</i> type	0	0	0	0	0
	Small Poaceae indet. Gr	210	22	33	33	0
	<i>Stipa</i> sp. Gr	1	0	4	4	0
<i>Taeniatherum</i> sp. Gr	7	0	1	1	0	
Small Grass Chaff	<i>Aegilops</i> sp. spk	53	1	3	3	0
	<i>Aegilops</i> cf. <i>tauschii</i> spk	2	0	0	0	0

	<i>Aegilops cf. squarrosa</i> spk	0	0	0	0	0
	<i>Avena fatua</i> floret	0	0	0	0	0
	Small Poaceae indet. spk	8	0	0	0	0
	<i>Taeniatherum</i> sp. spk	3	0	0	0	0
PULSES	Large Legumes indet.	6	25	1	1	0
	<i>Lathyrus sativus</i>	2	12	0	0	0
	<i>Lens culinaris</i>	37	10	2	2	1
	<i>Prosopis farcta</i>	0	0	0	0	0
	<i>Vicia ervilia</i>	2	0	0	0	0
	<i>Vicia faba</i>	0	0	1	1	0
	<i>Lathyrus/Vicia</i>	3	1	0	0	0
	Pod fgt	0	0	0	0	0
SMALL LEGUMES	<i>Alhagi/Astragalus</i>	0	0	0	0	0
	<i>Astragalus</i> sp.	2	0	1	1	0
	<i>Coronilla</i> sp.	0	1	12	12	0
	<i>Coronilla/Scorpiurus</i>	0	0	0	0	0
	<i>Medicago</i> sp.	4	1	9	9	0
	<i>Medicago astroites</i>	6	0	2	2	0
	<i>Medicago radiata</i>	0	0	1	1	0
	<i>Medicago radiata</i> pod	0	0	0	0	0
	<i>Melilotus</i> sp.	0	0	0	0	0
	<i>Melilotus/Trifolium</i>	0	0	0	0	0
	<i>Scorpiurus</i> type	0	0	0	0	0
	Small Legumes indet.	4	1	9	9	0
	<i>Trifolium</i> type	4	0	1	1	0
	<i>Trigonella</i> sp.	43	3	9	9	0
	<i>Trigonella/Astragalus</i>	6	0	0	0	0
FRUITS	<i>Amygdalus orientalis</i> Nutshell fgt	3	0	0	0	0
	<i>Capparis</i> cf.	1	0	0	0	0
	<i>Capparis</i> sp. (mineralised)	0	0	0	0	0
	<i>Ficus carica</i> sp. akene	4	0	8	8	0
	<i>Pistacia</i> sp. whole fruit	0	0	0	0	0
	<i>Pistacia</i> sp. Nutshell fgt	0	0	9	9	0
	<i>Prunus/Amygdalus</i> Nutshell fgt	0	0	0	0	0
	<i>Quercus</i> type (cupule)	1	0	0	0	0
	<i>Vitis</i> sp.	0	1	1	1	0
	Nutshell indet. fgt	6	0	0	0	0
	Nutshell indet. fgt type 1	0	0	0	0	0
	Nutshell indet. fgt type 2 ( <i>Pistacia</i> ?)	0	0	0	0	0
	Fruit indet.	0	0	25	25	0
OIL/ FIBER	<i>Linum</i> sp.	2	0	0	0	0
	Oil seed	0	0	0	0	0
WILDWEED TAXA	<i>Adonis</i> sp.	3	1	2	2	0
	<i>Adonis</i> cf. <i>aestivalis</i>	5	0	0	0	0
	<i>Ajuga</i> sp.	0	0	0	0	0
	Apiaceae	5	1	0	0	0
	Asteraceae	1	0	1	1	0
	<i>Bellevalia</i> sp.	1	0	1	1	0
	<i>Bolboschoenus</i> sp.	4	0	6	6	0
	Boraginaceae	0	0	0	0	0
	<i>Buglossoides tenuiflora</i>	0	0	0	0	0
	Brassicaceae	7	1	1	1	0
	Brassicaceae type <i>Erysimum</i> sp.	0	0	0	0	0
	Brassicaceae type <i>Neslia/Teesdalia</i>	0	0	0	0	0

	<i>Carex</i> sp.	0	0	1	1	0
	<i>Chenopodium</i> sp.	1	2	0	0	0
	Chenopodiaceae	4	0	2	2	0
	Cyperaceae	3	0	1	1	0
	<i>Erodium</i> sp.	0	0	0	0	0
	<i>Fumaria</i> sp.	1	0	0	0	0
	<i>Galium</i> sp.	8	2	2	2	0
	<i>Gypsophila/Silene</i>	0	0	0	0	0
	<i>Heliotropium</i> sp.	2	0	0	0	0
	<i>Malva</i> sp.	0	0	1	1	0
	<i>Ornithogalum</i> sp.	1	0	0	0	0
	Papaveraceae (mineralised)	3	0	0	0	0
	Papaveraceae	6	0	3	3	0
	cf. <i>Papaver</i>	0	0	0	0	0
	<i>Piptatherum</i> type	0	0	1	1	0
	<i>Plantago</i> sp.	1	0	0	0	0
	<i>Plantago lanceolata</i>	0	0	2	2	0
	<i>Poa</i> type <i>bulbosa</i>	0	0	0	0	0
	<i>Rumex</i> sp.	0	0	0	0	0
	<i>Sambucus</i> type	0	0	1	1	0
	<i>Scirpus</i> sp.	7	0	104	104	0
	<i>Silene</i> sp.	1	0	0	0	0
	<i>Sinapis</i> sp. (modern ?)	0	0	0	0	0
	<i>Teucrium</i> sp.	0	0	0	0	0
	<i>Thymelaea</i> sp.	0	0	1	1	0
	<i>Vaccaria</i> cf. <i>pyramidata</i>	1	0	0	0	0
OTHERS	A. residues	260	70	51	51	0
	A. residues with seeds	173	0	0	0	0
	A. residues with cereals	0	0	0	0	0
	A. residues thick and shiny	0	0	0	0	0
	A. residues with Poaceae stalk	0	6	0	0	0
	Dung type fgt	2	6	47	47	0
	Ovary indet.	0	0	0	0	0
	Poaceae stalk fgt	2	2	8	8	0
	Poaceae culmnodes	29	3	10	10	0
	Poaceae root	1	0	0	0	0
	Straw/Awn fgt (mineralised)	0	0	0	0	0
	Stalk fgt	0	0	0	0	0
	Reed culmnodes	0	1	0	0	0
	Reed stalk fgt	0	0	17	17	0
	Root	0	0	0	0	0
	Twig	0	0	0	0	0
	Floral parts	25	3	3	3	0
	Caprine coprolith (MNI)	9	0	35	35	0
	Rodent pellet	10	0	5	5	0
	Textile rope	0	0	2	2	0
Indeterminae	139	10	137	137	0	
Indeterminable	1149	775	238	238	0	

The assemblage composition from Logardan D is quite diversified (Plate I). Considering only botanical remains, it is dominated by the Poaceae family (n=1441, 88%), including cereal and small grass grains and chaff (Fig. 4). Nonetheless, amorphous residues/dung fragments are also numerous.





*Plate I* – Examples of archaeobotanical material recovered from Logardan D. a) Caryopsis of *Hordeum*/*Triticum*, b) Caryopsis of emmer wheat (*Triticum turgidum* subsp. *dicoccum*), c) Spikelet base of *T. turgidum* subsp. *dicoccum*, d) Lentil seed (*Lens culinaris*), e) *Dinebra retroflexa* type, f) *Aegilops* sp., g) *Lolium* cf. *multiflorum*, h) *Linum* type, i) *Adonis* cf. *aestivalis*, j) *Brassicaceae*, k) Amorphous residues. The red arrow shows a fragment of cereal included in the residue, l) Caprine coprolith.

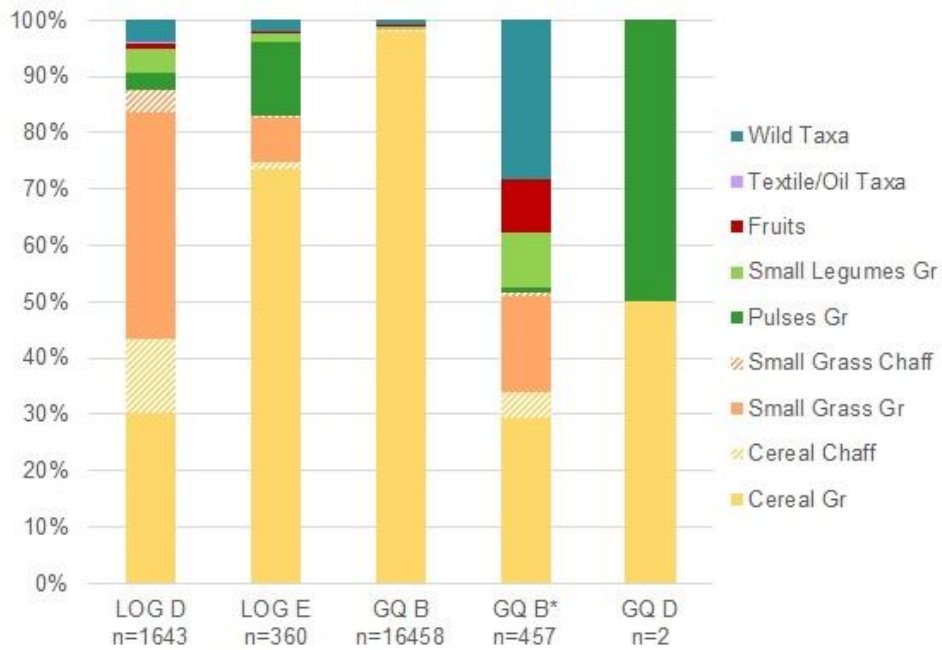


Fig. 4 – Graph presenting the botanical composition of assemblages from each site/trench. Girdi Qala B includes #FL.23 corresponding to a grain stock while Girdi Qala B\* does not.

Among the identified cereals, hulled barley (*Hordeum vulgare* subsp. *vulgare*) and emmer wheat (*Triticum turgidum* subsp. *dicoccum*) appear to be the main taxa recovered this year, both in terms of caryopsis and chaff (Fig. 5). While naked wheat (*T. aestivum/durum*) grain and internode rachis are attested, glume wheat is dominant. Pulses are dominated by lentil (*Lens culinaris*).

The importance of small grass is particularly high at Logardan D and is mostly dominated by single taxa: *Dinebra retroflexa*. Other taxa include *Aegilops* sp. (including *A. cf. tauschii*), *H. murinum*, *Lolium* sp. (*L. temulentum*, *L. multiflorum*) and *Taeniatherum* sp. Small legumes are represented by *Astragalus* sp., *Medicago* sp. (including *M. astroites*), *Trifolium* sp. and *Trigonella* sp. Few *Prunus/Amygdalus* nutshell fragments have been recovered together with fig akenes (*Ficus carica*). The wild/weed category comprise a large variety of taxa such as *Adonis* cf. *aestivalis*, Apiaceae, Brassicaceae, Chenopodiaceae, *Fumaria* sp., *Galium* sp., *Ornithogalum* sp., Papaveraceae, *Scirpus* sp.

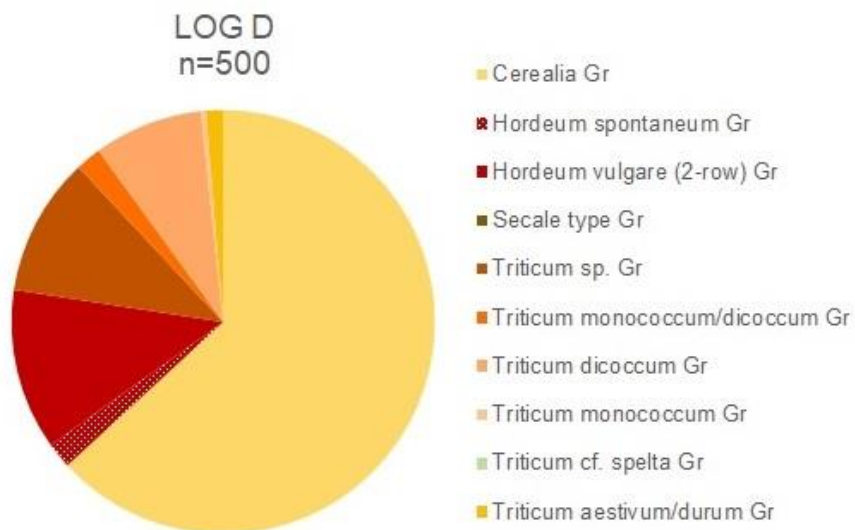


Fig. 5 – Graph presenting the composition of cereal grains from Logardan D.

Moreover, 10 rodent pellets and 9 caprine coprolites have been recovered from the archaeological samples. Indeterminable remains (too fragmented, distorted or cracked) constitute 34% (n=1149) of the whole assemblage.

Another interesting archaeobotanical discovery should be mentioned here. In the Locus 1006, level 3d, a phytolith layer has been excavated. A sample of soil has been taken and exported for further analysis but eyes observations indicate the aggregate of Poaceae stalk (straw?) (Fig. 6).

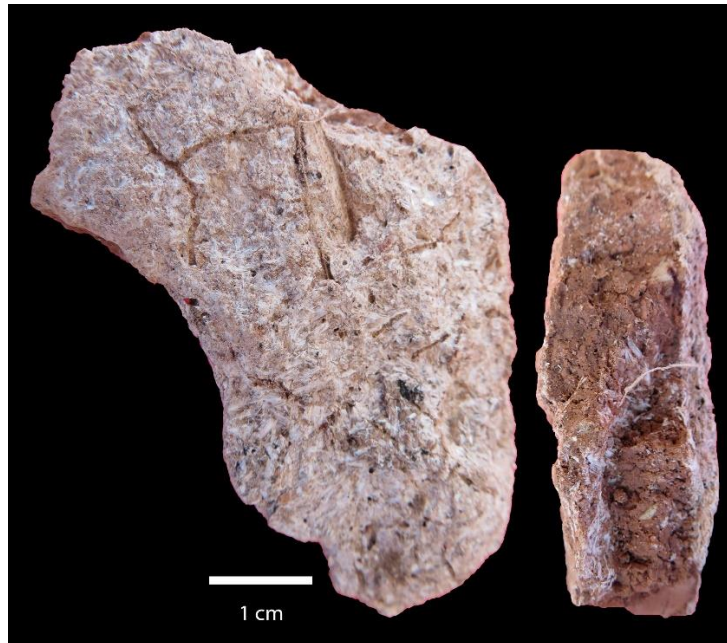


Fig. 6 – Fragments of the phytolite layer showing aggregation of Poaceae stalks.

### Logardan Trench E

Samples from Logardan E mostly come from tannur, kilns and occupation floors. From the 9 LR analyzed this year<sup>14</sup>, a total amount of 1235 remains, mostly including crop grains, wild/weed taxa, amorphous residues and indeterminable has been recovered (Plate II). The assemblage is largely dominated by cereal grains (n=265, 74%) but pulses (n=47, 13%) and small grass grains (n=29, 8%) constitute another important part of the plant remains composition (Table 3). As observed at Logardan D, amorphous residues/dung remains are numerous.

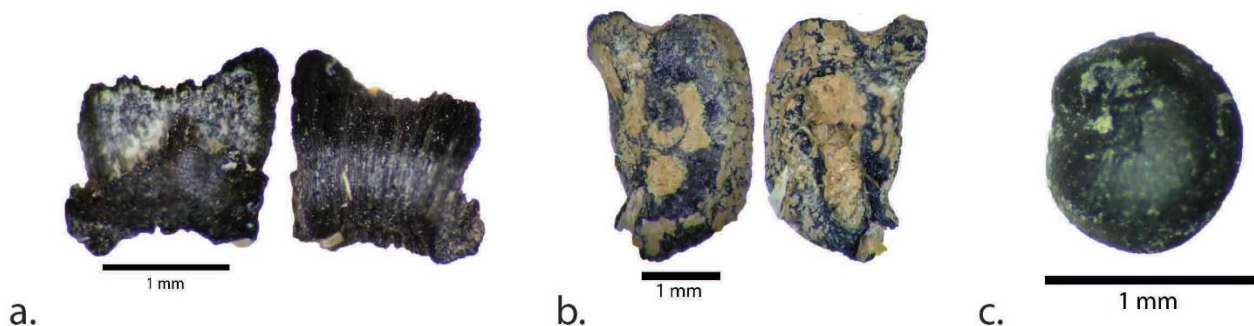


Plate II – Examples of archaeobotanical material recovered from Logardan E.

a) *Aegilops sp. glume type*, b) *Vitis sp. pip*, c) *Chenopodium sp.*

<sup>14</sup> One LR sample has been processed in 2018 but sorted this year.



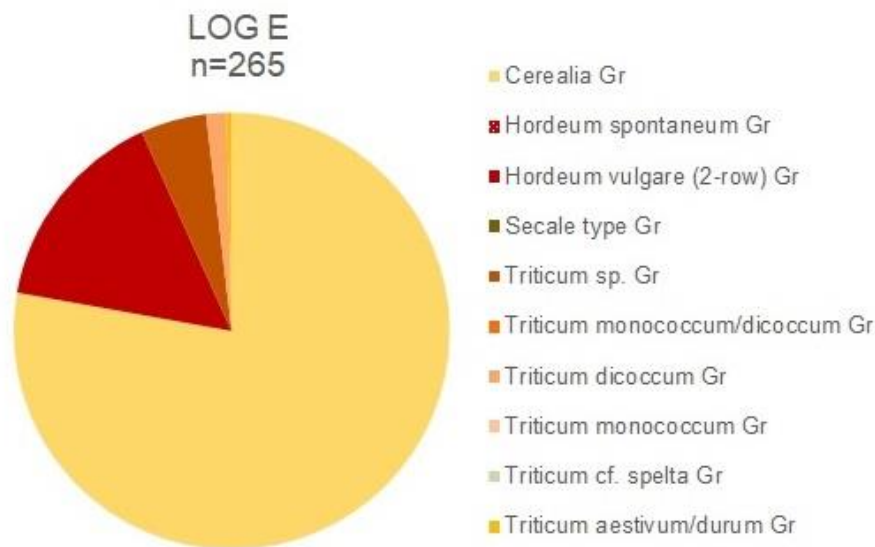


Fig. 7 – Graph presenting the composition of cereal grains from Logardan E.

While the cereal category is dominant, indeterminate grains (*Cerealia* spp.) mainly represent it. (Fig. 4). Hulled barley grains have been recovered in larger quantity than wheat (*Triticum* sp.) (Fig. 7). Chaff remains were very rare and badly preserved. Pulses are mostly indeterminate but grass pea (*Lathyrus sativus*) and lentil (*Lens culinaris*) have been identified.

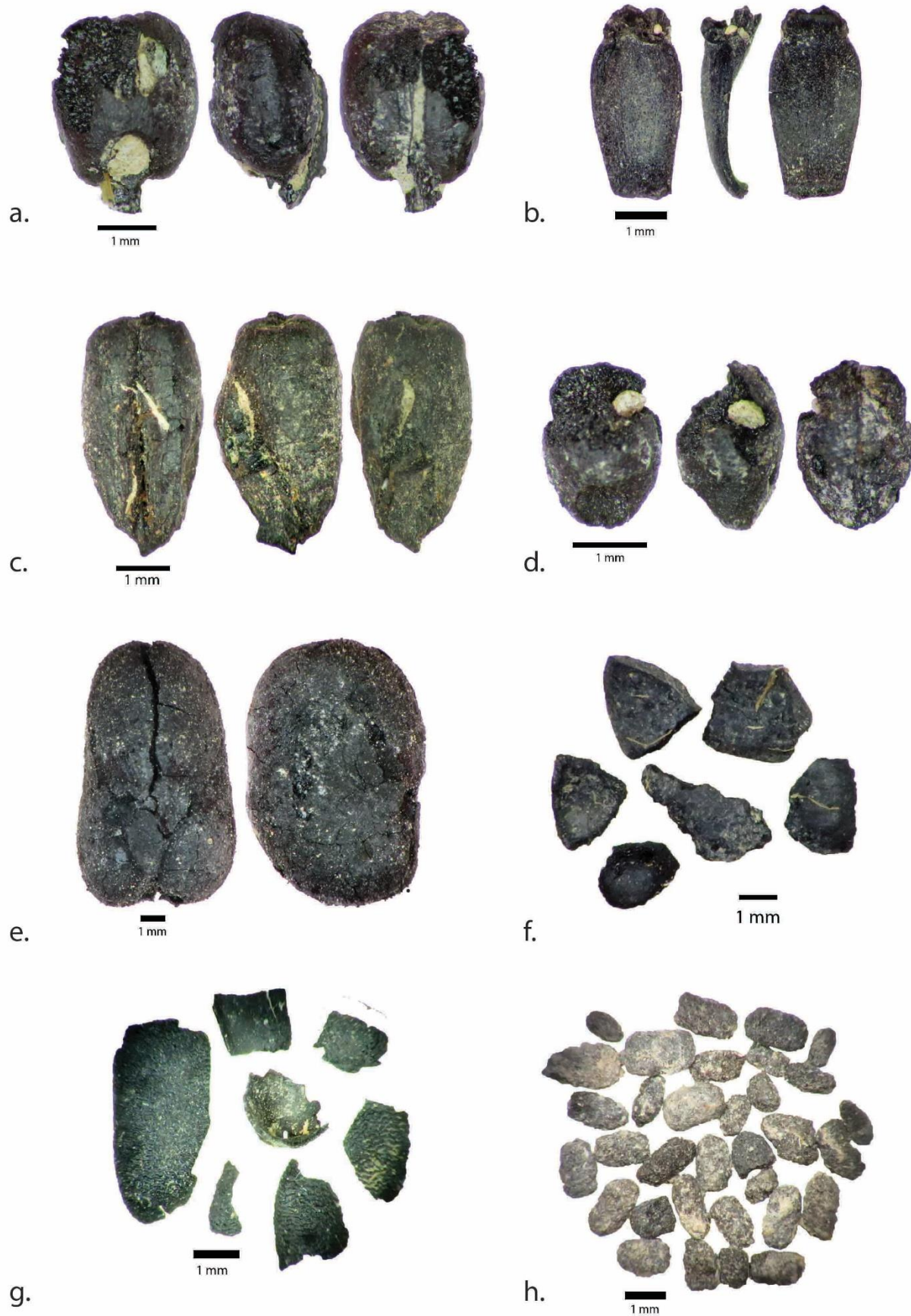
Most small grass could not be identified due to bad preservation but rare *Dinebra retroflexa* and *Lolium* sp. grains were recovered. Small legumes are represented by *Coronilla* sp., *Medicago* sp. and *Trigonella* sp. but in low quantity. The single grape pip (*Vitis* sp.) constitutes the fruit category. Similarly, the wild/weed taxa are poorly diversified and only represented by one or two remains such as *Adonis* sp., Apiaceae, Brassicaceae, *Chenopodium* sp. and *Galium* sp. Finally, it has been noted that the proportion of indeterminate remains is particularly high (n=775, 63%).

### Girdi Qala Trench B

The 15 samples recovered from Girdi Qala Trench B mostly come from pits from the Sassanian/Hellenistic period. Thanks to the widening of the trench, the Islamic occupation has been extensively excavated this year and two archaeological contexts have been sampled. Seven LR samples have been sorted (including one processed in 2018). A total amount of 17010 remains has been recovered (Plate III). It mostly includes crop grains, fruit akenes and nutshells, wild/weed taxa, amorphous residues, Poaceae culmnodes, reed fragments, animal coprolites and indeterminate/indeterminable (Table 3).

Considering all samples, the global plant assemblage is almost entirely composed by cereal grains (Fig. 4). But as already mentioned, a particular sample (#FL.23) biases the results. To overcome this bias, this sample has not been included in the general analysis of Girdi Qala Trench B. Without it, it appears that Poaceae family (including cereals and small grasses) constitutes half of the assemblage (n=237, 52%) (Fig. 4). The second half is dominated by the wild/weed category but fruit remains and small legumes are also important.

Without sample #FL.23, the assemblage from Girdi Qala B is dominated by hulled barley (*H. vulgare* subsp. *vulgare*) and naked wheat grains (*T. aestivum/durum*) (Fig. 8a). While chaff remains were present, they were badly preserved and it was hard to make the difference between bread wheat and pasta wheat. However, few specimens have been identified as bread wheat, *T. turgidum* subsp. *aestivum*. Except two lentil seeds (*Lens culinaris*) and a single fava bean (*Vicia faba*) seed, pulses are almost absent.



*Plate III* – Examples of archaeobotanical material recovered from Girdi Qala B. a) Caryopsis of a naked wheat (*Triticum aestivum/durum*), b) Spikelet base of bread wheat (*T. turgidum* subsp. *aestivum*), c) Possible wheat grain (*Triticum* type), d) Grain of *Panicum* type, e) Fava bean seed (*Vicia faba*), f) *Pistacia* sp. nutshell fragments, g) *Sambucus* type fragments, h) Rodent pellets type.

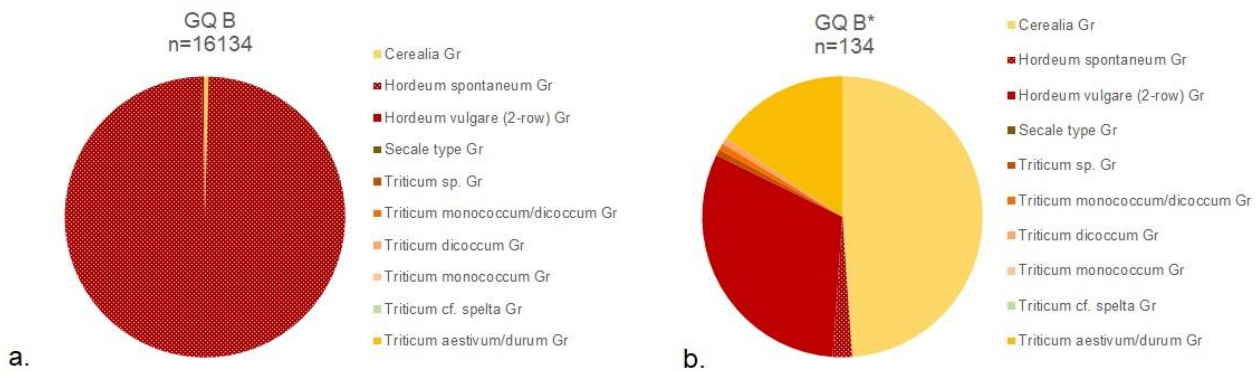


Fig. 8 – Graph presenting the composition of cereal grains from Girdi Qala B. a) excluding #FL.23. b) including #FL.23.

Similarly to Logardan D and E, small grasses are widely indeterminate but some specimens have been attributed to *Dinebra retroflexa*. *Aegilops* sp., *Bromus* sp., *Lolium* cf. *multiflorum*, *Stipa* sp. and *Taeniatherum* sp. The small legumes category is quite diversified as shown by the identification of *Astragalus* sp. *Coronilla* sp., *Medicago* sp. (including *M. astroites*), *Trifolium* sp. and *Trigonella* sp. Fruit remains are also well represented and diversified by fig akenes (*Ficus carica*), pistachio nutshell fragments (*Pistacia* sp.), a single grape pip (*Vitis* sp.) and indeterminate fruit fragments.

The wild/weed taxa are composed by *Adonis* sp., Asteraceae, *Bellevalia* sp., Cyperaceae (including *Bolboschoenus* sp., *Carex* sp. and *Scirpus* sp.), Brassicaceae, Chenopodiaceae, *Galium* sp., Papaveraceae, *Plantago lanceolata* and *Thymelaea* sp.

Amorphous/dung residues have been encountered, as well as reed fragments. Numerous caprine coprolites (n=35) and rodent pellets (n=5) have been found. Additionally, two tiny charred textile fragments have been recovered from two distinct pits (Fig. 9). Indeterminable remains represent 24% of the assemblage (n=238).

According to its plant composition, #FL.23 – sampled in a small pit associated to the internal floor of a Late Islamic building - likely corresponds to a crop stock. Caryopses were very badly preserved (distorted and cracked) but look like a mix of barley and oat grains (Fig. 10). The assemblage was almost pure, without any chaff remains and weed taxa.

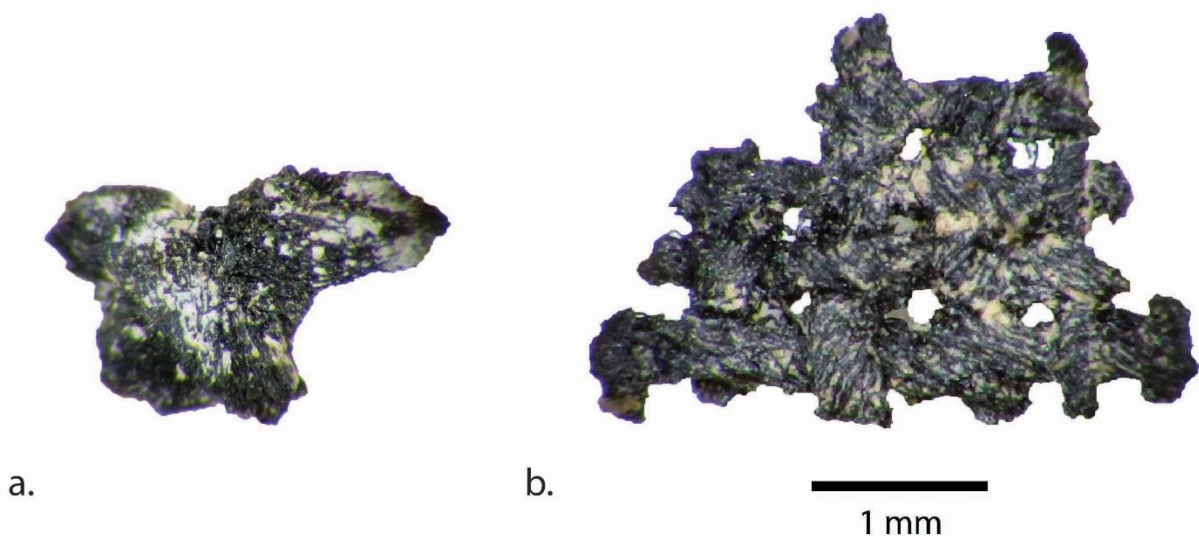
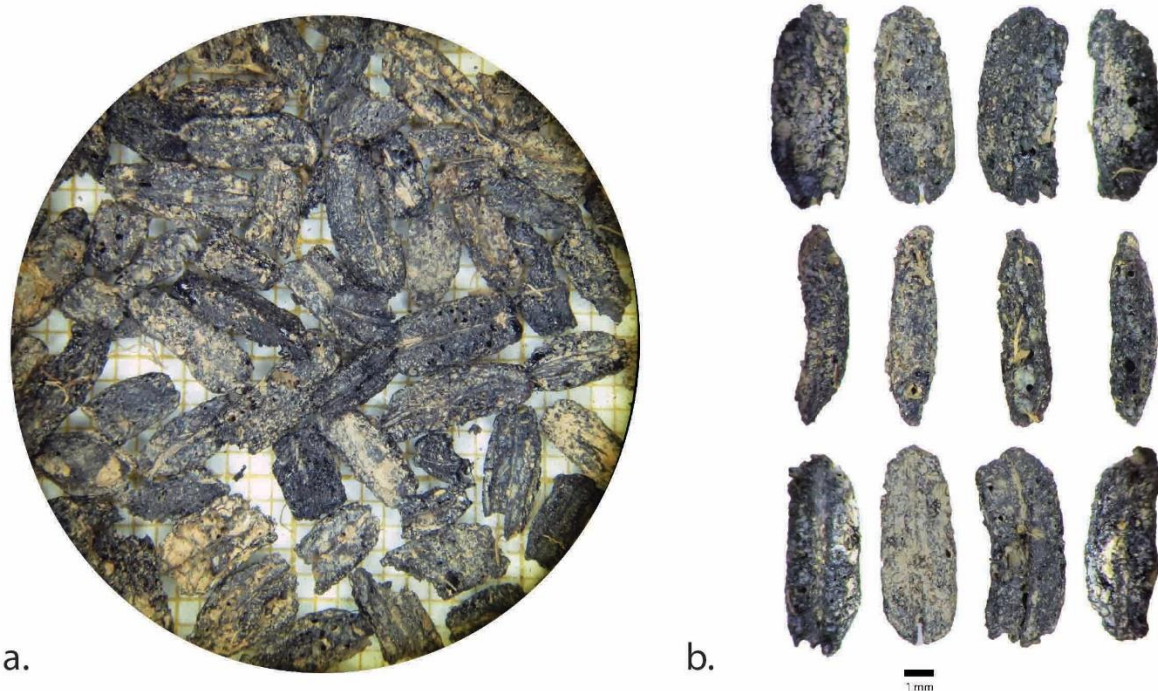


Fig. 9 – Photo of textile remains recovered from pits at Girdi Qala B: a) rope, b) fragment of textile.





*Fig. 10 – Photos of grains recovered in the internal pit from Girdi Qala B (Level 1). a) Large amount of grains. b) Dorsal, lateral and ventral view of some typical grains from this sample (#FL.23).*

## DISCUSSION

Including archaeobotanical results obtained in 2018, some preliminary considerations can be made.

### *Chronological considerations*

Thanks to preliminary chronological data we have from Logardan (trenches D and E), considering only samples whose occupation period is known, we can make the following observations (Fig. 11):

- The proportion of two-row hulled barley (*Hordeum vulgare* ssp.) does not change much between the Early Dynastic I, the ED III and the transition period ED III/Akkad. It constitutes between 39% and 48% of the cereal category (excluding indeterminate grains) and corresponds to the main crop.
- The proportion of unidentifiable wheat (*Triticum* sp.) decreases
- The proportion of emmer wheat (*T. dicoccum*) increases
- Naked wheat (*T. aestivum/durum*) is absent during the ED III period

The high proportion of barley during these periods has already been noted last year but the addition of new samples confirms this preliminary observation. Rise of hulled barley has previously been mentioned by archaeobotanists working on Northern Mesopotamia sites dated from the Late Chalcolithic period such as Tell Brak (Hald 2010), Tell Bderi (van Zeist 1999/2000) and Tell es-Sweyhat (Miller 1997). Due to its better tolerance to high temperatures and dry climates, barley is often considered as better adapted to more arid regions (Zohary et al. 2010). Its high or increasing proportion may indicate an arid/aridification of the climate. Although palaeoenvironmental records from Lake Van core<sup>15</sup> do not show any sign of climate change during the Late Chalcolithic period (Robinson et al. 2006), new study based on wood charcoal analysis from Tell Brak has shown a change in *Pistacia*-deciduous *Quercus* ratio, indicating a substantial increase in climatic aridity from LC2 to LC5 (Charles et al. 2010). The earliest

<sup>15</sup> The results are based on multi-proxy analysis (pollen, charcoal, Mg/Ca and stable oxygen isotope).

occupation analyzed at Logardan refers to the ED I that follows the LC5. Thus, if aridity were persisting during about a millennium, it would be not surprising that inhabitants were cultivating barley, more tolerant than wheat.

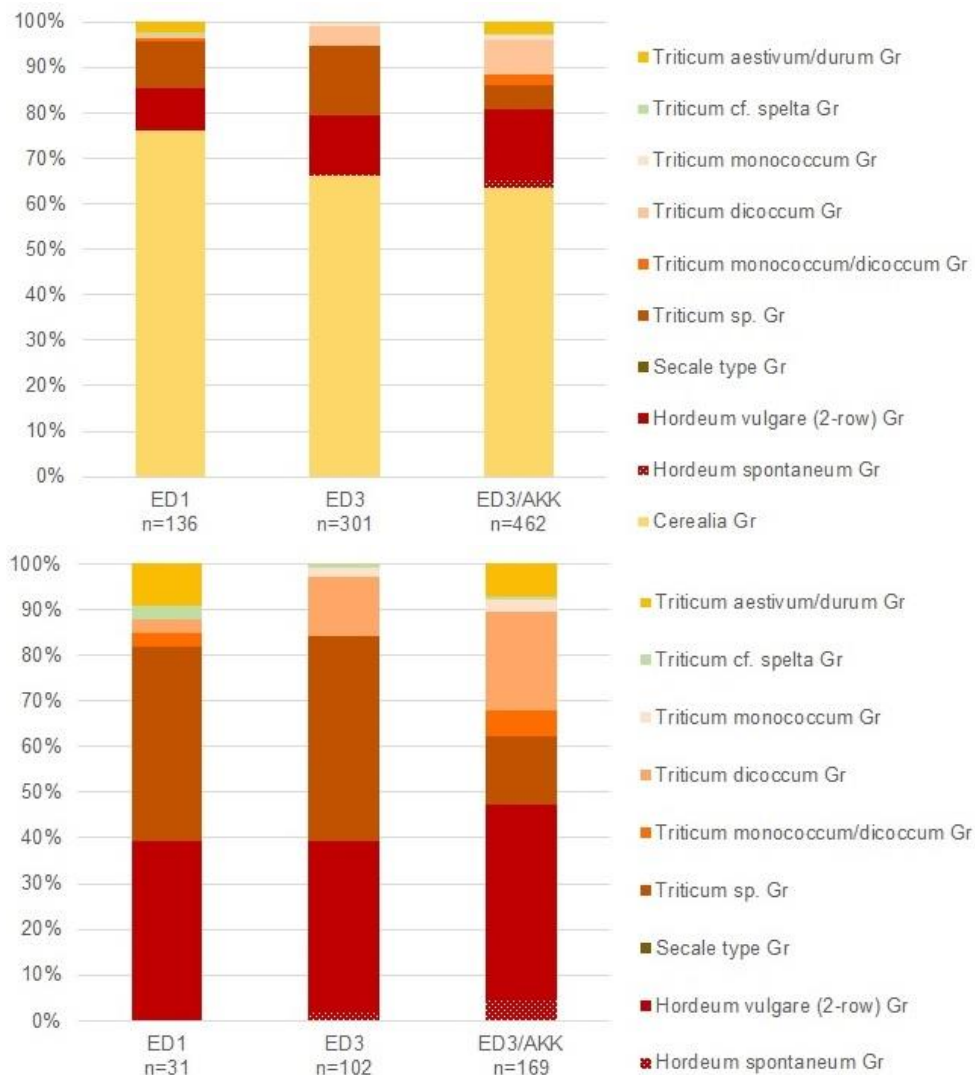


Fig. 11 – Graph presenting the composition of cereals according to chronological data available (samples with unknown levels excluded). Top) including indetermined cereals. Bottom) excluding indetermined cereals.

### Fuel used for kilns at Logardan D

At Logardan D, while the number of sorted samples from each level is heterogeneous, results can lead to preliminary interpretations. The archaeobotanical samples from Level 3a and 3b, come from the bottom of pottery kilns and likely correspond to fuel used to feed fire installations. Based on the plant composition, charcoals are absent or microscopic. Assemblages are dominated by Poaceae grains, chaff and culmnodes, associated to amorphous/dung residues, animal coprolites/pellets, small legumes and reed fragments and likely reflect the use of animal dung as fuel (Fig. 12). Plants, including small legumes and other wild/weed taxa were probably grazed by animals<sup>16</sup> in the surrounding environment or gave as fodder. Another argument suggesting the use of animal dung to feed kilns is the presence (and ubiquity) of the small grass *Dinebra retroflexa* (type). In the *Flora of Pakistan*, this common weed of cultivation is described as the “favourite food of buffaloes”. Moreover, an ethnographical investigation has

<sup>16</sup> The archaeozoological study led by E. Vila (2018) led to the identification of *Ovis* sp., *Capra* sp., *Sus scrofa* and *Bos/Equus* animal bones at Logardan D.

shown that villagers continue to add wild plants (usually small grasses gathered in the surroundings) to dung and wood because it plays a role of starter for fire in tannur and fireplaces (Douché and Padovani, this volume).

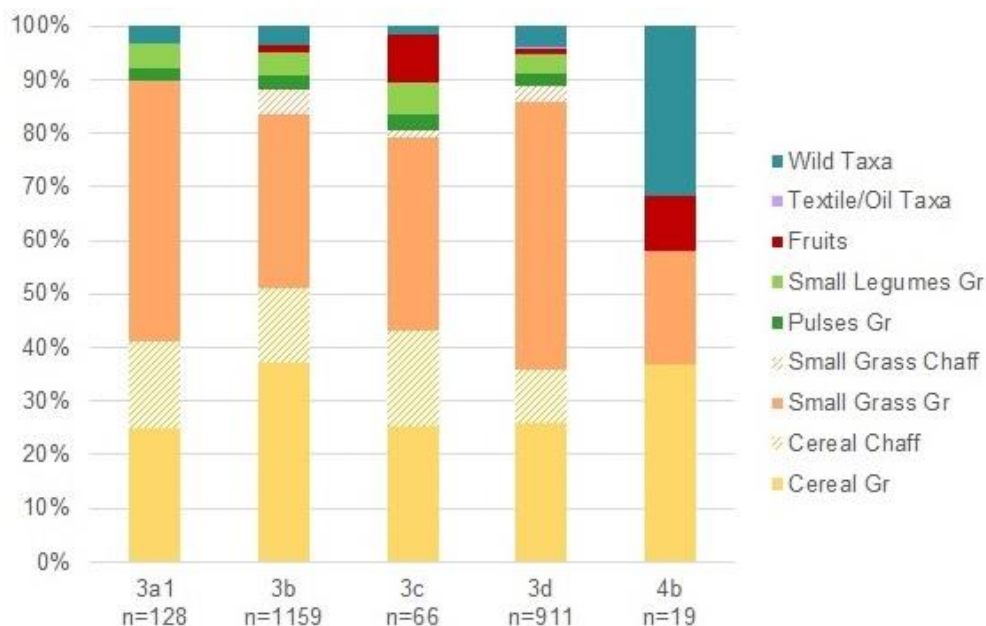


Fig. 12 – Graph presenting the composition of samples from Logardan D according to occupation levels.

### Cooking practices at Logardan E

Interestingly, last year, at Logardan E, a tannur – #FL.53, related to Level IB corresponding to the Late Bronze period; see also Appendix A for its radiocarbon dating – has been sampled and delivered a large amount of grass pea seeds (*Lathyrus sativus*). During this campaign, while very few archaeological operations have been led in this trench, another tannur has been found and sampled for flotation. It relies also to the Late Bronze Age occupation and provided some grass pea (*L. sativus*) and lentil (*Lens culinaris*) seeds together with a few barley grains (*H. vulgare*). The identification of grass pea in this context – tannur - is surprising because it is normally dedicated to bread cooking. Nowadays, Iraqi breads are mostly made with bread wheat (*T. turgidum aestivum*) and sometimes with barley (*H. vulgare*) flour. The use of grass pea in bread making has only been recorded in Ethiopia (Lyons and D’Andrea 2003). Seeds are roasted to remove its toxicity (Butler et al. 1999) and then ground into flour to prepare a flatbread (and for brewing beer). Pliny the Elder that mentions their leavening effect on the dough has also noted the use of pulse flour (bitter vetch and chickpea) to make bread<sup>17</sup>. The recovery of grass pea in large quantity at Logardan E is not unique<sup>18</sup> but questions food ways in Northern Mesopotamia during the Late Chalcolithic/Bronze Age period. While barley and wheat are the main crops identified in the archaeobotanical assemblages, why one would make bread with grass pea? Were these tannur dedicated to specific purposes or particular consumers? It would be interesting to pursue systematic sampling in order to compare the composition of potential further tannur.

### Girdi Qala B: fields on the riverbank?

Samples from Girdi Qala B contain a large proportion of wild/weed taxa. Considering that most samples come from pits, the composition of assemblages may refer to “undesirable” remains. It has been

<sup>17</sup> *Natural History* XVIII, 71

<sup>18</sup> The proportion of this taxa increases through the Late Chalcolithic period at Tell Brak (Charles et al. 2010) and it has also been seen in large amount at the LC site of Kuruçay, in western Anatolia (Nesbitt 1996).



noted that the Cyperaceae family dominates the wild/weed category (60% of the wild/weed assemblage) (Fig. 13). This family includes taxa such as sedge, club-rush and bulrush and is emblematic of aquatic environments. Their presence in high proportion among the archaeobotanical assemblages from Girdi Qala B may reflect the exploitation of the Tavuk Çay River, situated on a lower level. Some Cyperaceae species are also arable weeds, growing in cultivated fields. This could indicate that fields were probably located along the river where reeds, sedges and club-rushes are growing. Moreover, compared to other sites/trenches, fruit remains are important at Girdi Qala B. The presence of fig (*Ficus carica*), pistachio (*Pistacia* sp.), grape (*Vitis* sp.) and indeterminate nutshells may reflect gardening or horticultural practices during the Sassanian/Islamic periods. All these archaeobotanical observations find parallel in the modern mix orchard settled on the low terrace of the river, where farmers cultivate fruit trees such as fig, olive, pomegranate and grape (Fig. 14). Fig trees are usually encountered along rivers because they require water to grow. The presence of this fruit at Girdi Qala may suggest that this taxa was growing 'wild' along the river or was cultivated there, using an irrigation system.

About the textile fragments found in the pits, no identification could be made but literature on the Sasanian period mention the existence and use of wool, cotton, silk and linen (Belenitskij et al. 1963, Hansman and Stronach 1970, Kurbanov and Teplyakova 2014). Analyses have shown that the weight of spindle whorls and the type of fibers are related (Kossowska-Janik 2017). Heavy fibers such as flax requires heavy spindle whorls. Thanks to preliminary observations under the low-power microscope, it has been noted that thickness of fibers from Girdi Qala B is *c.* 0.4 mm. Experiments led to conclude that whorls weighing 8–20g are ideal for obtaining a thread 0.2–0.7 mm thick (Grömer 2005). Further studies on these objects and on fibers would be interesting to better understand textile production during the Sasanian period.

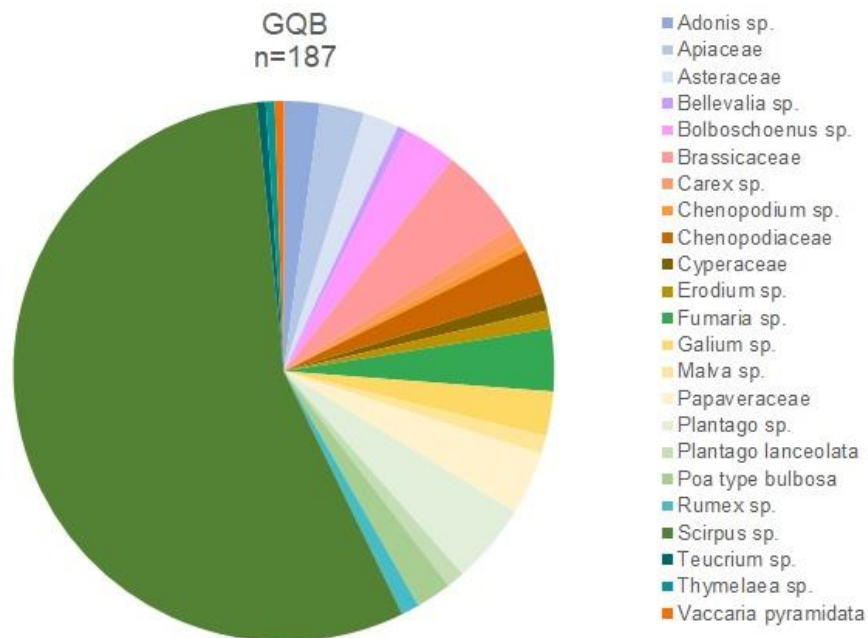


Fig. 13 – Graph presenting the composition of the wild/weed category from Girdi Qala B (2018 samples included).



*Fig. 14 – Photo of the mix orchard located on the low terrace of the Tavuk Cay River, next to Girdi Qala.*

## CONCLUSION

The last campaign at Girdi Qala and Logardan provide new information on what and how inhabitants were cultivating, cooking, eating and dealing with plant resources.

Except at Logardan E, cultivation was focusing on cereals, two-row hulled barley and emmer wheat during the Early Dynastic period (3rd millennium BC) and two-row hulled barley and naked wheat (likely bread wheat) during the Sasanian-Islamic period (3rd –16th cent. AD) at Girdi Qala B. The importance of pulses is very low compared to cereals but they may have been exploited or consumed for special occasions. It is interesting to mention that nowadays, while pulses – lentil and chickpea in particular – are very important in the Kurdish cuisine, they are not widely cultivated in the local area (cf. Douché and Padovani, this volume).

Potential weeds, emblematic of humid environments (Cyperaceae), in the assemblages from Girdi Qala B suggest that fields were settled on the Tavuq Çay riverbanks. This system may have been related to an irrigation system to supply fields during the dry season (from April to October). Further studies leading to the identification of the wild/weed species will provide more information on ecological growing conditions and subsequently on agricultural practices.

While storing rooms (discovered and excavated in 2016-17) have been identified at Logardan E, no sample for archaeobotanical analysis has been taken. For now, storing system has only been recognized at Girdi Qala B. A pit located in the internal floor of a building from Level 1 (Late Islamic period) delivered a large amount of pure grains, perfectly cleaned. Future work is required to better understand

the nature/function and the organization of this building in order to clarify the storing system (domestic?) during this period.

Several amorphous residues have been recovered in all sites/trenches. Some have been identified as dung residues, containing small seeds but also fibers, straw fragments etc. but some could be food residues. Cooking techniques can only be clearly approached thanks to the fill of tannur. Examples from Logardan E (Bronze Age)<sup>19</sup> suggest the use of grass pea (*Lathyrus sativus*) to make bread or beer.

Finally, it is important to mention that, as it is still the case in the modern rural town of Shorsh, people from Logardan D were using available resources. The pottery workshops settled during the Akkad/Ur III periods required fuel to feed the numerous kilns. The Qara Dagh Mountains (located c. 13 km further east) were probably covered by forest vegetation but due to the distance and the scarcity of wood, this resource was certainly carefully used. It is not excluded that wood charcoals have been used to feed kilns but according to its rarity, not alone and likely until the complete ashy state. For that reason, we may consider that potters mainly used animal dung to feed 'industrial pottery area' requiring large amount of fuel. Inhabitants practiced animal husbandry and dung stocks were available in large quantity. After having been dried for a year (Douché and Padovani, this volume), these residues were thrown into the fuel pit.

A short note, based on the discovery of two textile fragments recovered in pits from Girdi Qala B may questions the textile craft industry. Which fibers were used? Animal such as wool or vegetal such as flax? Apart from these two small fragments, numerous loom weights have been found in pits, suggesting the importance of this activity during the Sasanian period.

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<sup>19</sup> Another tannur, discovered at Girdi Qala B (Sasanian period), did not provide large amount of crops. Few cereal and barley grains have been identified.







# CONSERVATION REPORT OF THE FRENCH ARCHAEOLOGICAL MISSION IN WESTERN QARA DAGH (SHORTENED VERSION)

ACAT PROJECT {FRA---312}

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Chamsia Sadozai

## 1. MISSION'S BACKGROUND

This ACAT mission was supported by a grant from the French Ministry of European and Foreign Affairs, which aims to support French archaeological missions abroad in the preservation of earthen architecture (project called ACAT). The mission followed an identification campaign of potential sites in Iraqi Kurdistan carried out in 2017 by CRAterre laboratory.

### 1.1. *Terms of reference*

- To provide a preliminary technical diagnosis on the state of conservation of the excavated remains.
- To study mid-term and long-term conservation options.
- To provide recommendations on preventive conservation strategies.

### 1.2. *Mission schedule*

- J1 – Saturday 28/09/19  
Flight Lyon-Istanbul and Istanbul-Suleymaniah
- J2 – Sunday 29/09/19  
Arrival in Suleymaniah (02h30). Transfer to Chamchamal.  
Visit with Qara Dagh's team of Girdi Qala and Logardan.
- J3 – Monday 30/09/19  
Visit with Régis Vallet of Girdi Qala and Logardan.
- J4 – Tuesday 01/10/19  
Work on Logardan site (backfilling).
- J5 – Wednesday 02/10/19  
Transfer to Erbil via Suleymaniah. Meeting with Dr Mahmood Khayat
- J6 – Thursday 03/10/19  
Meeting with Barbara Couturaud and Nihad Koja. Visit of Erbil's citadel.  
Transfer to Chamchamal
- J7 – Friday 04/10/19  
Work on the report, last visit on site
- J8 – Saturday 05/10/19  
Flight Suleymaniah-Istanbul and Istanbul-Lyon. Arrival in Lyon (10h30).

## 2. SITE PRESENTATION

The activities of the Western Qara Dagh French mission are concentrated on two archaeological sites in the eastern part of the Chamchamal plain: a flattened tell called Girdi Qala and another natural mound with human occupation called Logardan (2.5 km north of Girdi Qala) (Fig. 1). Excavations started in 2015 with trenches on both sites.



*Fig. 1 – Aerial view of the Upper Tavuq Cay Valley. Logardan (left, North) and Girdi Qala (right, South) are located at the junction of the tributaries of the river.*

Geologically, both sites are located on the transition plateau between Zagros Mountains (East) and Mesopotamian plain (West), at an average altitude of 650 meters above sea level. The landscape shows an abundance of reddish clay or silt clay and greenish gray sandstone.

The climate in Chamchamal is semi-arid continental, which means very hot and dry in summer, and cold and wet in winter (Fig. 2). Data found on the Internet show that there is no snow or frost but discussions with local inhabitants suggest some episodic falls.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	5.8	7.3	11.3	16.6	22.9	29	32.5	32.4	28.2	22.2	14.3	8.1
Min. Temperature (°C)	1.3	2.5	6	10.6	15.8	21.3	24.6	24.7	20.3	14.9	8.6	3.3
Max. Temperature (°C)	10.3	12.2	16.6	22.6	30.1	36.7	40.4	40.2	36.2	29.5	20.1	13
Avg. Temperature (°F)	42.4	45.1	52.3	61.9	73.2	84.2	90.5	90.3	82.8	72.0	57.7	46.6
Min. Temperature (°F)	34.3	36.5	42.8	51.1	60.4	70.3	76.3	76.5	68.5	58.8	47.5	37.9
Max. Temperature (°F)	50.5	54.0	61.9	72.7	86.2	98.1	104.7	104.4	97.2	85.1	68.2	55.4
Precipitation / Rainfall (mm)	126	104	108	60	29	0	0	0	0	5	47	86

*Fig. 2 – Chamchamal climate. Source: <https://en.climate--data.org/asia/iraq/sulaymaniyah/chamchamal--25281/>*

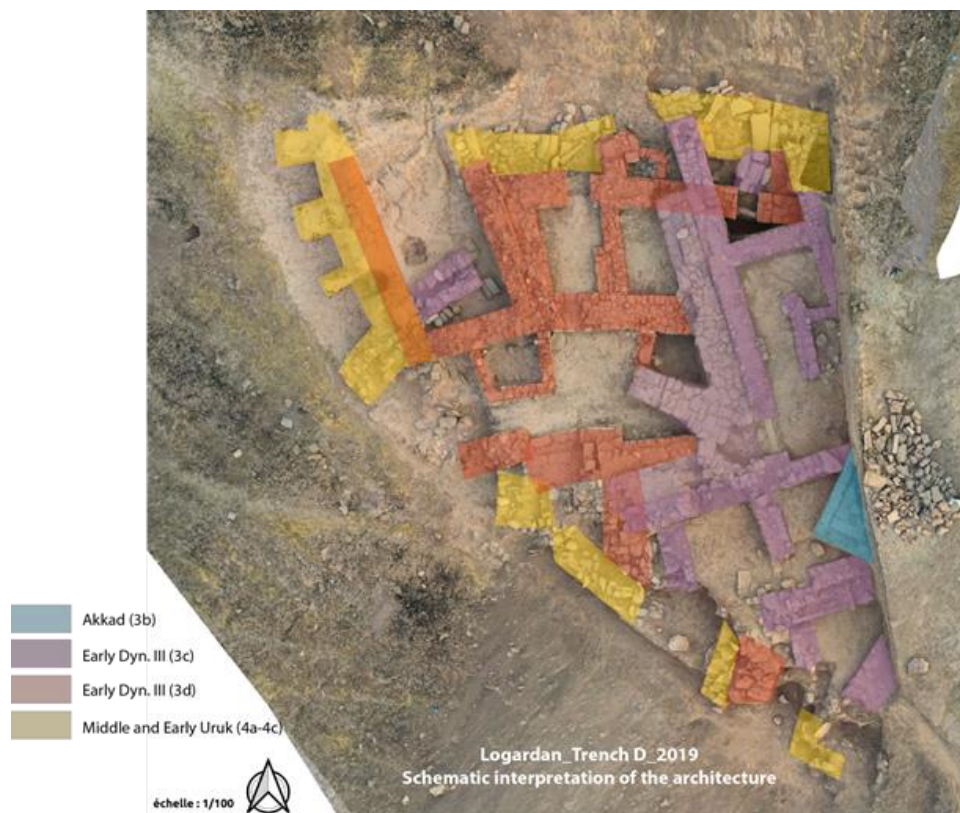


### 2.1. Chronology at Logardan

The top of the main mound has been under research since 2016 by the French team. Two areas are now under extensive research, Trench D on the western edge of the Tell and Trench E on the southern top (Fig. 3).



*Fig. 3 – Logardan in 2017 (top) and 2019 (bottom). ©CRAterre C. Sadozai*



*Fig. 4 – Logardan Trench D chronological phases. ©CRAterre C. Sadozai 2019*



*Fig. 5 – Logardan Trench E chronological phases. ©CRAterre\_C. Sadozai 2019*

The architectural remains in Logardan are mostly composed of stone masonry with mud mortar, in a very good state of conservation. Different periods follow one another mainly between c. 3900 BC (Early Uruk) and 2000 BC (Ur III) with complex stratigraphic interactions. To summarize, during the 3rd millennium BC a huge factory of pottery was established on the top of the hill with many kilns disturbing layers beneath. They have been carefully studied and removed to reveal a residential building with walkways along narrow walls and a staircase leading to a fortified western gate (in purple, Trench D, Fig. 4). The stones are from a medium caliber, showing a flat face on the outside, the inner space being filled up with mortar.

Few generations before, a more defensive building was erected with thick walls of large stones very well organized (in red). On the eastern side, the same two bastions are keeping the monumental staircase leading to the gate (Trench E, Fig. 5), where on the western side, previous massive walls are reused to reinforce the building facing the landscape (Trench D). A large open courtyard flanked with rooms attests the presence of Early Dynastic I period, only visible on the eastern side (in green, Fig. 5).

Before that, at the beginning of the 4th millennium (Early Uruk), a group from southern Iraq settled a colony here. They started with the erection of a massive platform in mudbricks with recesses supporting a large room (in yellow, Fig. 4) that is reused afterwards, during the Middle Uruk period where the complex acquires a more defensive function. Earlier evidences of occupation (Ubaid, Halaf) have been noticed during the surveys and in Trench C but not excavated in trenches D and E.

## **2.2. Chronology at Girdi Qala**

The top of the Main Mound has been under research since 2015 by French and Belgian teams, to have a full stratigraphic trench with all different layers of occupation and abandonment of the site.

Architectural remains in the upper levels (medieval period) are scarce, preserved on a few centimeters. Lines depicting buildings are hardly visible, even mudbricks are not easy to delimitate. The foundation trench under each wall is filled up with soil and pieces of stone or mudbrick. These structures are very badly preserved, located just under the surface, which is certainly caused by a combination of erosion and bad quality fabric factors.

After layers of abandonment, Sassanian structures were found during previous campaigns, dismantled to reveal a Hellenistic building (3rd century BC), still visible today, and preserved on approximately one meter high. The paste of the mud bricks does not resemble that of the upper levels, and the bricks are much better preserved. The clay is a little orange, the consistency is more homogeneous and cohesive than the medieval material and the bricks are square, 35 x 35 cm. Another important fact is that those bricks had inclusions of old pottery shards (probably from the 4th millennium BC, Uruk period). The depth (minus 1.20 m) and the location away from the edge of the Tell are possible reasons of its good condition.

The defensive wall surrounding the top of the Tell is Islamic (medieval). The very poor state of conservation does not allow distinguishing the mudbricks. Visible wall thickness is 1.2 m.

### 3. CONDITION ASSESSMENT OF LOGARDAN

#### *3.1. Previous conservation measures*

During first two campaigns, no specific protection measures were undertaken, except the regular surveillance of the site by the steward of the mission. Vandalism has been noticed between the excavations' campaigns by the removal of several stones. Consequently, the biggest stones are since covered every year after the excavations under a layer of soil taken from the spoil material. This operation requires a day of work with the full team of workers.

Régis Vallet and the director of antiquities of Suleymaniah Kamal Rashid also conducted discussions with the local representatives and peasants, in order to stop agricultural activities temporarily and protect the sites. It has been effective since 2017. The mission pays a rent every year to local farmers around the sites, while agents of the Antiquities make regular visits. Acts of vandalism have much decreased since.

#### *3.2. Conservation strategy*

The objective of the excavations in Logardan is to have an overview of the ancient layers, mainly represented by the architectural remains. The two trenches excavated separately today, will be joined in the coming years to have an extensive excavation of the top of the mound. The late occupation of the 3rd millennium will be destroyed to enhance the previous layers, except if remarkable elements were found.

**Considering the good state of preservation of the remains and the fact that this settlement is the earliest testimony of an Uruk colony in northern Mesopotamia, with its impressive walls and construction system, it may be a great value to show this site to the public.**

Consequently, the conservation goals are:

- On the short term, to keep the scientific information from one campaign to the other, for the excavators and the future visitors.
- On the mid-term, to prevent vandalism and keep the integrity of the remains to display.
- On the long-term, to continue the scientific activities in parallel with enhancement and site presentation of the different archaeological layers.



### *3.3. State of conservation*

Compared to Girdi Qala, the general shape of the Tell is not so flat. The top has been preserved from agricultural activities, which is not the case on the lower parts (still visible). Since 2017, the upper and middle terraces ceased to be cultivated. The good preservation can be due to the poor accessibility of the site, trapped between two rivers, without any dirt road before the arrival of the archaeologists.

The main trench (D) is exactly situated on the most exposed face to climate threats, mainly wind and rain, coming from the West. The Early Uruk terrace in earth, directly located on the edge of the Tell, is damaged but the material looks in a relatively good condition certainly because of the quality of the clay and the thickness of the structure. The other structures, mainly in stones or burnt clay (walls of the kilns) are in a good condition. Structures such as pavement or staircase are still preserved which is a good indicator of the building technique quality, and by extension here, of the sticky mortar between the stones.

Three main threats have been noticed here:

- First, leaving the remains without any protection and considering the weather conditions is significantly weakening the original material. Even if the structure and the inner materials are good, runoff waters create gullies and holes, and the earthen material loses the finest particles that allow the whole to stick: clays.
- Moreover, the integrity of the drainage system has been lost with time and worsened by the excavations. Rooms and holes are dug without any evacuation system so water is pooling and damaging the archaeological levels. In some areas, the excavation is deep and goes under the stone masonry, which can create undercuts and collapses. To ensure security on site, the water drainage system must be a priority.
- Finally, vandalism has been noticed here, in a place where the accessibility with a vehicle is not easy. Consequently, it is assumed that the administrative status of the site is a direct threat to the sustainability of the conservation.

### *3.4. Activities during the mission*

#### *Documentation*

To understand the complex sequence of archaeological levels as well as the intentions about conservation, readings and interviews were undertaken during the mission. The schematic interpretation presented above is the result of this work, for conservation and valorization purposes.

#### *Monitoring*

Photographic comparisons were done with our own pictures of 2017's visit, and between the beginning and end of each mission. Aerial photos of before and after each campaign were collected. A quick layout of the water drainage system was drawn, showing the main pools, to be compared in the future (see Annex below).

#### *Material and capacity research*

Soil from the spoil material of this campaign was tested on the field and showed a good consistency for conservation and reuse purposes. More samples and more tests need to be done to confirm its technical and aesthetical compatibility.

#### *Backfilling*

Assistance was given to the backfilling of the main noticeable walls. Jute membrane (or burlap cloth) was bought in the market to be used as a geotextile. A natural fiber coat preserves the hygrometric transfer between the layers and helps in the soil removal for the next season. No mechanical compaction

was done on the top, there was no appropriate tool available, but the convex shape of the added material should drain the runoff waters away from the top of the backfilled structures (Fig. 6).



*Fig. 6 – Logardan 2019 Preventive conservation. © CRAterre C. Sadozai 2019*

#### 4. CONDITION ASSESSMENT OF GIRDI QALA

##### 4.1. Previous conservation measures

Trench C, which is on the southwestern side of the Main Mound and no longer excavated, has been partially reburied with plastic tarps and soil. Trench D on the North Mound is no longer exploited either. Since 2017, a rent is paid by the mission to the farmers to stop cultivating the hold of the Uruk occupation (1 ha), which covers part of the North mound.

For the excavations of the main trench (B), the methodology is to avoid engraving the joints between the bricks and lay down stones on the top of the Hellenistic wall. This helps to reduce decay processes in between the excavation campaigns.

A guard is continuously present on site (day and night) during the excavation, and while the archaeologists are away, a person is paid to monitor the site along with agents of the Antiquities

(monthly visits). Discussions were here also conducted with the peasants and the local representatives in order to stop agricultural activities temporarily. It has been effective since 2017 and the mission pays a rent to the farmers.

#### *4.2. Conservation strategy*

The excavations' objective in this area is to have a full stratigraphic trench, which involves the destruction of current layers to go deeper and deeper every year.

Consequently, the conservation goals are:

- On short term, to keep the scientific information from one campaign to the other, for the excavators.
- On mid-term, to prevent vandalism.
- On long term, possibly to display the accumulation of archaeological layers.

#### *4.3. State of conservation*

The general shape of the Main Mound, very flat at the top, is certainly the result of an anthropic leveling. Traces of agricultural equipment are still visible on the surface; it gives testimonies of the exploitation of the site during recent times and explains its flatness.

Moreover, the main trench is facing west, directly exposed to the dominant wind. The very bad state of conservation of the upper layers' bricks can be explained by the reuse of material already eroded (fine particles such as clay), the exposure after the abandonment of the structures, the anthropic activities after, and again the natural erosion. The archaeological excavations can increase the phenomenon, if no protection is planned.

### 5. CONCLUSIONS AND RECOMMENDATIONS

- There is not much architecture entirely made of earth remaining. Most of the buildings discovered that will be presented to the public are made of stones, laid with clay mortars. The upper parts of the wall may have been in earth but disappeared. Some interesting features such as pottery kilns are made of earth, but slightly fired by their use.
- Ancient levels remains are in a very good state of preservation, because of a difficult access for agricultural purposes (Logardan) or recently excavated (Girdi Qala). To conserve them on the long-term, preventive conservation is necessary.
- Recent levels remains are in a bad state of preservation, difficult to preserve.
- The present administrative status of both sites is a threat for their physical preservation.
- Legal protection from the Heritage authorities could easily avoid vandalism.
- Archaeologists from abroad and local partners need to reinforce their capacities in preventive conservation and training to respect international standards.
- A monitoring methodology can be easily implemented to better understand the speed of deterioration and the decay processes.
- For long-term conservation, a program of maintenance needs to be ensured.
- As this program is still in its beginnings, it is recommended to conduct in parallel excavations and conservation, to prevent risks related to water management and allow a clear understanding of the site for the visitors.

#### *Recommendations to improve preventive conservation*

- Before excavating: prepare a water drainage strategy (avoid creation of areas where water will be concentrated and cannot be drained, especially if expected levels are going beneath walls masonry).



- During excavations: manage spoil material as a raw material for conservation purposes.
- Between two campaigns: cover the bottom of a pool and the top of fragile walls with geotextile or burlap cloth (or jute called “guni” in the market) and a layer of compacted soil; make or buy a rammer for compacting soil (Fig. 7).



Rammer in wood for rammed earth construction (Ladakh, India)



Rammer in metal for pathway compaction (Hili, United Arab Emirates)



Burlap cloth in the market (Chemchemal, Iraqi Kurdistan)

*Fig. 7 – Burlap cloth and rammers. ©CRAterre. S. Moriset and C. Sadozai 2018-2019.*

### *Recommendations for the site presentation of Logardan*

- Organize a meeting with local and international stakeholders to identify the values of the site and determine a strategy for conservation.
- **Improve the access of the site. The building of a road or a good stabilized track and a small bridge on the Tchashma Spi River are essential to ensure good protection of the site in the future.**
- Compare grain size distribution between original material / spoil material / surroundings material (near the two streams) to find the appropriate material for consolidation.

### ANNEX: LAYOUT OF WATER STAGNATION IN LOGARDAN AFTER 2019 EXCAVATIONS

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## APPENDIX A

### RADIOCARBON DATING

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**E**ight samples, charcoal and grains, were analyzed in 2019, two from Logardan Trench D (FL.64 and 99), two from Logardan Trench E (FL.53 and 100), two from Girdi Qala Trench D (Ech 1396.2 and 1522.1) and two from Girdi Qala Trench B (FL 18 and 23).

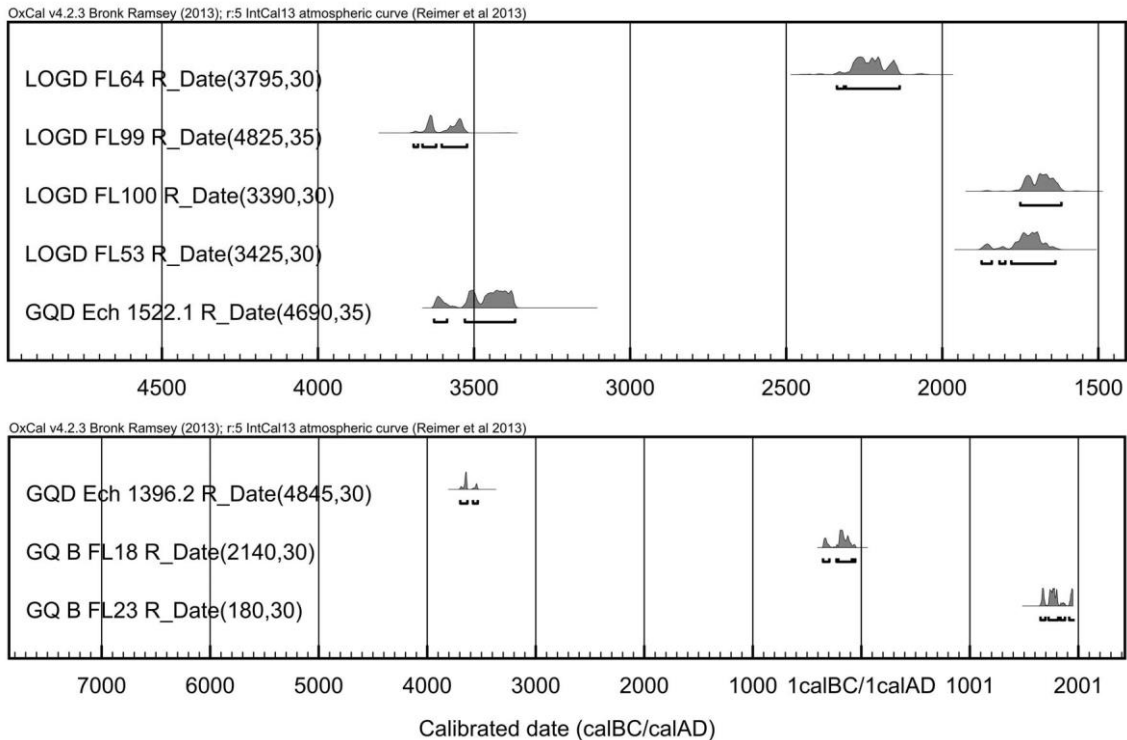
- FL.64 is Barley Gr. (*Hordeum vulgare* subsp. *vulgare*) coming from a charcoal layer in a corridor (Loc. 1008) of Log. D Level 3d (ED IIIB);
- FL.99 is Cerealia spp. coming from an internal floor (Loc. 652) of Log. D Level 4A (early Middle Uruk);
- FL.53 is a piece of *Lathyrus Sativus* coming from a tannur (NV 1608) of Log. E Level IB (early Late Bronze Age);
- FL.100 is Barley Gr. (*Hordeum vulgare* subsp. *vulgare*) coming from a floor (Loc. 2325) of Log. E Level IB (early Late Bronze Age);
- Ech.1396.2 is Cerealia coming from a floor (Loc. 350) of GQ D Level 4B (Middle Uruk);
- Ech.1522.1 is Cerealia coming from the filling of the channel (Loc. 386) of GQ D Level 2a2 (late Middle Uruk);
- FL.18 is Barley Gr. (*Hordeum vulgare* subsp. *vulgare*) coming from a tannur (Loc. 210) of GQ B Level 6 (Hellenistic);
- FL.23 is Barley Gr. (*Hordeum* type *spontaneum*) coming from a domestic silo (NV 1324) of GQ B Level 1 (Late Islamic);

All dating is consistent with the stratigraphic provenance of the samples, although FL.64 is slightly later than expected.

<i>Sample name</i>	<i>Lab. no.</i>	<i>Age 14C</i>	<i>Remark</i>
LOGD FL64	Poz-120357	<b>3795 ± 30 BP</b>	
LOGD FL99	Poz-121065	<b>4825 ± 35 BP</b>	
LOGD FL53	Poz-120480	<b>3425 ± 30 BP</b>	
LOGD FL100	Poz-120478	<b>3390 ± 30 BP</b>	+ res B
GQD Ech 1396.2	Poz-120482	<b>4845 ± 30 BP</b>	
GQD Ech 1522.1	Poz-120481	<b>4690 ± 35 BP</b>	
GQ B FL18	Poz-121062	<b>2140 ± 30 BP</b>	+ res B
GQ B FL23	Poz-120400	<b>180 ± 30 BP</b>	



## RESULTS OF CALIBRATION OF 14C DATES



Given are intervals of calendar age, where the true ages of the samples encompass with the probability of ca. 68% and ca. 95%. The calibration was made with the OxCal software.

OxCal v4.2.3 Bronk Ramsey (2013); r:5  
IntCal13 atmospheric curve (Reimer et al 2013)

LOGD FL64 R\_Date (3795, +/-30 BP uncal.) *Log D LvL 3D (ED IIIB)*

68.2% probability

2287BC (60.3%) 2198BC

2165BC ( 7.9%) 2151BC

95.4% probability

2338BC ( 2.1%) 2316BC

2310BC (93.3%) 2137BC

LOGD FL99 R\_Date (4825,35) *Log D LvL 4A (early Middle Uruk)*

68.2% probability

3653BC (30.9%) 3631BC

3578BC ( 3.0%) 3574BC

3565BC (34.3%) 3536BC

95.4% probability

3694BC ( 2.2%) 3680BC

3666BC (37.5%) 3622BC

3604BC (55.7%) 3523BC

LOGD FL53 R\_Date (3425,30) *Log E Lvl IB (early Late Bronze)*  
68.2% probability  
1765BC (68.2%) 1685BC  
95.4% probability  
1875BC ( 7.9%) 1842BC  
1817BC ( 2.8%) 1799BC  
1780BC (84.7%) 1638BC

LOGD FL100 R\_Date (3390,30) *Log E Lvl IB (early Late Bronze)*  
68.2% probability  
1737BC (19.5%) 1715BC  
1696BC (48.7%) 1643BC  
95.4% probability  
1751BC (95.4%) 1619BC

GQD Ech 1396.2 R\_Date (4845,30) *GQ D Lvl 4B (Middle Uruk)*  
68.2% probability  
3660BC (56.3%) 3633BC  
3553BC (11.9%) 3540BC  
95.4% probability  
3696BC (73.0%) 3630BC  
3579BC (22.4%) 3535BC

GQD Ech 1522.1 R\_Date (4690,35) *GQ D Lvl 2a2 (late Middle Uruk)*  
68.2% probability  
3519BC (15.1%) 3496BC  
3461BC (53.1%) 3376BC  
95.4% probability  
3629BC (12.4%) 3587BC  
3530BC (83.0%) 3369BC

GQ B FL18 R\_Date (2140,30) *GQ B Lvl 6 (Hellenistic)*  
68.2% probability  
345BC (11.0%) 322BC  
206BC (42.2%) 149BC  
141BC (15.0%) 112BC  
95.4% probability  
353BC (19.5%) 295BC  
230BC (1.5%) 220BC  
213BC (71.2%) 88BC

GQ B FL23 R\_Date (180,30 BP) *GQ B Lvl 1 (Late Islamic)*  
Warning! Date probably out of range  
68.2% probability  
1667AD (11.7%) 1683AD  
1735AD (33.9%) 1784AD  
95.4% probability  
1652AD (19.1%) 1696AD  
1726AD (51.9%) 1815AD












APPENDIX B  
FINDINGS LIST







**Excavations at Girdi Qala (GQ) and Logardan (LOG) 2019 تنقيبات**  
**Findings - Small Objects and Pottery**

الصورة او رسم Photo or drawing	الوصف description	رقم المعثر locus no	القياسات dimensions	مادة الأثر material	نوع الأثر kind of object	الرقم Code
	Incomplete, conical Logardan, trench E Sub-surface Middle Uruk?	Sub- surface, 2316	L. 5,5 cm Dmax. 2.3 cm Dmin. 1.6 cm	Clay	Architectural decoration cone (fragment)	LogE. Tc17 23.1
	Incomplete, conical Logardan, trench E Sub-surface Middle Uruk?	Sub- surface, 2316	L. 4,1 cm Dmax. 1.3 cm Dmin. 0.9 cm	Clay	Architectural decoration cone (fragment)	LogE. Tc17 23.2
	Incomplete, round, central perforation  Logardan, trench E Sub-surface Halaf	2323	Diam. 4 cm W. 1 cm	Clay	Spindle Whorl	LogE. Tc17 26.2
	Head of a bird, brown paint  Logardan, trench E Sub-surface Halaf	2322	H. 3 cm W. 2.7 cm	Clay	Zoomorphic Figurine (incomplete)	LogE. Tc17 29.2








	<p>Bull?, Animal front leg, brown paint</p> <p>Logardan, trench E Sub-surface Halaf</p>	<p>2323</p>	<p>H. 4,2 cm W. 4,2 cm</p>	<p>Clay</p>	<p>Zoomorphic Figurine (incomplete)</p>	<p>LogE. Tc17 26.1</p>
	<p>Incomplete, dome-shaped</p> <p>Logardan, trench E Sub-surface</p>	<p>2322</p>	<p>H. 1,6 cm Diam. 3,4 cm</p>	<p>Clay</p>	<p>Loom Weight</p>	<p>LogE. Tc17 29.1</p>
	<p>Incomplete stone ring</p> <p>Logardan, trench E Sub-surface</p>	<p>Sub-surface, 2316</p>	<p>Diam. 3 cm H. 0,7 cm W. 0,4 cm</p>	<p>Stone</p>	<p>Ring</p>	<p>LogE. P172 3.1</p>
	<p>Fragmentary chariot wheel, edges completely broken</p> <p>Logardan, trench E Sub-surface</p>	<p>Sub-surface, 2316</p>	<p>Diam.(preserved) 3,8 cm W. 3,1 cm</p>	<p>Clay</p>	<p>Model chariot wheel</p>	<p>LogE. Tc17 16.1</p>
	<p>Fragmentary globular miniature pot</p> <p>Logardan, trench E Sub-surface</p>	<p>Sub-surface, 2330</p>	<p>Diam. 2,4 cm H. 2,2 cm</p>	<p>Clay</p>	<p>Miniature pot</p>	<p>LogE. Tc17 36.1</p>
	<p>Two round tokens</p> <p>Logardan, trench E</p>	<p>2002</p>	<p>Diam. 1,5 cm W. 0,3 cm Diam. 1,2 cm W. 0,1 cm</p>	<p>stone</p>	<p>Tokens</p>	<p>LogE. P157 4.1</p>

	Incomplete, ovoid, central perforation Logardan, trench D Level 3c/3d Early Dynastic III	Pièce 1006	L. 6,2 cm W. 4 cm H. 0,6 cm	Clay	Spindle Whorl (Token?)	LogD .Tc59 0.7
	Fragmentary chariot wheel, edge broken in places. Logardan, trench D Level 3c/3d ED III - Akkad	On paving 1014	Diam. 7 cm H. 4,1 cm	Clay	Model chariot wheel	LogD .Tc60 3.1
	Fragmentary chariot wheel, edge mostly broken. Logardan, trench D Level 3c ED III- Akkad	Wall 1064	Diam. Preserved 6,4 cm H. 4 cm	Clay	Model chariot wheel	LogD .Tc66 8.1
	Bull ?, head, tail and lower part of legs broken. Logardan, trench D Level 3d ED III	Staircase 1002	L. 8 cm W. 3,4 cm H. 5,5 cm	Clay	Zoomorphic figurine	LogD .Tc57 2.1
	Bull ?, head, front part of the body and legs broken. Logardan, trench D Level 3d ED III	Staircase 1013	L. 7,1 cm W. 3,1 cm H. 3,5 cm	Clay	Zoomorphic figurine	LogD .Tc58 9.3
	Complete, bird Logardan, trench D Level 3d ED III	Access 1016	L. 3,3 cm W. 1,7 cm H. 3,5 cm	Clay	Bird pendant	LogD .Tc58 4.1






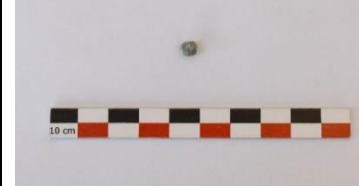


	<p>Incomplete, round, central perforation. Logardan, trench D Level 3d ED III</p>	<p>Paving 1075</p>	<p>Diam. 4,6 cm W. 0,9 cm</p>	<p>Clay</p>	<p>Spindle Whorl</p>	<p>LogD .Tc62 7.3</p>
	<p>Complete, ovoid, grooved Logardan, trench D Level 4a Uruk</p>	<p>Acces 1015</p>	<p>L. 4 cm W. 3,4 cm H. 1,4 cm</p>	<p>Stone</p>	<p>Weight</p>	<p>LogD .Tc62 7.3</p>
	<p>Bronze nail, ovoid section. Logardan, trench D Level 3d ED III</p>	<p>Room 1006</p>	<p>L. 4,8 cm W. 0,5 cm</p>	<p>Bronze</p>	<p>Nail</p>	<p>LogD .Met 608. 2</p>
	<p>Bronze needle, round section. Logardan, trench D Level 3d ED III</p>	<p>Room 1006</p>	<p>L. 6,5 cm Diam. 0,1 cm</p>	<p>Bronze</p>	<p>Needle</p>	<p>LogD .Met 608. 1</p>
	<p>Almost complete, miniature pot. Logardan, trench D Level 3d ED III</p>	<p>Staircase 1013</p>	<p>H. 3,6 cm Diam. 2,4 cm</p>	<p>Ceramic</p>	<p>Pot</p>	<p>LogD .Tc58 9.2</p>
	<p>Fragmentary small goblet with sinuous profile and round base. Logardan, trench D Level 3d ED III</p>	<p>Staircase 1013</p>	<p>H. 7 cm Diam. 6 cm</p>	<p>Ceramic</p>	<p>Goblet</p>	<p>LogD .Tc58 9.1</p>

	<p>Incomplete sieve.</p> <p>Logardan, trench D Level 3b ED III - Akkad</p>	<p>Paving 1075</p>	<p>H. 3,6 cm Diam. 8,1 cm</p>	<p>Ceramic</p>	<p>Sieve</p>	<p>LogD .Tc65 7.1</p>
	<p>Almost complete cylindrical stand (restored).</p> <p>Logardan, trench D Level 3b EDIII - Akkad</p>	<p>Kiln 1005</p>	<p>Diam. rim 16 cm Diam. base 13 cm H. 15 cm</p>	<p>Ceramic</p>	<p>Pot-stand, with hand modeled rim</p>	<p>LogD .Tc59 5.1</p>
	<p>Almost complete cylindrical stand (restored). Logardan, trench D Level 3b EDIII - Akkad</p>	<p>Kiln 1005</p>	<p>Diam. rim 13 cm Diam. base 15 cm H. 14 cm</p>	<p>Ceramic</p>	<p>Pot-stand, with hand modeled rim</p>	<p>LogD .Tc59 5.2</p>
	<p>Complete cylindrical stand. Logardan, trench D Level 3b EDIII - Akkad</p>	<p>Kiln 1005</p>	<p>Diam. rim 13 cm Diam. base 12 cm H. 12,8 cm</p>	<p>Ceramic</p>	<p>Pot-stand, with hand modeled rim</p>	<p>LogD .Tc59 5.3</p>
	<p>Complete cylindrical stand. Logardan, trench D Level 3b EDIII - Akkad</p>	<p>Kiln 1005</p>	<p>Diam. rim 13 cm Diam. base 13 cm H. 15 cm</p>	<p>Ceramic</p>	<p>Pot-stand, with hand modeled rim</p>	<p>LogD .Tc59 5.4</p>

	Complete staple, rectangular section. Girdi Qala B, Level 1 Late Islamic	Floor 247	L. 8,5 cm W. 3,8 cm H. 0,3 cm	Iron?	Staple	GQB. Met1 272. 1
	Fragmentary ring. Girdi Qala, trench B Level 1 Islamic level	Wall 279	Diam. 1,6 cm H. 0,9 cm W. 0,2 cm	Copper alloy	Ring with 3 circular cavities decoration	GQB. Met1 341. 1
	Complete diamond-shaped Iron arrowhead. Girdi Qala, trench B Islamic period	Surface	L. 8,5 cm W. 1,5 cm H. 0,3 cm	Iron	Arrowhead	GQB. Met1 268. 1
	Complete iron needle, round section. Girdi Qala B, Level 1 Late Islamic	Foundation trench of the defensive wall 238	L. 13,8 cm W. 0,4 cm	Iron	Needle, with a square needle eye section	GQB. Met1 304. 1
	Complete spoon Girdi Qala, trench B Islamic period	Outside of the defensive wall 238	L. 16,5 cm W. 1,6 cm	Copper alloy	Spoon	GQB. Met1 289. 1
	Incomplete blade Girdi Qala, trench B Islamic period	Outside of the defensive wall 238	L. 3,4 cm W. 1,1 cm H. 0,2 cm	Iron	Blade	GQB. Met1 289. 2
	Half silver coin Girdi Qala, trench B Level 1 Islamic level	Foundation trench of the defensive wall 238	Diam. 2,3 cm H. 0,1 cm	Silver	Coin without inscription or figuration	GQB. Met1 304. 2







	Almost complete coin  Girdi Qala, trench B Level 1 Islamic level	Floor 246	Diam. 1,8 cm H. 0,3 cm	Copper alloy	Coin without inscription or figuration	GQB. Met1 296. 1
	Square head nail  Girdi Qala, trench B Islamic period	Outside of the defensive wall 238	L. 3,2 cm W. 0,4 cm Head 1,7 cm x 1,3 cm	Iron	Nail	GQB. Met1 300. 1
	Fragment of glass bangle, Dark green. Girdi Qala B, Level 1 Late Islamic	Floor 272	L. 4,9 cm Diam. 0,6 cm	Glass	Bangle (fragment)	GQB. V134 4.1
	Fragment of green glass.  Girdi Qala, trench B Late Sassanian		L. 6,1 cm W. 4,1 cm H. 0,5 cm	Glass	Bottle fragment blown into a mold	GQB. V126 6.1
	Fragment of green glass.  Girdi Qala, trench B Late Sassanian	Outside of the defensive wall 238	L. 2,2 cm W. 1,5 cm H. 0,1 cm	Glass	Vessel	GQB. V127 2.1
	Complete bead. Girdi Qala, trench B Level 1 Islamic level	Floor 247	L. 0,5 cm Diam. 0,5 cm	Glass paste	Bead	GQB. Coq1 276. 1

	<p>Complete cylindrical bead. Girdi Qala, trench B Level 1 Islamic level</p>	<p>Floor 268</p>	<p>L. 0,6 cm Diam. 0,8 cm</p>	<p>Baked clay</p>	<p>Bead</p>	<p>GQB. Tc13 14.1</p>
	<p>Complete round bead  Girdi Qala, trench B Islamic period</p>	<p>Outside of the defensive wall 238</p>	<p>Diam. 0,6 cm</p>	<p>Clay</p>	<p>Bead</p>	<p>GQB. Tc12 89.1</p>
	<p>Round token, cut from a potsherd  Girdi Qala, trench B Level 1 Islamic period</p>	<p>Floor of the 2<sup>nd</sup> room of the level 1 building</p>	<p>Diam. 2,5 cm W. 1,2</p>	<p>Clay</p>	<p>Token</p>	<p>GQB. Tc13 05.1</p>








## APPENDIX C EXPORTED SAMPLES






### QARA DAGH (LOGARDAN AND GIRDI QALA) MISSION AUTHORISATION FOR EXPORT OF SAMPLES – SEASON 2019

Qty	Description	Sample no.	Provenance	PHOTO
1 Bag 1 Tube	Archaeobotanical sample	#FL.16	Girdi Qala D	
1 Bag 6 Tubes	Archaeobotanical sample	#FL.17	Girdi Qala D	
1 Bag 39 Tubes	Archaeobotanical sample	#FL.18	Girdi Qala B	
1 Bag 3 Tubes 1 Minibox 1 Bag containing 1 Tube	Archaeobotanical sample	#FL.23	Girdi Qala B	













<p>1 Bag 10 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.45</p>	<p>Logardan E</p>	
<p>1 Bag 13 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.46</p>	<p>Logardan E</p>	
<p>1 Bag 5 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.47</p>	<p>Logardan E</p>	
<p>1 Bag 6 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.48</p>	<p>Logardan E</p>	
<p>1 Bag 19 Tubes 1 Minibox</p>	<p>Archaeobotanical sample</p>	<p>#FL.49</p>	<p>Logardan E</p>	


<p>1 Bag 2 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.50</p>	<p>Logardan E</p>	
<p>1 Bag 1 Tube</p>	<p>Archaeobotanical sample</p>	<p>#FL.51</p>	<p>Logardan E</p>	
<p>1 Bag 1 Tube</p>	<p>Archaeobotanical sample</p>	<p>#FL.52</p>	<p>Logardan E</p>	
<p>2 Bags 1 Big Tube 8 Tubes 2 Miniboxes 1 Bag containing [4 Tubes and 1 Minibox]</p>	<p>Archaeobotanical sample</p>	<p>#FL.53</p>	<p>Logardan E</p>	
<p>1 Bag 5 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.54</p>	<p>Logardan D</p>	

<p>1 Bag 5 Tubes 1 Minibox</p>	<p>Archaeobotanical sample</p>	<p>#FL.55</p>	<p>Logardan D</p>	
<p>1 Bag 29 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.56</p>	<p>Logardan D</p>	
<p>1 Bag 28 Tubes 1 Minibox</p>	<p>Archaeobotanical sample</p>	<p>#FL.57</p>	<p>Logardan D</p>	
<p>1 Bag 23 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.58</p>	<p>Logardan D</p>	
<p>1 Bag 6 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.59</p>	<p>Logardan E</p>	



<p>1 Bag 23 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.60</p>	<p>Logardan D</p>	
<p>1 Bag 12 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.61</p>	<p>Logardan E</p>	
<p>1 Bag 16 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.62</p>	<p>Logardan E</p>	
<p>1 Bag 36 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.63</p>	<p>Logardan D</p>	
<p>1 Bag 33 Tubes 1 Bag containing 1 Tube</p>	<p>Archaeobotanical sample</p>	<p>#FL.64</p>	<p>Logardan D</p>	

<p>1 Bag 23 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.65</p>	<p>Logardan D</p>	
<p>1 Bag 28 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.68</p>	<p>Logardan D</p>	
<p>1 Bag 23 Tubes</p>	<p>Archaeobotanical sample</p>	<p>#FL.69</p>	<p>Logardan D</p>	
<p>1 Bag 10 Tubes 1 Bag containing 1 Tube</p>	<p>Archaeobotanical sample</p>	<p>#FL.99</p>	<p>Logardan D</p>	
<p>1 Bag 2 Tubes 2 Bags containing 1 Tube</p>	<p>Archaeobotanical sample</p>	<p>#FL.100</p>	<p>Logardan E</p>	

26 Bags	Archaeobotanical sample	#FL.66 #FL.67 #FL.71 #FL.72 #FL.73 #FL.74 #FL.75 #FL.76 #FL.77 #FL.78 #FL.79 #FL.80 #FL.81 #FL.82 #FL.83 #FL.84 #FL.85 #FL.86 #FL.87 #FL.88 #FL.89 #FL.90 #FL.91 #FL.92 #FL.93 #FL.94	Logardan D	
1 Bag	Phytoliths sample	#PH.1	Logardan D	