

LOGARDAN TRENCH D: STRATIGRAPHY AND ARCHITECTURE

Johnny Samuele Baldi, Hugo Naccaro and François Bridey

The excavations have been carried-out during four weeks between September 16th and October 12th in the aim to better understand the planimetric organization of the structures identified during the 2016 campaign on the western edge of the site. For this purpose, the trench has been considerably widened towards south and southeast, where several recent large illegal excavations have badly disturbed the top of the hill. The entire currently excavated area exceeds 400 m² on four main architectural levels, with a height difference of about 6 m between the surface and the deepest vestiges (Fig. 1). Many questions remain open and can be answered only in the coming years. Nevertheless, the main chronological phases recognized during the 2016 campaign (between the beginning of the 4th and the second half of the 3rd millennium BC) have been confirmed in 2017, and they are now much better known as far as both their stratigraphic evolution and their spatial development.



Fig. 1 - View of Trench D at the end of the 2017 campaign.

LEVEL 4

Level 4 is represented by three distinct architectural phases of a monumental complex dating from Early Uruk and beginning of Middle Uruk (Fig. 2). In 2017, excavations focused mainly on Levels 1-3, but compared to the 2016 campaign an additional architectural Level has been recognized in Level 4 and the architectural and stratigraphic development of the Early Uruk complex has been studied more in details. As already stressed in 2016, it is the first time that in northern and central Mesopotamia monumental buildings are associated to early 4th millennium ceramic materials belonging to the Early Uruk south-Mesopotamian

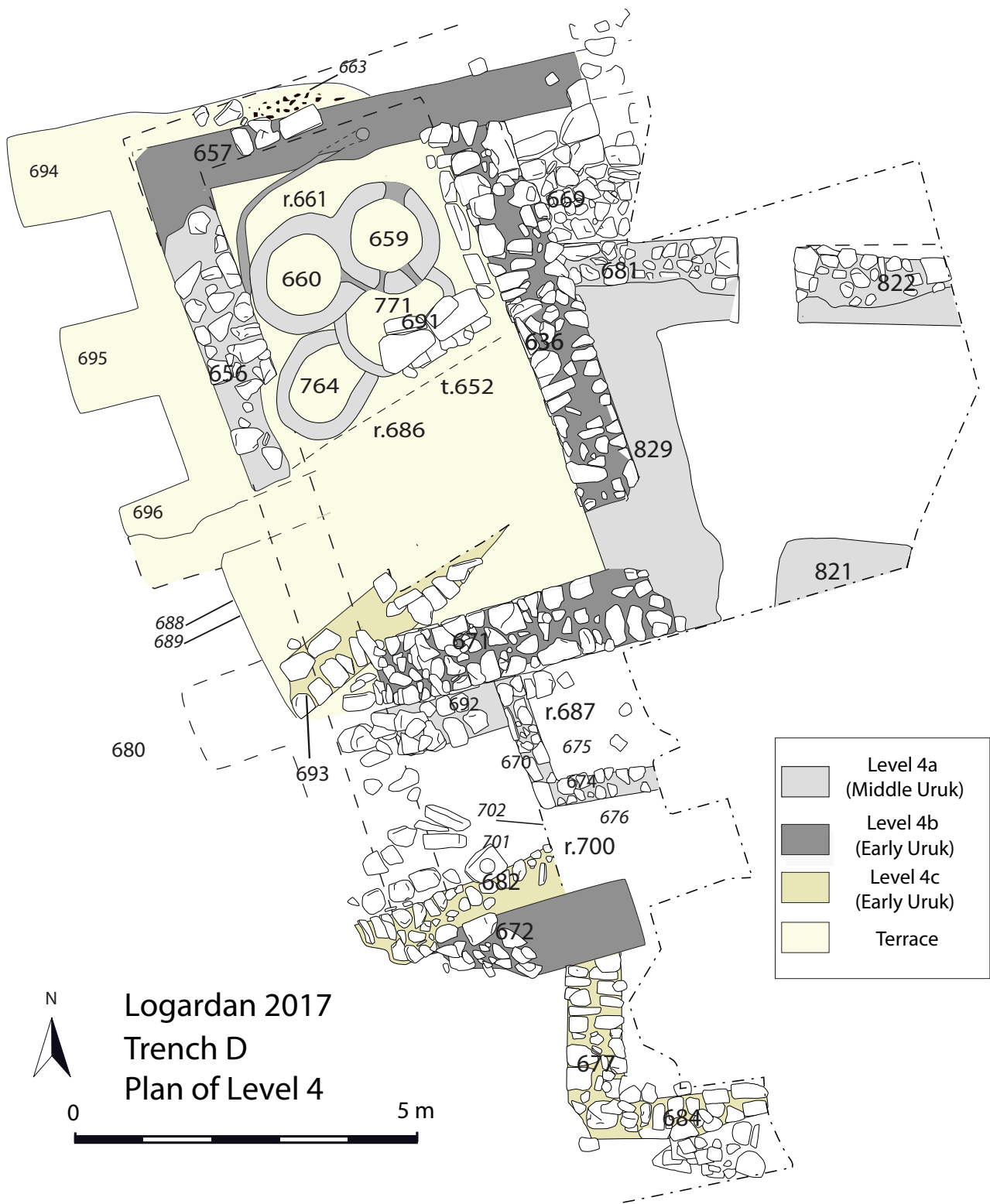


Fig. 2 - Plan of Level 4.

tradition. The northern and western sectors of the complex are severely damaged, both by the reuse of the structures in later levels 3a and 3b, and by the strong erosion on the slopes. Therefore, the enlargement of the excavated surface towards south and east was aimed at better understand the structural organization of the massive architectures.

The first phase (Level 4c) is very little known. First of all, a terrace in mud-bricks (652) has been built on a quite flat floor (688). Some stone walls of this phase (693, 682, 677, 684) have been also identified. But, since for the moment there is no connection between these walls, it is difficult even to state whether they all belong to the same construction stage. In particular, Wall 682 lays at a lower altitude than Wall 693, which is founded on the mud-bricks platform. Walls 677 and 684 are cut through some remains on this same platform in the southern part of the trench. It indicates that some difference existed between the northern sector, where Wall 693 were founded on Platform 652 (Fig. 3), and the southern area, where Walls 677 and 684 were cut through the platform in a deep foundation trench. The reading of all these structures is complicated not only because they are only partially exposed, but also by the fact that, in the sector between Walls 693 and 682, Platform 652 has been completely removed during the phase 4a. However, despite their solid character, all the walls of Level 4c are thinner than the main structures of Levels 4b and 4a, while their orientation does not seem to follow any standardised criteria. It could indicate that, before the construction of the monumental complex in Level 4b, the Early Uruk presence on the western edge of Logardan was characterized by some agglutinated architectures rather than wide planned structures.



Fig. 3 - Wall 673 on Platform 652

During a second phase (Level 4b), the terrace in mudbricks (652) is rebuilt and raised to constitute the base of the west wing of a large complex. The whole platform was partially stripped and rebuilt by replacing 4 layers of bricks. On the western face of Terrace 652 a clear distinction is visible between its basal floor (688) and the base of the four layers of bricks added in Level 4b (Floor 689). The main walls (656, 657, 671 and 636)¹ delineate a rectangular structure, their foundation trenches are dug deep into the ancient stage (Level 4c) of the mud-brick terrace, while the rising of this platform leans against Wall 636 on the eastern side and against Wall 671 to the south². All these walls have a size between 80 cm and 1 m

1. Walls 656 and 657 were observable in their second stage (Level 4a, see below) even if their emplacement and foundation trenches were the same than in Level 4b.
2. This reconstruction of the phases of Platform 652 is still tentative. It could be possible that the second stage (Level 4b) of this terrace continues east of Wall 636 (which, in this case, could be cut through the both phases of the platform). But Level 4 has not yet been reached in the north-eastern sector of Trench D.

thick and are made of large-sized flat stones (Fig. 4). They define the west wing of a roughly north-west – south-east oriented complex. In its southeastern corner, Walls 636 and 671 were not connected because of the presence of a passageway allowing the circulation with the eastern (and not yet excavated) wing of the compound. Moreover, it is still impossible to establish whether, beyond this door and the corner with Wall 671, Wall 636 continues towards the south. Likewise, the kilns of Level 3b have almost completely erased the segment of Wall 656 south of its angle with Wall 671. Indeed, if Walls 656 and 636 do not continue to the south, the monumental complex would consist of two separate buildings. The considerable thickness of wall 671 could also be considered as a clue in this sense. Nevertheless, for the moment, some evidences suggest that it is reasonable to consider the architectural complex as one large edifice. First, even if Wall 656 is not preserved in its southern sector, its foundation trench continues south of the angle with Wall 671. Moreover, in Level 4b, the western façade of the mud-brick terrace was reinforced by a series of regularly spaced large (1,6 m thick) buttresses with a masonry that, starting from Floor 689, is intertwined with Terrace 652³. Despite the erosion of the slope, a slight trace of one of these buttresses has been identified exactly where Wall 656 probably formed an angle with the first stage of Wall 672, which thickness and orientation are the same than Wall 671. Not only the presence of a buttress at this place would be coherent from an architectural point of view, but it also respects the regular distance between the buttresses. Therefore, it seems that, for the moment, the complex can be interpreted as a bi-partite building.



Fig. 4 - Stone walls 671 and 636, from the South.

To the north, the main room of the west wing (686) has an internal size of about 7 m x 3,5 m. The structures of Level 3, especially the stone pavement 673 made reusing the masonry of Wall 656 (see below), have erased any kind of floor of Room 686. However, an external floor (663, associated to the foundation trench of Wall 657) laying on Terrace 652 and connected to the building has been identified north of Wall 657 (Baldi, Naccaro and Rahoof 2016, fig. 4 p. 24). This one (more specifically) foundation trench of Wall 656 does constitutes the northern façade of the edifice, that continues east of the angle between Walls 657 and 636, demonstrating the existence in Level 4b of an eastern wing of the complex. South of Room 686, the sector between Walls 671 and 672 (first stage) is very poorly known for the Level 4b. The only traces of the mud-brick Terrace 652 identified south of Wall 672 are inherent to the first stage of this platform (Level 4c), while there is no evidence for the rising of the terrace in Level 4b. It could suggest that Wall 672 represents in this phase the southern limit

3. Because of the atmospheric erosion and the very strong slope, it is impossible to know whether a similar renovation also occurred north of wall 657: the mud-brick terrace extends beyond this wall, but any kind of structures (or possible buttresses) on its northern face is lost.

of the architectural complex. Another clue in this sense could be the fact that the foundation trench of Wall 656 does not continue south of its corner with Wall 672. Nevertheless, there is another possible reading. It could be possible that the construction of 3d Level structures (as Terrace 815 and the paved forecourt 683) produced the complete destruction of the second stage of Platform 652 south of Wall 672. This kind of evolution, which seems quite likely, could imply that the southern limit of the complex was since Level 4b the north-east – south-west oriented Wall 833 (Fig. 10), characterized by the same alignment of Walls 671 and 672. In fact, some stones of its foundation trench cut deep in Terrace 652 could suggest that Wall 833 constitutes the southern façade of the Early Uruk building of 4b Level.

In a third moment (Level 4a), the whole complex was restructured. It no longer consists of a single building, but it is rather composed by several agglutinated units with divergent orientations. In the north-eastern area of the complex, Wall 829 is built against Wall 636 (Fig. 5): it has the same orientation and thickness as Wall 636 and forms a 90° angle with wall 671, sealing the door that, in Level 4b, existed between Walls 671 and 636. This north-eastern sector of Trench D, which was the eastern wing of the complex in Level 4b, becomes an independent quadrangular unit, delimited by Walls 821, 822 and 681. This 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), but was separated from Room 686.

Moreover, the orientation of these two spaces diverges significantly: if the alignment of Room 686 remains approximatively the same as in Level 4b, the eastern space appears north south oriented. Wall 681 provides an additional proof in this sense (with 6 layers of stones for 80 cm of preservation in its 4a Level phase): it is connected to Wall 636, but it does not form with it a 90° angle and it is not parallel to Wall 657. The space defined by these three walls (657, 636 and 681) is paved with stones (669) amongst which some in-situ early 4th millennium ceramic materials have been recovered (Baldi, Naccaro and Rahoof 2016, fig. 5 p. 25) (Fig. 6). This paved space (669) played a key-role for the reorganization and reorientation



Fig. 5 - Level 4a - Wall 829 against Wall 636.



Fig. 6 - Level 4a - Paved space 669

of the different units of the complex. Indeed, Space 669 was in continuity with Wall 829, but to put in place its stones, the northern portion of Wall 636 was restructured (Fig. 7) and, in the same way, Wall 657 – the northern limit of the complex – was rebuilt with a slightly different orientation, further north-east – south-west oriented than in Level 4b. Simultaneously, Wall 656 was also rebuilt (with a slightly more north-west – south-east orientation, to form a 90° angle with the new version of Wall 657) according to the same construction technique than Wall 657, namely by using both bricks and large-sized rounded stones. Their masonries, even if solid, are visibly different from stone Walls 636 and 671.



Fig. 7 - Level 4a - restructured portion of Wall 636.



Fig. 8 - Level 4a - kitchen with several ovens, from the East.

The northern portion of Room 686 was occupied by several ovens (first Oven 771, then 764 and finally Ovens 659-660) (Fig. 8). In all probability, they were food installations, as suggested by several bones in their filling layers, by the absence of ceramic slags, as well as by the presence of an important quantity of bowls in this sector (Fig. 9). On the southern side, this space (Room 661) was delimited by a wall (691), parallel to 657 and built in bricks and large stones. Room 661 was probably a kitchen intended for large-scale distributions of food, as indicated not only by the dimensions of the ovens, but also by the fact they have been intensively used. Their intricate ventilation system has been restructured and regularly maintained, with the application of several layers of clay to plaster the cooking chamber and the aeration pipes. The chimneys were stuck in Wall 691 and a funnel (reusing a part of the foundation trench of the first stage of Wall 657) was devoted to evacuate the smoke to the outside. South of Room 661, a door was opened through Wall 656, where in Level 4b there was a buttress (696). It demonstrates that in Level 4a there was no longer any external buttress or pillar.



Fig. 9 - Level 4a - BRB in masonries of Wall 691.

The entire area south of Wall 671 has undergone a dramatic transformation. The 4b Level mud-brick terrace (652) was almost completely dismantled over several layers of bricks without being rebuilt. Wall

672 still exists: it has no foundation trench and simply lays on what was left of Terrace 652 (as at Level 4b). The newly reconstructed Wall 656 no longer continues south of the angle it forms with Wall 671: it means that, in 4a Level, the same separation one can observe between the ancient eastern and western wings of the complex also occurs between its northern and southern portions. Actually, the space between Walls 671 and 672 (Room 700) becomes a transit zone within the compound, partially occupied by a little utilitarian area (Room 687), with a floor (675) covered by some *in-situ* bevelled-rim bowls and delimited by two thin walls (Baldi, Naccaro and Rahoof 2016, fig. 8 p. 27). The first one (670) is perpendicular to Wall 671, while the other one (674) is parallel to the big wall 671. The construction of this closed space dates back to the same period of the construction, along Wall 671, of a solid wall in bricks and stones (692). All these walls laid on Floor 702 without any foundation trench and were associated to an external 8 cm thick grey floor (676) representing the later phase of occupation of Room 700.

Level 4a represents both the last stage dating back to the 4th millennium (Uruk) occupation and a major phase in the evolution of the entire excavated area. The large monumental building of Level 4b no longer exists, replaced by quite small agglutinated units. The thickness of the external walls, their re-orientation according to the topography of the edge of the tell and the circulation inside the complex – with narrow doors through very strong walls – seems to suggest that the complex became a sort of stronghold. In this sense, the location of the external doors (through Wall 656 on the western side and through Walls 681-822 to the north) suggests the existence of a narrow path (to patrol and supply?) on the exterior side, where no easy access could exist because of the extremely steep nature of the slopes.

LEVEL 3

This phase is inherent to a series of activities that occurred after a long hiatus and it marks the transition to the 3rd millennium BC (Fig. 10). First, in Level 3d (Early Dynastic III) the north-eastern sector is separated in two different rooms (825 and 826) by the construction of Wall 820 (Fig. 11). It compartmentalizes 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 reinforced by a stone pillar (832) is settled almost exactly in continuity with Wall 820. Two different clay floors, located at the same altitude, have been recognized respectively in Room 825 and Room 826. Bench 827 and Fireplace 824 were founded on these floors and the entire area has yielded some *in-situ* materials.

After a long hiatus during the second half of the 4th millennium, the reconstruction of the acropolis of Logardan renews the fortified nature of the Uruk structure, with narrow accesses close to the slopes, thick buttressed walls and little rooms. Both the spaces identified in this sector of the complex have a utilitarian nature. On the contrary, in the western Room 661, the alimentary ovens were no longer in function. Some important changes occur in the southern sector. The upper portion of Wall 672 is rebuilt and, on its southern side, a mud-bricks



Fig. 10 - Plan of levels 3d-3c (ED III).

terrace (815) is built to raise the floor (Fig. 12). This one is paved with large-sized stones to cover the entire forecourt (685-683). This paved area, delimited to the south by Wall 833, represents the southern limit of the complex. A large staircase (683) occupies the paved forecourt. All these structures are built according to the orientation of ancient 4th millennium vestiges (as also Walls 677-684 of Level 4c), reused as foundation. Therefore, Staircase 683 is north-south oriented and appears divergent if compared to the rest of the edifice, even if it respects the topography of the tell in this area. The steps of the staircase go east and progressively change their orientation. Some elongated stones form each of them: the first and lower one is perfectly aligned with Wall 672, the second step turns slightly to the east, the third one turns in an even more pronounced way and so on, according to a curved path.



Fig. 11 - Level 3d - Room 825 with two different doors, view from the East.



Fig. 12 - Architectural modification in the southern sector at Level 3d.

The following phase (Level 3c, Early Dynastic III) is represented by the construction, in the western Room 686, of a solid stone staircase (690) (Fig. 13). It is north-east – south-west oriented, according to the orientation of Wall 691 and, above all, according to the northern limit of the room (Wall 657) since Level 4a. Staircase 690 represents the main segment of a path that, from the west slope of the tell and by the door through Wall 656, gives access to the eastern part of the complex allowing to climb over Wall 636. This one was crossed thanks to a chicane-shaped passage: first, the staircase turned south leaning on the stone pillar 831 (stuck in the corner of room 686), then the path went beyond Wall 636 through the area where,

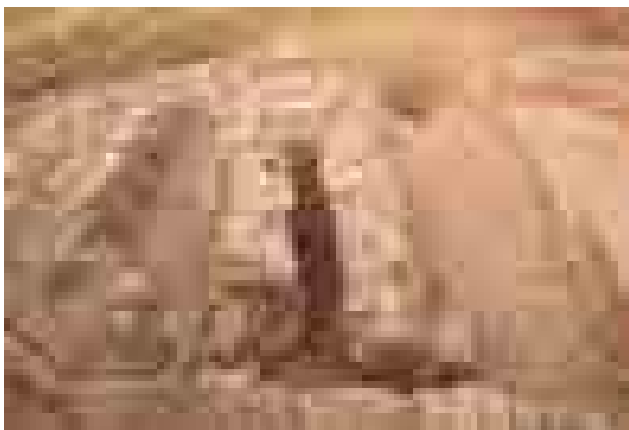


Fig. 13 - Level 3c - Stone staircase 690, from the East.



Fig. 14 - Level 3c - Staircase in chicane-shaped passage.

in Level 4b, there was a door (830) then closed in 4a (Fig. 14). In front of this passage, Wall 829 was used as a threshold to access the eastern unit of the complex. This area was no longer represented by different rooms, but by a single space, delimited by Walls 828 (to the east) and Wall 823 (to the north). In continuity with Wall 823, on the western side of Wall 636 (the northern portion of which is rebuilt in Level 4a) a massive wall (637), almost 1 m wide, was built (incorporating the remains of 4a Level Wall 691) according to the same technique as Walls 828 and 823 (stones and irregular mud-bricks) and orientation of Wall 657 (since its 4a Level stage) and Staircase 690. In the southern sector of the trench, the construction of a thin wall (819) with an orientation that does not fit with other structures indicates a major architectural change in this zone. In the next campaign, it will be necessary to enlarge the excavated area (under the vestiges of Level 2) to better understand the architectural plan in

the southern sector. In the same way, the southern limit of the complex is still represented by Wall 833, against which a very homogeneously paved forecourt is built (818), covering the remains of the earlier 3d Level forecourt (683-685) (Fig. 15).

Later, during the Akkad period, Level 3b (Fig. 16) is represented by an overall reuse of ruins of Level 4 and 3d-c (particularly Walls 671, 672, 636, 637, 823, 828 and the northern part of 656) to structure a huge workshop for firing ceramics. The strong erosion and the very steep slope on the northern and western sides have severely damaged the firing structures, but the architectural and functional organization of the workshop is clear. The firing structures were aligned along the exterior sides of the ruined building



Fig. 15 - Level 3d and 3c - Paved forecourt 818 and Wall 833 (Level 3c) and paved forecourt 685 (level 3d).

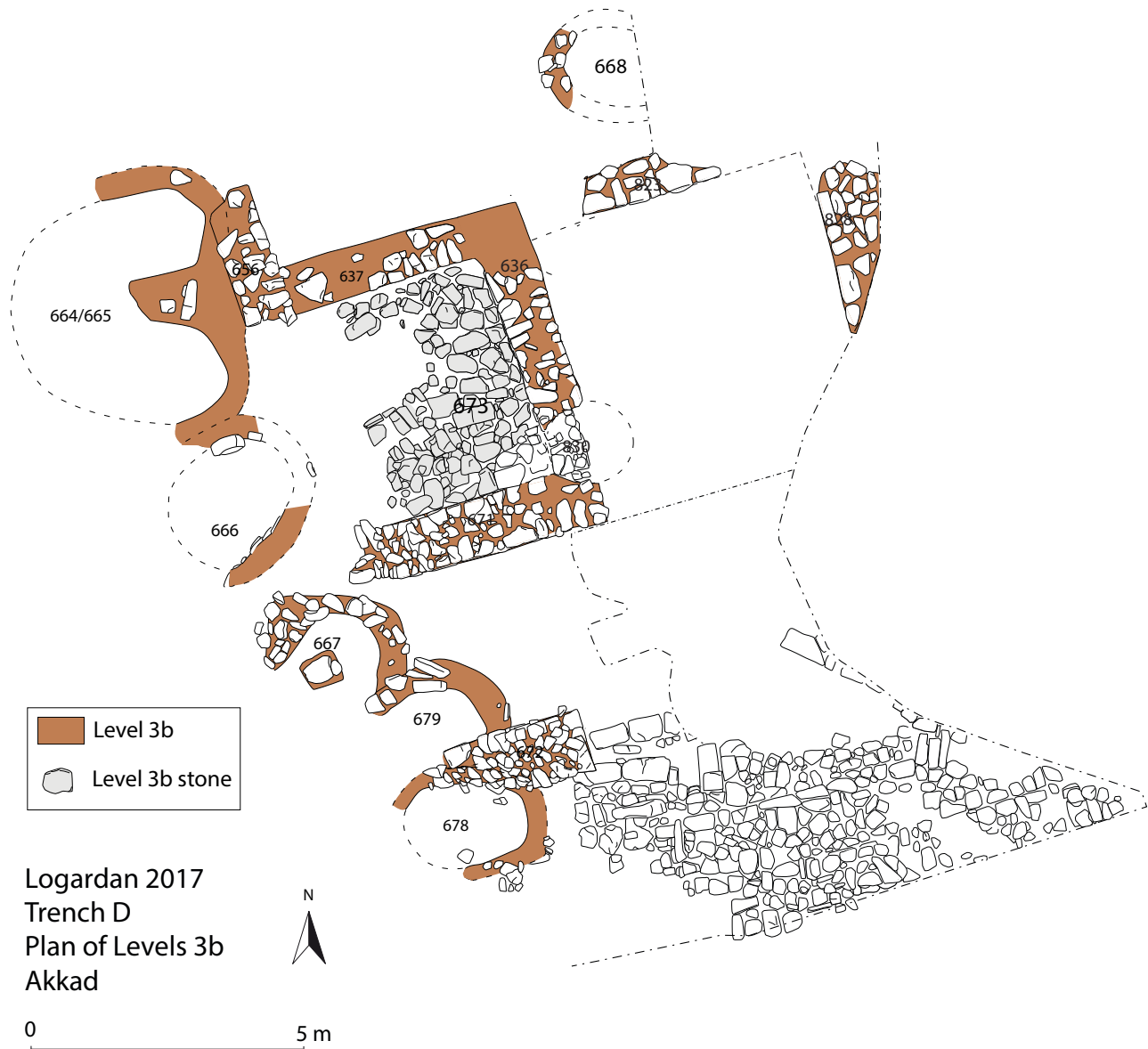


Fig. 16 - Plan of Level 3b.

of Level 4 to facilitate the evacuation of the fumes along the edge of the hill, while inside the ancient building the space was used to manufacture and dry the vessels. To the north, a one chamber oval kiln (668) was associated to a production unit located east of Wall 636. To the west, several kilns (664-665, 666, 667, 678, and 679) were arranged in a row along ancient Wall 656 of Level 4. The ruins of this wall were used to sustain the domed roofs of the kilns. A double dome reusing an external buttress of the Level 4 building covered the largest amongst them (the enormous structure 664-665, with a diameter of about 4 m). In the same way, to the south, Kilns 678 and 679 reused the Wall 672 to sustain their domes. The presence of different typologies of potter's kilns confirms the complexity of the ceramic workshop. Despite their architectural and dimensional differences, furnaces 659, 660, 664-665, 666, 667 and 678 were two-storey up-draught kilns, with a lower partially buried heating chamber and an upper domed firing chamber⁴. On the other hand, kilns 668 and 679 were single chamber firing structures with a domed roof covering a space dedicated to both the fuel and the ceramic materials⁵. East of this row of furnaces, the ruins of the previous level were adapted to define different production units. The space between Wall 671, 636 and 637 was carefully paved with large stones taken from ancient Wall 656 (rebuilt in stones and bricks in Level 4a). Its northern portion was restructured, but the large majority of its stone masonry was reused to build both Wall 637 and stone Floor 673 (Baldi, Naccaro and Rahoof 2016, fig. 13 p. 30). South of this room, between Walls 671 and 672, another production unit had an ashy clay soil. Probably, this architectural difference depends on the different functions of the two units. Indeed, several potter's tools – scrapers, spherical stone pestles and shells – come from the southern space, while some little complete vessels (as the little painted jar LOG_D.243.1) come from the stone-paved northern unit. It could suggest that the southern room was used for operations inherent to the shaping, while the northern space was rather dedicated to finish, dry, decorate and store the pottery.

Level 3a2 (Fig. 17) represents a later occupation occurred after an abandonment of the workshop, dating from Late Akkadian period. When the area was reoccupied, the profile of the hill, determined by the accumulation of the previous structures of Levels 4 and 3d-c-b, was very sloping, towards both the north and the west. Instead of levelling the whole sector, the artisans of Level 3a chosen to adapt their new workshop to the topography: they reused some parts of previous structures and built new kilns respecting the slope. North of Wall 637, a little workspace, with a medium-sized kiln (651), is created. This firing structure is partially recessed into Wall 637: two thin walls (653 and 654) built with recycled materials close a room whose southern corner is formed by Walls 656 and 637. Actually, the upper part of 637 is further restructured in Level 3a2, while the northern portion of Level 4 Wall 656 is the only segment still existing of it. The absence of the Level 4 large walls, which were reused in

4. 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), Khafajah (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).

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

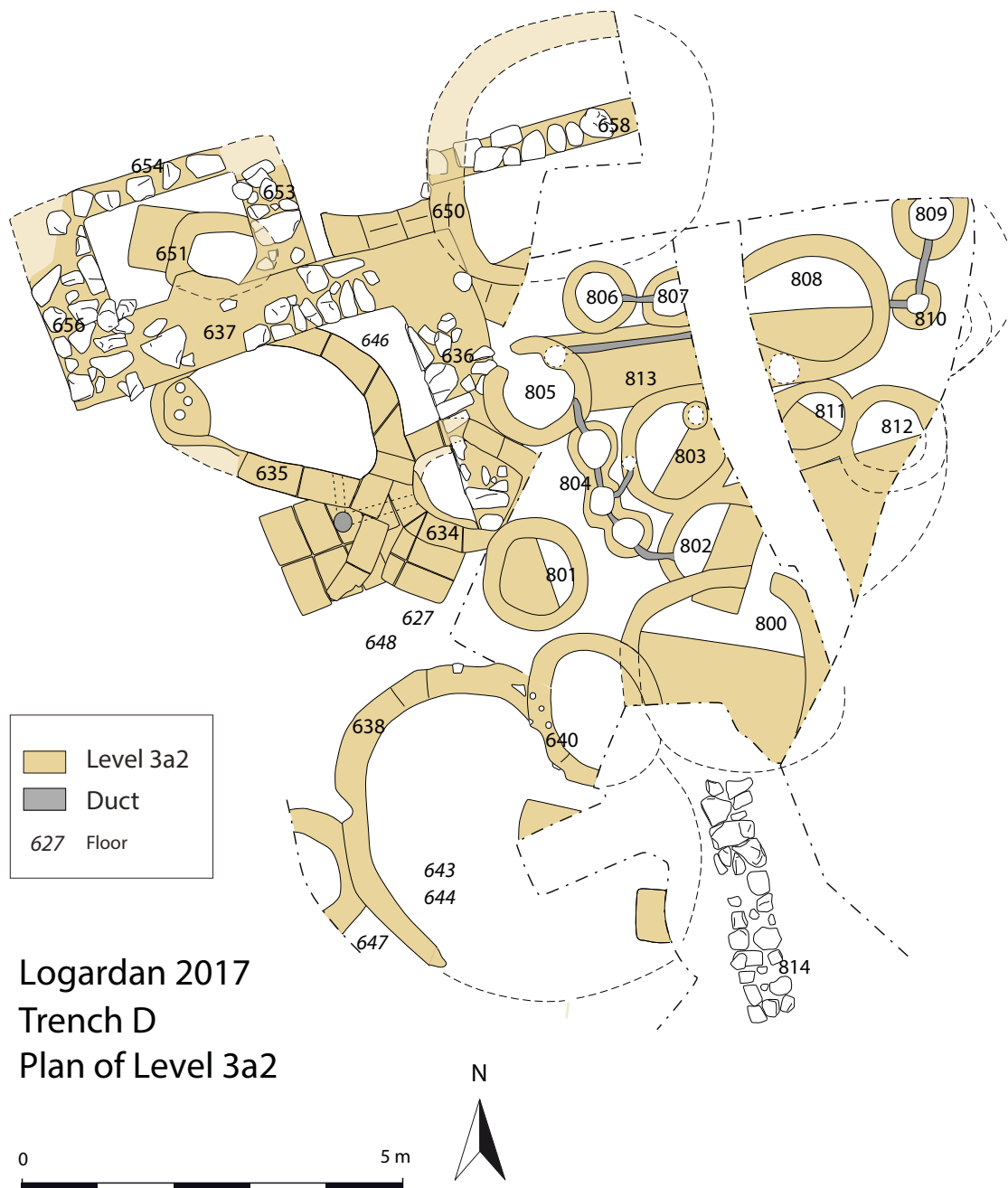


Fig. 17 - Plan of Level 3a2 (Late Akkad).

Level 3b, determines a total change of the previous structural organization of the workshop. To the north, in the area previously occupied by stone Floor 669 and Wall 681, the 3 m large Kiln 650 is associated to a workbench along Wall 637 and uses the corner between Walls 636 and 637 (as well as the ancient Level 4 Wall 681) to sustain its domed roof. This sub-circular structure is built in a sector of the hill where the steep gradient is very strong and the traces of the dome in the eastern section of the trench show that this kiln was about 3.5 m high. It would be a very important size even for a two-storey kiln with two superposed chambers separated by a pierced sole. However, Kiln 650 did not have any sole and its chambers were not perfectly built one on the other, but formed a sort of stairs. A wall (658) runs through the structure and constitutes a 1.30 m high step between the lower chamber and the upper one. Therefore, this firing structure is not an up-draught kiln, but rather a furnace where draught was almost horizontal.

Although with a lower internal slope, the kilns inside the space delimited by walls 636 and 637 were built according with the same criterion on the stone-paved space 673. In this sense, structures as 634 and 635 were not independent furnaces, but parts of one sloping kiln. The oval fireplace 635 was used for the fuel, as indicated by its *praefurnium* pit on the western side. During the firing cycles, the heat rose-up towards Chamber 634, where vessels were stacked on two different levels. In fact, this chamber incorporates a segment of wall 636 using this Level 4 ruin as an internal step to facilitate the draught. On the western side, both the chambers (634 and 635) of this horizontal-draught complex kiln were connected to a bench in mud-bricks built around a vertical chimney that centralizes the evacuation of the smoke. To the south, another structure composed of different chambers (638-640) works in the same way. Combustion began in a western *praefurnium* full of ashes; the fuel was loaded in an oval structure (638), whose floor, hardened and cracked by the heat, has been rearranged several times (internal Floors 643 and 644); then heat attained another higher chamber (640), where vessels were fired. Given the size of the lower chamber (638), it is even possible that several upper firing chambers were connected to it. The two complex furnaces of this workspace (635-634 and 638-640) lay on the same external floor (648), worked during the same period and were abandoned in the same time (as demonstrated by Floor 627, which covers the ruins of this early Level 3a occupation).

The eastern sector of the trench (excavated in 2016) was flatter than the western area. A small figurine was discovered there in secondary context, in the levelling of previous structures (Fig. 18). It was occupied by firing structures built according to the same architectural and technical criterion as the other ones. They were horizontal-draught kilns reusing (where possible) ruins of the previous levels to create an internal step to facilitate the circulation of the heat. It is the case of Kiln 801, a circular structure located in the middle of the trench (and connected to 635-634), that reuses the remains of ancient Wall 636 to arrange an internal bench (Fig. 19). However, where there were no ancient ruins to re-employ, the internal bench was built in mud-bricks, as in the chamber of Kiln 800, the biggest furnace of this sector with a diameter of about 3 m. From a technical point of view, internal benches are the essential equipment of this kind of horizontal-draught kilns. Nevertheless, from an architectural point of view, their construction does not depend simply on a structural logic concerning every single furnace: it rather obeys a criterion of connection and integration of the various firing



Fig. 18 - Level 3 - Equid figurine, with mane and tail (Tc387).



Fig. 19 - Level 3a2 - Kiln 801 with its internal bench.

structures within the workshop. In this sense, the internal bench of large Kiln 800 does constitute not only its inner step to enable the draught, but it also constitutes a connection between Kilns 800 and 640 (namely the upper chamber of the complex structure 638-640). Indeed, the two kilns worked separately, but have been built as one structure: their internal benches form a single mud-bricks block upon which the walls of the respective chambers have been founded. In the same way, Kiln 800 is physically connected to Kiln 802 because on the north, close to its mouth, the wall of Kiln 800 is founded on the bench of Kiln 801. Most of the time, the architectural connections between the different furnaces imply also a technical linking during the firing cycles. The walls of the chambers of Kilns 802 and 803 were entangled to each other and the chamber of Kiln 803 was founded on an external bench (813) connected to Kilns 805, 806 and 807. In the same time, Kilns 802, 803 and 805 were connected through a triple set of external chimneys (804) that was joined to some internal smokestacks, located inside the walls of the chambers of Kilns 803 and 805. The vertical conduit inside the

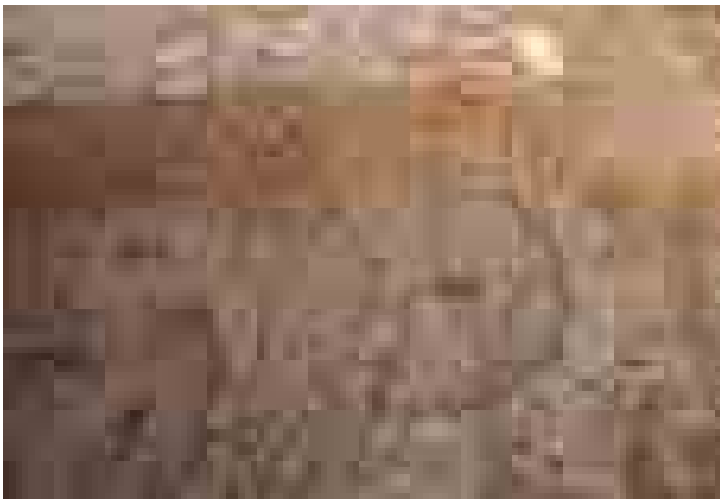


Fig. 20 - Level 3a2 - Kiln 808 with its bench, from the East.

wall of Kiln 805 is linked to a horizontal duct that runs through Bench 813 and connects Kiln 805 (and therefore the entire system of Furnaces 802-803-805) to Kiln 808 (Fig. 20). Both the circular installations 806 and 807 are also connected to 808. This one, according to the same architectural and technical criteria, has an internal bench that represents the extension of the external work platform 813. As Kilns 803 and 805, a chimney located at the edge of the internal bench and

integrated into the wall of the chamber also characterizes Kiln 808. Moreover, it is connected to some external chimneys (809-810) that play the same role as the triple chimney (804) between Kilns 803, 802 and 805. South of Kiln 808, the walls of its chamber are built against the chamber of Kiln 811. The chamber of this one is entangled with the masonry of the chamber of Kiln 812 and their respective benches represent two internal extensions of an external mud-bricks block. In other terms, 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. They can work separately even if all the structures are interconnected. On the north-western side, the complex furnace 635-634-801 is connected to Kiln 805 and, through the latter, to Kiln 808. To the south, the large structure 638 formed a single system with 640, 800, 802 and (probably) 803. On the northern side, the huge kiln 650 is functionally connected to the installations 806-807-808-810-809. Similarly, on the eastern side of the workshop, Kilns 811-812 were probably connected to other furnaces. All these different clusters of firing structures present the same architectural and technical features.

They have external platforms where pots were 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 tell to facilitate the draught and they are all interconnected through some chimneys (as 804, 806-807, or 809-810). 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 an extremely rare typology and become better documented since the 2nd millennium BC⁶. 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 3rd millennium BC⁷.

A later phase, Level 3a1 (Fig. 21) of this workshop has been identified in the eastern side of the excavated area, while at this stage the western zone has been largely disturbed by the enor-

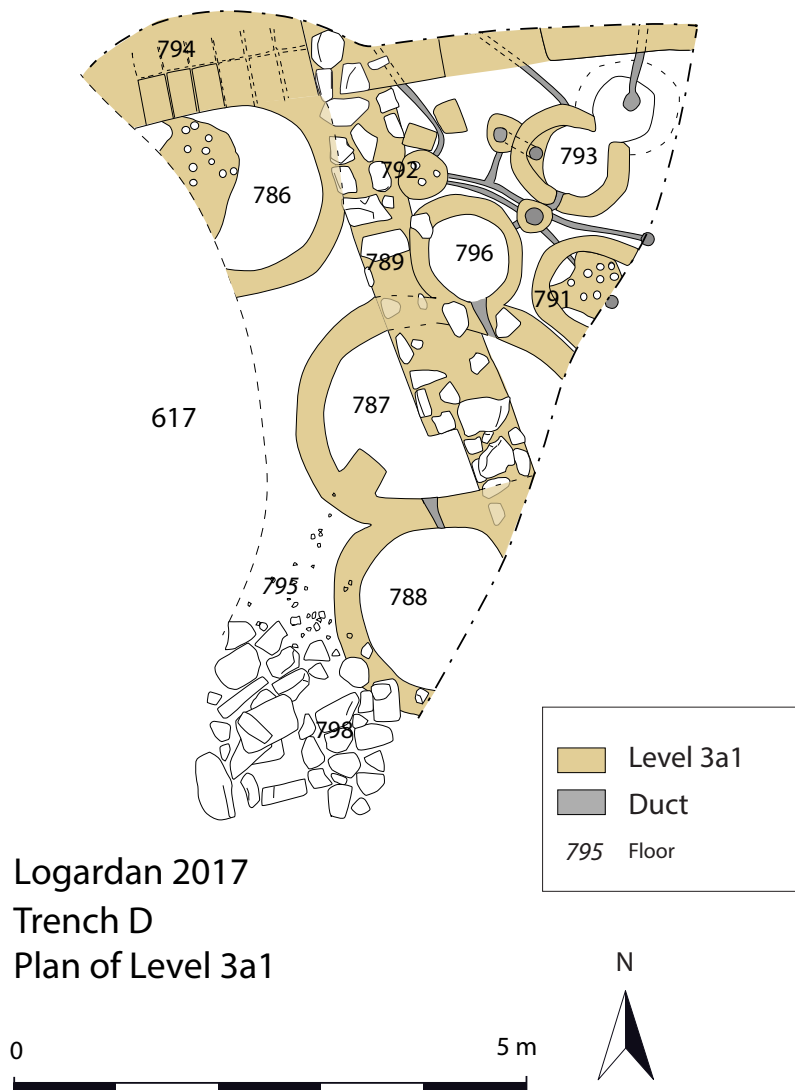


Fig. 21 - Plan of Level 3a1 (Late Akkad).

6. 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).

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

mous Kiln 617 of Level 1-2. The exposed surface is quite limited, but one can observe that, despite the construction of new kilns, the main techno-architectural criteria that determined the organization of the workshop in Level 3a2 were still respected (Fig. 22). On the one hand, kilns were connected because they often shared a part of their walls, but also because of the presence of structures used both as external work platforms and as internal benches. It is the case of Kilns 788-787-796, which have common masonries where they are in contact to each other. Besides, Wall 789 links them to Kiln 786: this one is a long bench, used to create an internal step and facilitate the draught inside Kiln 787, but also as an external work shelf, that forms an angle with a brick platform (794) around Kiln 786, where a model chariot wheel was discovered in its filling (Fig. 23). On the other hand, as in Level 3a2, kilns are also connected by an elaborate system to evacuate the smokes. The walls of Kilns 788-787-796



Fig. 22 - Level 3a1 workshop, from the South-east.

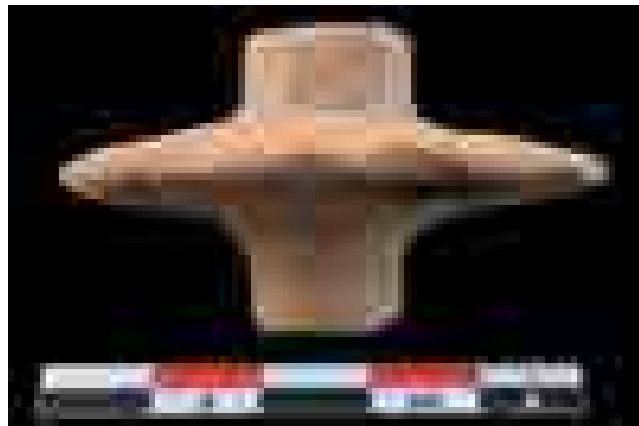


Fig. 23 - Kiln 786 - Model chariot-wheel (LOGD.Tc366).

are crossed by ducts and, through some underground funnels, all the firing installations (not only Kilns 788-787-796 and Kiln 786, but Kilns 793 and 791) were connected to vertical chimneys. The circulation of the heat (that is the main reason to join the firing structures to each other) and the evacuation of the smokes (channelled 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 that nonetheless remained separate. In fact, despite the limited excavated surface, furnaces of Level 3a1 appear organised according to the same rule observed in Level 3a2. Even if connected, the set of Kilns 788-787-796 and the large structure 786 with its banquette 794 represent distinct production units. Smokestacks as 792 and 791 were common installations to mutualize the heat and share the flow of hot air, while the circular installation 793, close to the northern limit of the workshop, was intended to centralize the evacuation of the smokes towards the slope of the tell. In this organization, the low wall 789 (a mud-bricks bench paved with stones on its upper surface) represented both a connection and a separation between the different units.

LEVEL 2

This phase is clearly separated from Level 3 by a thick and regular clay floor (629) plainly visible in section (Baldi, Naccaro and Rahoof 2016, fig. 19 p. 34) laying on the destruction of the previous structures. This level is represented by a ceramic workshop devoted to the firing of the vessels, dating from late 3rd millennium (Fig. 24). The excavated area (about 120 m²)

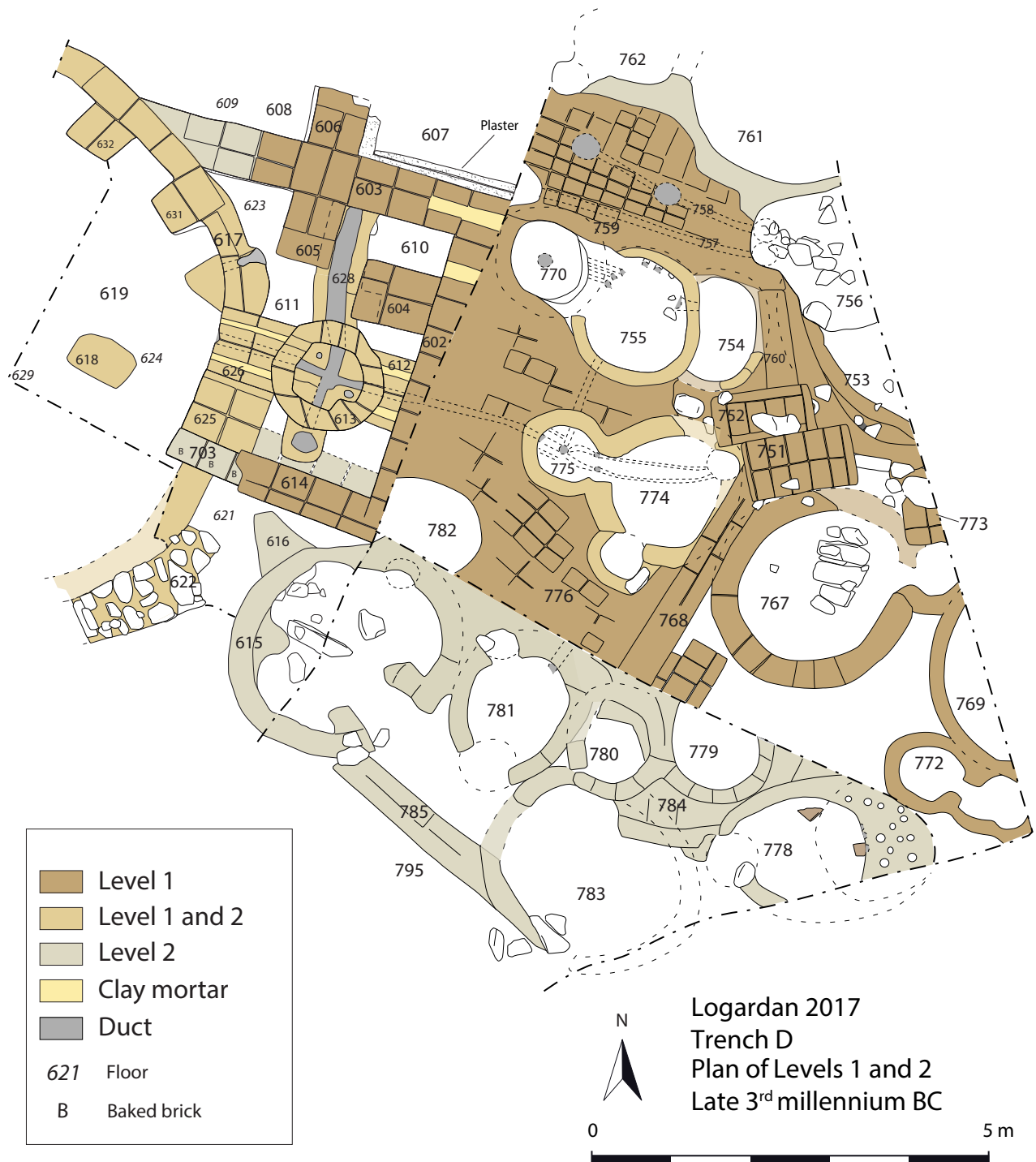


Fig. 24 - Plan of Levels 2-1.

constitutes a little portion of a much larger complex, as suggested by the dimensions of some firing structures. In particular, it has been possible to identify a 3,6m large workspace (611) delimited by three walls: 602, 603 and 703. The roughly north-south oriented Wall 602 is 1.5 rows of bricks wide and is conserved on 5 layers of bricks. The northern Wall 603 is 1.5 rows of bricks large and visible over 5 layers of bricks in its eastern portion (where 2 of these layers belong to a later reconstruction in Level 1) and over just one layer of bricks to the west, where the slope is much more exposed to the atmospheric erosion. On the southern side of the workspace 611, Wall 703 has the same east-west orientation and similar thickness of Wall 603. The entire space was carefully built. Walls 602 and 603 were reinforced by internal



Fig. 25 - Level 2 - Wall 703 with re-used baked bricks.

buttresses (604 and 605) probably used as banquettes for drying and pre-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 pillar (606, corresponding to the inner but-

tress 605) defines two different working spaces (608 and 607), that were probably occupied by kilns of which no trace remains. However, the clearest proof that Room 611 was very carefully built is offered by the walls themselves. The masonries of 602 and 603 were joined together, namely designed and built as a single structure. Furthermore, at this stage, Wall 703 was constituted by yellowish 40x40x8 cm slabs made of re-used baked bricks: these bricks were fragmentary, but meticulously assembled (Fig. 25). The absence of plaster on the southern face of Wall 703 (and its different nature of this latter) suggests that there was another closed room south of the workspace 611.

A large production unit occupied the southern area. Since in the eastern portion of the workshop (east of Wall 602) Level 2 has not yet been reached under the structures of a later renovation (Level 1) of the atelier, it is difficult to establish precisely the surface of the production unit occupying this southern sector. Anyway, Walls 703, 785 and 622, delimited it. Both Wall 703 and 785 are north-west/south-east oriented, but they are not parallel: it does not depend on a random arrangement of the structures, but on the necessity of organizing them according to the topography of the tell and to the slope that, south of Wall 703, becomes quite steep. This is the reason why Wall 622 (built by reusing stones from Level 4 structures) constitutes a ramp going up the slope and giving access to this portion of the workshop. Six firing installations (615, 781, 780, 773, 778 and 779) have been identified in this sector. Kiln 615 was visible over 3 layers of bricks on its exterior side (above Floor 621): it has a large rounded structure, with a diameter of about 2 m (Fig. 26). Its lower chamber was dug deep into the soil and lined with bricks, while the pierced sole (whose fragments were sustained by a stone lintel and have been recovered in the lower chamber) was located at the same height than the exterior floor (621). Even if quite thin (just one brick large), some little buttresses reinforced the wall of its chamber: one on the interior side, two others flanking the mouth of the chamber, and another external pilaster (616) used as an external workbench. Close to the opening of Kiln 615, built against its eastern wall, Kiln 781 appears as the first installation of a series of firing structures (781, 780, 779, 783) whose masonries were entangled to each other (Fig. 27). Nevertheless, these kilns did not form a single complex structure (as Kilns of Levels 3a2-1). They have different sizes, features and orientations. Three of them (781, 779, and 783) were single-chamber up-draught kilns, while the small intermediate furnace (780) was a horizontal-draught structure with a little internal banquette. The mouth of Kiln 779 was



Fig. 26 - Level 2 - Kiln 615, view from the North.



Fig. 27 - Level 2 - Kilns 781, 780 and 779.

probably located on its northern side (under the not-yet removed vestiges of Level 1), while Kiln 781 has a south-oriented mouth occupied by a pit used as *praefurnium* to ignite the fuel and start the heating cycles. It was also equipped with an internal chimney integrated in the masonry of its perimeter. Close to the eastern limit on the trench, Kiln 778 does not share its masonry with other installations but is built against 779. It shows some features similar to Kiln 781, as the ovoid shapes and a *praefurnium* pit in front of the mouth. Nevertheless, from a technological point of view, Kiln 778 is a two-chamber up-draught structure (as Kiln 615), with a well-preserved pierced sole (Fig. 28). Therefore, a cluster of architecturally and technically different kilns occupies the southern production unit: they are stuck into the same mud-bricks platform (784), they are adjacent to each other and sometime even built together (as demonstrated by their intertwined walls and shared masonries). However, they are functionally independent and their proximity to each other was just intended as a structural economic solution to construct their domed roofs. Some of them could be built at the beginning of each firing cycle and then destroyed at the end of the process to take out the pots. The clear advantage of roofs leaned against each other was that they were easier to reconstruct than isolated domes.



Fig. 28 - Level 2 - pierced sole of Kiln 778.

Probably, this kind of organization characterized also another production unit, on the northern side of the excavated area, where the erosion of the very steep slope has almost completely obliterated the architectural vestiges. Nevertheless, the ruins of Kilns 761 and 762 seem to respect the same planning observed in the southern sector, with different agglutinated firing installations, sometimes equipped with a smokestack (as 762) or a little banquette (761), showing distinct technical features (with one-chamber and a horizontal draught as 762, or two superposed chambers and a vertical draught as 761), and sharing a portion of their perimeter to easily support their respective roofs.

The better evidence for massive dimensions and care for architectural details comes from Kilns 617 and 613, in the western production unit of the workshop. Kiln 617 is a huge roughly circular structure, which was completely obliterated by the atmospheric erosion in its

western portion. Based on the excavated sector, Kiln 617 had a diameter of about 8 m, with an internal space (619) constituted by an 8 cm thick clay floor (624) hardened by the heat. Internal buttresses (632, 631) reinforced its 1.5 bricks large external wall. Some of these buttresses were hollowed structures used as chimneys to evacuate the smoke. Because of the enormous dimensions of Kiln 617, the system of aeration and evacuation constituted a critical element from both the architectural and the physical point of view. The excavated surface allows us only a partial understanding of this extremely complex system, where Kiln 613 played a central role. On the one hand, it is a medium-sized (internal diameter of about 80 cm) two-storey kiln, with a pierced sole separating the chambers and supporting the vessels during the firing cycles. On the other hand, it was also used as a way to evacuate the smoke of Kiln 617. In fact, under the pierced sole, the heating chamber of kiln 613 was not intended to contain the fuel: it was occupied by the intersection of two evacuation channels. Two little internal chimneys (about 20 cm of diameter) had the function of conveying the smoke outside from the firing chamber (the upper one) of Kiln 613. But the most impressive structures were represented by the system connected to Kiln 617. North of Kiln 613, a north-south-oriented 20 cm large duct (628) formed an underground (under Floor 623) conduit lined and covered by bricks that passed under Wall 603 and carried a part of the fumes to the outside. South of kiln 613, this same duct was connected to a chimney. Likewise, a west-east oriented duct connected Kilns 617 and 613. The fumes passing through this channel were incandescent:

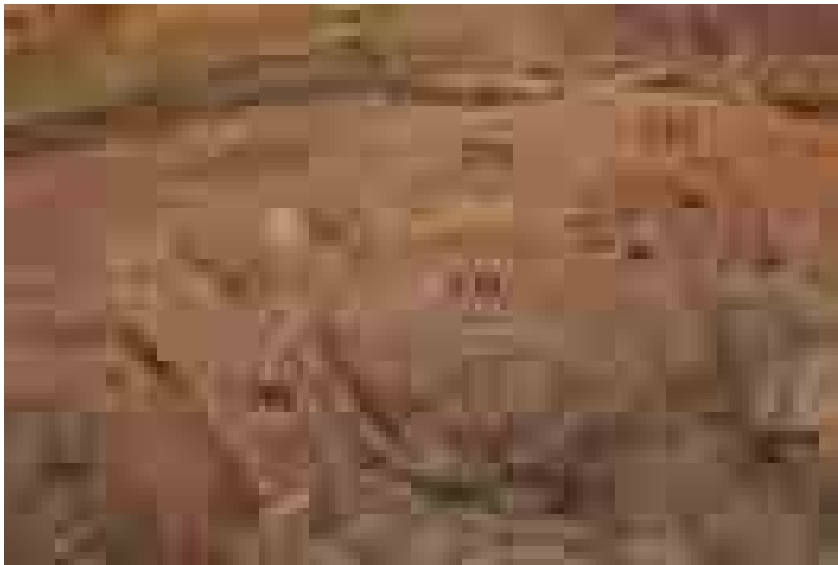


Fig. 29 - Level 2-1 - Kiln 774 ant *prae-furnium* 775.

to isolate this pipe, the connection between Kilns 617 and 613 is constituted of bricks hardened by the heat, laid sideways and separated by thick layers of clay mortar. This same structure continues to the east of Kiln 613, passes under the wall 602 and reach another complex structure, composed by a *prae-furnium* intended for centralize the incandescent smokes (775) and by a kiln (774) equipped with two large chimneys (Fig. 29).

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 channelled there, and to evacuate the fumes through its lateral chimneys. As Kiln 613, also *prae-furnium* 775 distributed heat not only on an east-west axis (namely towards Furnace 774), but also towards north, where, through an underground duct (similar to 628), the *prae-furnium* 775 was connected to a two-chamber (755-754) horizontal-draught kiln. This double structure (a third chamber, 770, has been added later) used the heat channelled through the underground ducts to enable the internal horizontal draught thanks to the little

step between the two compartments, 755 and 754. The entire system – Kilns 617-613, Ducts 626-612 and 628, *Praefurnium* 774, vertical Kiln 775 and horizontal Kiln 755-754 – was conceived and constructed 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 to a small slope towards north and towards east, in order to facilitate the draught of heat and fumes of the huge Kiln 617. Moreover, it is not occasional that the mouth through which Furnace 617 was supplied with fuel and vessels is located between Wall 703 and the channel (626) connecting Kilns 617 and 613. The hardened (or rather baked) bricks of Floor 625 constituted the entrance of the inner space of Kilns 617 and represent an additional evidence of the fact that the entire workspace 611 has been built to organize firing structures working together.

From a typological point of view, several structures of the workshop, as Kilns 615, 778, 761 (and even Kiln 613 and 774, if considered as isolated furnaces) are up-draught two-storey firing installations, a well-known kind of kilns since the Halaf phase in the 6th millennium BC (Hansen Streily 2000)⁸. Kilns with one chamber used both for fuel and for vessels (as 617 or 783) are also well documented in this period⁹. But the system constituted by kilns 617-613-775-774-755-754 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 Kilns 774 and 755-754. Given the enormous dimensions of kiln 617 (more than adequate for a brick kiln)¹⁰, 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 3rd millennium.

LEVEL 1

The most recent phase is represented by a renovation of the workshop. In the western sector, Walls 602, 603 and 703-614 are rebuilt. The latter, whose first stage (Level 2) was in baked bricks, was rebuilt in 49x35 large mud-bricks. The masonries of the three walls are embedded to each other as in Level 2, which confirms that Level 1 corresponds to a general reconstruction of the ceramic workshop. In the corner, both Walls 602 and 603 show regular fillings of mortar between some bricks, according to the same technique used in Level 2 for the isolation of the aeration duct 626-612. This is a clear evidence for the presence of channels leading to the horizontal Kiln 755-754, newly restructured by building a *praefurnium* (770) (Fig. 30). They were certainly connected to 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

8. During the second half of the 3rd millennium, 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).

9. 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)

10. 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.



Fig. 30 - Level 1 - Kiln 770, view from the South.

of chimneys 613. These latter remain in function in Level 1, as well as *praefurnium* 775 and kiln 774, and the entire system becomes even more complex than in Level 2. In the northern portion of the system, a noticeable development is represented by the extension of the structure formerly composed by the double horizontal kiln 755-754. In Level 1, a workbench (752) is also built between Kiln 775-774 and this mul-

multiple installation, that becomes a triple structure. Its *praefurnium* (770) worked according to the same mechanism of *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. It is the same mechanism one can observe 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 (because Wall 603 had a thick coat of plaster on its northern surface) space probably occupied by a kiln heated by gasses channelled through Duct 628. According to the general design of this kiln system, from Workspace 607, heat and smokes were conveyed eastwards, where two horizontal pipes (757 and 758) were equipped with vertical chimneys and led to another kiln (753), alongside the eastern limit of the excavation. Even if Kiln 753 is badly damaged by a recent pit (756), its rubified walls, as well as the many slags and overfired ceramics it yielded, leave no doubts about the high temperatures reached inside its chamber. Even if the erosion of northern slope does not allow to reconstruct the entire firing system which radiated from the enormous Kiln 617, the functioning of this chains of kilns can be easily read. 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 and other devices between Workplace 607 and Kiln 753). But 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 both to disperse and to exploit the heat. From a structural point of view, an important 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, this one, that was a wall in Level 2, is no longer a wall in Level 1: it is incorporated in the platform, that plays both an architectural and a technical role (Fig. 29). On the one hand it constitutes a floor layering the entire area and, on the other hand, it isolates the ducts conveying the heat between

the different installations of the system. Both portions of the platform (759 and 776) were built to allow the passage of the ducts, while bricks were arranged to wrap and isolate them. This way, the floor, where probably pots were 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 that its northern portion (that constituted a separate production unit in Level 2) was incorporated in the Kiln 617-centred workplace. The eastern limit of the production unit and of its platform is indicated by a roughly north-east/south-west oriented two-rows of bricks wide wall (778). It represents a major partition within the workshop and a significant change compared to the previous phase, where production units extended eastwards without any divider, as demonstrated by the southern portion of the Workshop in Level 2. The presence of a deep illegal excavation on the southern side of the atelier did not allow to reconstruct the organization of the Level 1 workshop in this area: all the structures have been removed by a profound east-west oriented trench that damaged some portions of Platform 776 (as the pit or kiln 782), but above all vestiges close to the eastern limit of the excavation. Nevertheless, the organization of the workshop is still understandable. Given the absence of southern pipes and ducts radiating from Kiln 617, the southern limit of its production unit (and therefore also the southern limit of Platform 776) probably matched with Wall 614. But East of Wall 768 some structures (as a banquette built against 768) are clearly fragmentary and indicate that the production unit located in this area developed also southwards. The only installation completely excavated is Kiln 767, with a large external chimney on its eastern side (Fig. 31). But also Kiln 769 (partially visible along the limit of Trench D) probably had the same structure, with a large external double chimney (772). Installations of this production unit are built close to those of the unit characterized by the complex system of kilns and pipes around Furnace 617. A banquette (751) related to Kiln 767 was built against another banquette inherent to Installations 770-755-754 and 775-774. The two workbenches constituted a mud-bricks block shared by the two production units, as also Wall 768. This one 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 any kind of functional integration. On the contrary, Wall 768 represents a very substantial separation. On its western side, the floor was layered by a mud-brick platform, while



Fig. 31 - Level 1 - Kiln 767 and wall 768, view from the North.

On its western side, the floor was layered by a mud-brick platform, while

on its eastern side the space between the kilns was a simple clay soil. In the western production unit, the entire system developed around Kiln 617 worked according to a horizontal draught, while in the eastern unit Kilns 767 and 769 were two-storey up-draught structures. In the western unit all the firing facilities were multiple installations, while in the eastern unit kilns are simple circular structures where even chimneys are always external. It is obvious that the importance of Level 1 workshop goes beyond the extreme complexity of some of its firing structures and the architectural planning offers clear evidence for the organization of the production in the last quarter of the third millennium BC.