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Developments in food storage at late seventh millennium BCE Tell Sabi Abyad, Syria: buildings with suspended floors

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THE ARCHAEOLOGY OF THE 'MARGINS'

Studies on Ancient West Asia in Honour
of Peter M.M.G. Akkermans

53

ANALECTA
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edited by
BLEDA S. DÜRING AND JO-HANNAH PLUG



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Developments in Food Storage at Late Seventh Millennium BCE Tell Sabi Abyad, Syria: Buildings with Suspended Floors

Merel L. Brüning

ABSTRACT

At Tell Sabi Abyad in Syria, large-scale excavations have revealed a continuous sequence of seventh and early sixth millennium settlements. This paper focuses on the appearance of suspended floors, in occupation layers dated to 6455-6375 BCE. These floors were supported by the foundations of previous buildings and helped control humidity and temperature by providing air circulation. This made them suitable for food storage, especially of grain or other plant foods with a long shelf-life. Two of the buildings with suspended floors had compartmentalized plastered or basin-shaped floors. It is proposed here that, although the evidence is indirect, storage practices can be inferred from the presence of suspended floors, and that buildings with such floors can be interpreted as granaries or storehouses. These buildings were located around or near the village square, along with many fire pits used for cooking, and a platform without architecture. These storage structures might have increased the scale of storage, and might have reinforced social cohesion through the sharing of surpluses and increased collaborations between households. Ultimately, this might have contributed to the community's resilience by improving their ability to adapt to environmental changes.

This paper is dedicated to Peter Akkermans, my mentor and friend of 25 years. Peter's hard work and boundless energy made it possible for me and scores of other students and researchers to join his excavations and to collaborate on the fascinating and pioneering research, not only at Tell Sabi Abyad but also at Jebel Qurma in Jordan, the other research project close to his heart. Peter is always full of ideas, and he enjoys sharing them. He teaches by example and, over the years, instilled an enduring love for the archaeology of West Asia in me. I am grateful for his friendship and all he has taught me.

1 INTRODUCTION

Tell Sabi Abyad ('Mound of the White Boy') is a site of 5 ha in north-east Syria, about 80 kilometres north of Raqqa and close to the border with Turkey. It is part of a cluster of mounds, located in the Balikh Valley. At Tell Sabi Abyad, large-scale excavations were carried out from 1986 to 2010. The extensive exposures in different areas of the site were named Operations I-V (figure 1). The area under consideration here is Operation III, 2000 m³ in size, in the north-western part of the site (Akkermans ed. 2006; Akkermans 2013). The twelve main phases of occupation (called 'levels') were dated extensively with radiocarbon (van der Plicht *et al.* 2011; van der Plicht and Plug this volume), revealing a sequence of seventh and early sixth millennium settlements. Earlier phases were excavated on

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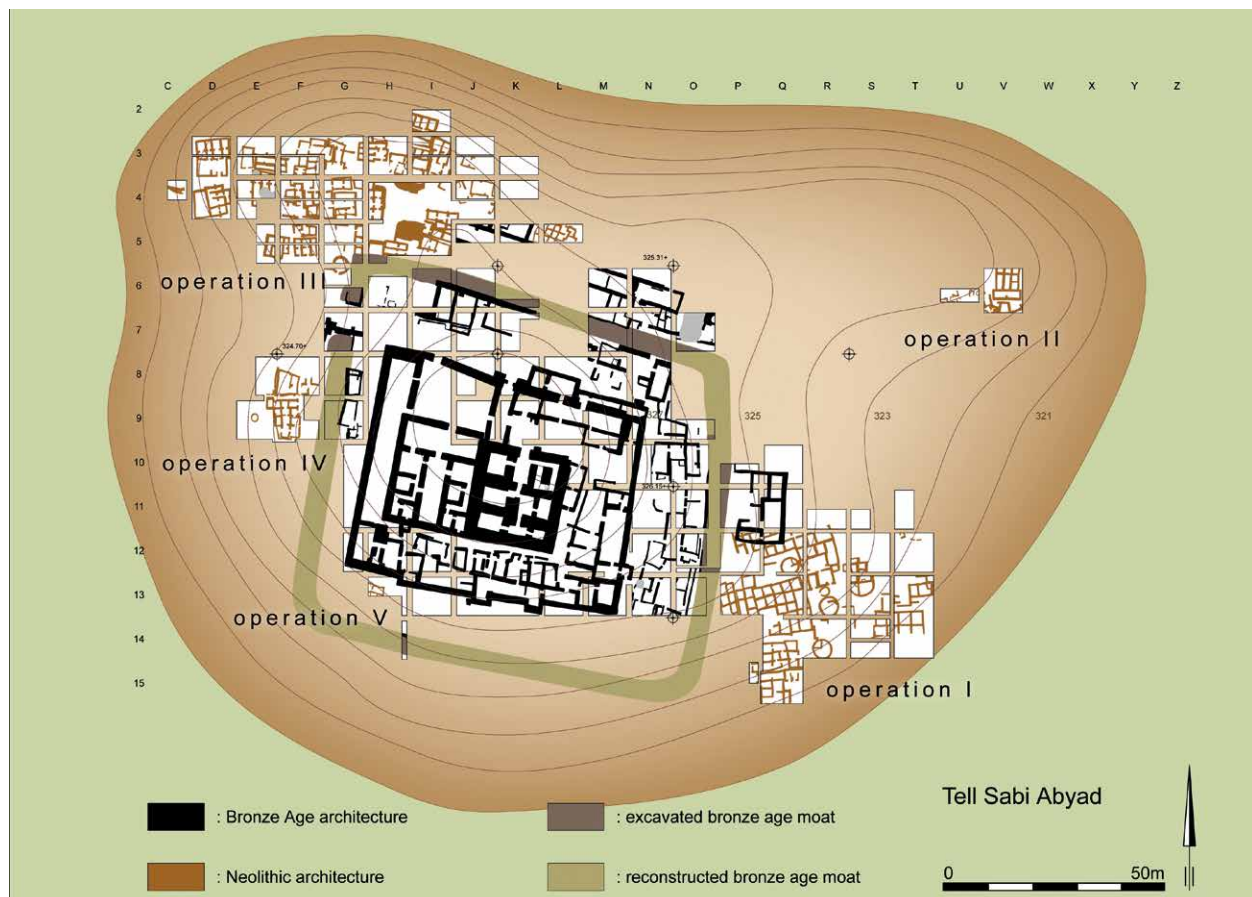


Figure 1: Plan of Tell Sabi Abyad, with the main areas of excavation (image: Tell Sabi Abyad Archive).

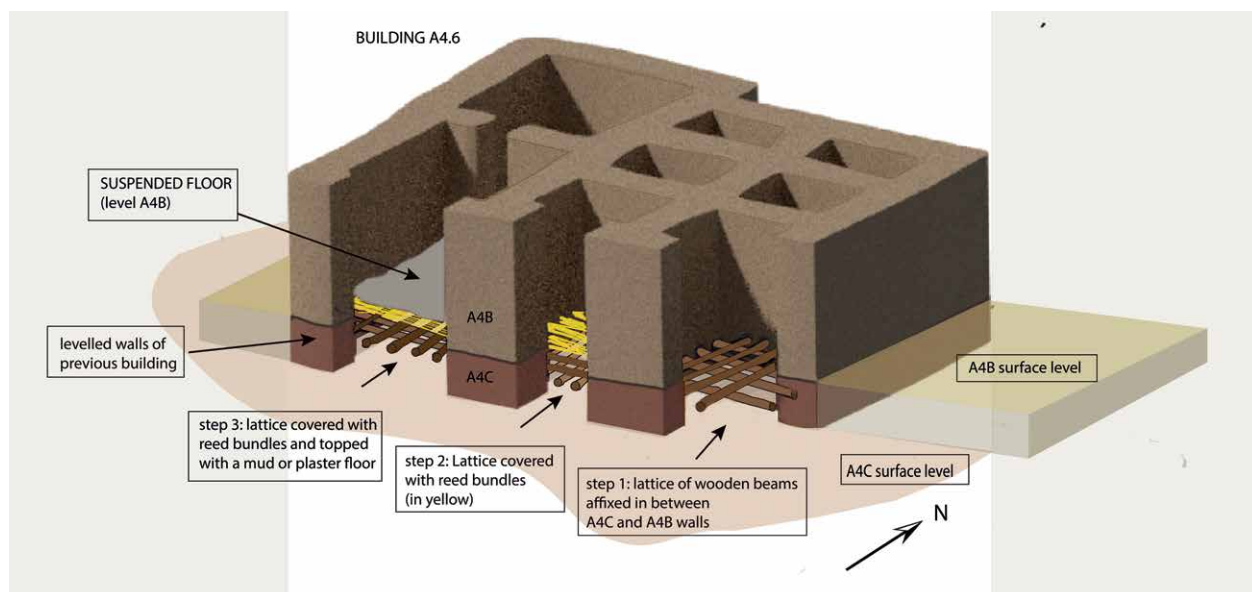


Figure 2: Reconstruction of suspended floor construction in square G4, building A4.6 (image by author).



Figure 3: Plan of levels A4B and A4A with suspended floors and bins. Suspended floors are indicated in yellow (image: Tell Sabi Abyad Archive).



Figure 4: Wooden beam holes of suspended floors in the walls of building A4.6, level A4B.

adjacent mounds II (Verhoeven and Akkermans 2000) and III (Akkermans and Brüning 2019). The region is semi-arid, and although the site has relatively profitable conditions for agriculture due to its location in the basin of the Balikh river (van Zeist and Waterbolk-van Rooijen 1996), it is susceptible to droughts.

In each of levels A4B, A4A and A3B, dated to 6455-6375 BCE (van der Plicht *et al.* 2011), three to five abandoned structures, eleven in total, were levelled to a height of 30-80 cm and spanned with wooden beams. The beams, thus suspended over very low walls, were covered with bundles of reed topped with a layer of mud. In two buildings, the wooden beams were placed like a lattice, in two crossing layers, whereas in another buildings one layer of beams was used. Subsequently, a new building with the same plan was erected on top of the levelled walls carrying the wooden beams, affixing the construction by bonding the beams into the new walls (figure 2).

It is proposed here that these constructions represent suspended floors and that food storage practices can be inferred from their presence. The evidence for this is indirect, since hardly any *in situ* concentrations of plant or animal remains were found. Stored food, such as grains and seeds, would survive only in charred contexts if a building was burnt. Suspended floors prevent contact of the floor with the underlaying soil and facilitate air circulation, which helped to control moisture and temperature. This would have made them well suited

for food storage. In some buildings, compartmentalized floors were made on top of the suspended construction. The spaces under the floors seem not to have been used.

In four of eleven buildings where raised floors were detected, in levels A4 and A3, most rooms had them (figures 3 and 7). In the other buildings the construction was found in one or two rooms only. This might have been a matter of preservation, since the construction revealed itself only by the presence of phytoliths of the reed bundles and cylindrical hollows where wooden beams had been and was not completely preserved everywhere. Apparently, at least some of these buildings were dedicated to storage in their entirety.¹

2 BUILDINGS WITH SUSPENDED FLOORS

2.1 Level A4B

2.1.1 Building A4.6

Building A4.6 (figure 3) in trench G4 is a T-shaped building with an outline of 8.65 × 6.30 / 5.50 m. It had six small rooms and one larger anteroom with

1 A word of caution: this article must remain a brief interim evaluation, since the stratigraphy and architecture of Operation III is still under study and the conclusions presented here may be revised once the data have been fully analysed.

an entrance. In five of the rooms the remains of a suspended floor construction were found.

Wooden beams were placed over the levelled walls of an earlier level A4C building with the same layout (figure 4). The surrounding surface had risen almost to the level of the A4B suspended floor, about 30 cm above the older floor, so the lower part of the building was buried in soil. The chambers were likely at least partly filled up with wall debris and other deposits, and emptied before the suspended floors were made. The beams were placed like a latticework, in two layers perpendicular to each other, in north-south and east-west directions. In north-south direction they had a diameter of 10 cm and were placed between 5 to 18 cm apart. In east-west direction the beams were 6 cm in diameter and 22-30 cm apart. Reed bundles were placed in between the layers of beams as well as on top of them. On top of the reeds, hard red mud-plastered floors were laid. The plaster was applied higher and thicker against the walls than in the middle of the rooms, resulting in a basin-shape.

Wooden beam holes were found in rooms 3, 5 and 8, 30 cm above the floor of the levelled walls that supported them. The suspended construction was no longer intact inside the rooms, only patches of it were found here and there under the floor plaster. In room 6 on the south-east corner, coarse mud-brick debris of a later levelling phase had fallen through into the sub-floor space. The rooms measured between 1.80 – 1.60 metres in length and 1.40 – 1.20 metres in width. In room 2, a large rib of an aurochs was found under remnants of the suspended floor. In room 8, the south part of the anteroom, four concentrations of flint and a lot of stone tools were discovered: six grinding stones, four axes, two hammer stones and a spherical grinder or polisher, together with two bone awls, a sling missile and a lump of clay, perhaps a token. Most of these objects were found under the suspended level A4B floor, close to the floor of the levelled building underneath. Unfortunately, the suspended floor was not found intact here, making it difficult to establish the context. They might have fallen from the floor into the under-floor space. However, the flint concentrations did not appear to have fallen in, it rather looked like they were deposited here in piles. It is likely that the level A4B rooms were emptied before the suspended floors were made, otherwise there wouldn't be a void for air flow under the floors and the floors could have been founded on top of the room fill. It is then conceivable,

that the four piles of flint and cache of stone tools were deposited here closely together on purpose. Openings in the suspended floor giving access to the underfloor space have not been detected with certainty anywhere, but in many rooms the floors were not completely preserved. Another possibility is that of a closure ritual when the building was abandoned, or perhaps of a foundation deposit, right before the suspended floor was made. The aurochs' rib in room 2 might have been placed under the floor on purpose too. At Çatalhöyük, for example, abandonment sometimes involved the placement of artefacts (Hodder 2007, 32-3).

2.1.2 Building A4.10

Building A4.10 is a multi-roomed building with an outline of 5.90 – 6.90 metre x 5 metre. It had one large room with a bin and four small rooms. It was built against buildings A4.5 in the north and A4.11 in the east, forming a cluster.

Building A4.10 was constructed with floors suspended over the levelled rooms of a level A4C building with the same layout, 60-80 cm above the previous floor. The south wall of building A4.10 was built 50 cm more southwards than the previous one, on the same level as the suspended floors, meaning the ground level had risen to the same height as those floors and the spaces under the suspended floors were subterranean. The rooms of the previous building were likely filled with wall debris and other deposits and emptied before construction of the floors. The construction was made with wooden beams placed in two crossing layers, like a latticework. The north-south oriented beams were 8-10 cm in diameter, the east-west ones 4-5 cm and they were between 6 and 16 cm apart.

The lattice of wooden beams was covered with reed bundles topped with a layer of mud and a compartmentalized gypsum-plastered floor (figure 5). The floor had a thickness of 1 cm, and the compartments were made by moulding ridges in the plaster of approximately 15 cm in height. Bin GJ was placed in the south-west corner, on the suspended floor. It was similar in shape and size to bins GU, HL and II in the corners of room 4 of adjacent building A4.11. GU, HL and II were levelled and filled up with mud-brick debris when the next phase was built (level A4A) but had probably roughly the same volume originally. In room 1 of building A4.10 and in room 1 of A4.11 large rectangular bins (GD and EV), were present. The total preserved volume of bins alone in this building cluster amounted to



Figure 5: A: Suspended plastered compartmentalized floor, in building A4.10, room 5, level A4B. B: Plastered floor (not suspended) in room 4 of building A4.11, level A4B, with plastered bins in every corner.

about 1200 litres (table 1). Together with the storage space on the compartmentalized floor in room 5 and the other suspended floors it was much more.

The largest room, room 5, measured 2×4.25 m, but the wooden floor beams bridged only an area of 1.60×2.50 m, because the east part of the construction was supported by a platform or bench (HZ), built over a couple of hearths (IW and IU) that were used in previous level A4C. Hearth IU contained objects that were left in there intentionally, perhaps as a foundation deposit: a grinding stone, a stone axe and a clay vessel were sealed inside, by the large platform mudbricks covering it. Rooms 1, 2 and 3 measured 1.50×1.80 – 1.70 m, room 4 was 1.60×1.50 m.

2.1.3 Building A4.5

Building A4.5 formed a cluster with buildings A4.10 and A4.11 on the north side of a village plaza with many fire pits. All three were built against each other. While building A4.10 has suspended floors in all rooms but one, in building A4.5 a suspended floor was found only in the southernmost room, that had an entrance. The west side of the building was not completely excavated, it is partly reconstructed in the plan (figure 3). The size of the building is estimated at 7.2×7 m. It consisted of three parts but was different from the average tripartite building in Operation III. Instead of having three rows of rooms it had a row of four small rooms (1–4) on the north side, the smallest of which was 2.3×0.9 m, the largest 2.2×1.5 m, a long room in the middle of ca. 7×1.7 metre (room 5), and an entrance room on the south side (room 6) of

approximately 6×1.7 m. Only in room 6 a suspended floor was present. The wooden beams, placed over the width of the room only, had diameters of about 5 cm and were 20 cm apart on average (figure 6B).

2.2 Level A4A

2.2.1 Building A4.25

Building A4.25 (figure 7) was a tripartite building, of 5.15×6.25 m. Suspended floors were found in the three elongated north-south oriented rooms, measuring 6.60 metre in length and between 2.10 metre and 1.15 metre in width. They were supported by walls of the previous phase, levelled to a height of about 40 cm. The wooden beams were laid in east-west direction only, bridging the shortest distance, with the reed bundles lying north-south. On the north side of the building, three more rooms were present (building A4.25), which also had suspended floors with the same orientation of beams.

On the south side the building had an anteroom and an additional small room with a large opening. This entrance-room had a compartmentalized white plastered floor, of gypsum, the material most of the white-plastered floors in levels A4 and A3 were made of (B. Nilhamn, personal comment). The floor had three rectangular compartments, one covering the northern half of the floorspace, the other two dividing the southern half of the floor, slightly basin shaped. The low dividing ridges were moulded from plaster. Since this room had no suspended floor, the basin floor was sunk into room fill of the previous phase (level A4C).

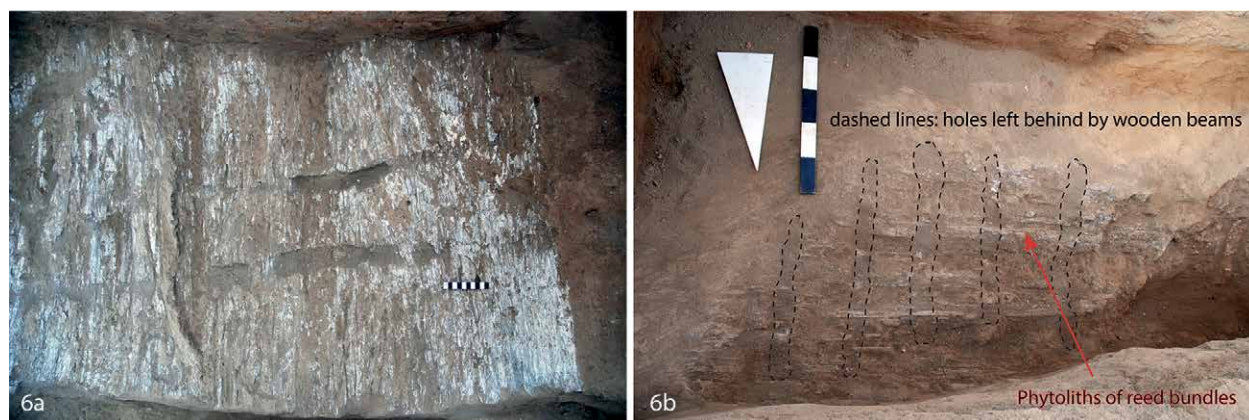


Figure 6: Reed phytoliths and wooden beam holes of suspended floors. A: in a room of building A3.2. B: in room 6 of building A4.5 (photos: Tell Sabi Abyad Archive).



Figure 7: Plan of level A3B with suspended floors and bins. Suspended floors are indicated in yellow (image: Tell Sabi Abyad Archive).



Figure 8: Finds in a niche in the north-west corner of room 1 of building A4.25. A: A tool set of six axes, a small, rounded grinder and a polisher. B: Two delicately worked bone hook-and-eye clasps in the shape of animal figurines (photos: Tell Sabi Abyad Archive).

In the north-west corner of room 1, in a small niche above the floor, a remarkable deposit was found: a tool set of six axes, a small, rounded grinder and a polisher was stored here (figure 8a), together with two extra-ordinary sets of delicately worked bone hook-and-eye clasps in the shape of animal figurines (figure 8b) (Arntz 2022, 119). Three of the axes were found on the ground in front of the niche and had probably spilled out. An almost identical animal figurine clasp was found in a bin in the platform in the village plaza. In the north-west and south-east corners of that bin a horn of an ovicaprid was placed. This seemed a deliberate deposit. Since the niche was not sealed by plaster or other architecture, we can't say for certain whether the cache of stone tools and bone clasps was also intentionally left behind or not, but it is striking that in this building and in adjacent building A4.26 find concentrations were discovered of which the contexts suggest that they may have been left behind on purpose.

2.2.2 Building A4.26

Building A4.26 measured 5.2×4.7 metre and consisted of three rooms, measuring between 1.90 metre and 1.75 metre in length and between 1.70 and 1.30 metre in width. It was built against the north wall of tripartite building A4.23. In all three rooms, suspended floor constructions were made over levelled A4B rooms with the same layout. Room 2 had a plastered opening in the west wall with a diameter of 25 cm, right under the suspended floor.

The opening was placed obliquely, in northwest-southeast direction, instead of perpendicular to the wall, and was probably an air vent as it didn't provide much daylight due to its shape. It was made in the levelled wall, but since the upper part of the levelled walls was still visible, it may have been used in level A4A to improve air flow and prevent the buildup of moisture in the underfloor space that wasn't otherwise accessible.

In room 2, two gypsum-plastered bins, HW and HX, were built in the corners, on top of the suspended floor. Both were white plastered and had slanting floors in southern direction. Their weight was not carried by the floor since they were right above a floor support – the north wall of the previous phase. Together, they had a volume of 424 liters. The wooden beams of the suspended floor were oriented east-west, had a diameter of 5-10 cm and were 15-20 cm apart. The layer of reed bundles was placed in north-south direction and discovered intact in the whole room. It was covered with a mud floor. The construction was built on levelled walls of about 40 cm high. In the south-west corner of the room, in a small niche, a cache of sling missiles was found. In the previous phase, level A4B, room 2 had a white-plastered floor, suggesting the room was already used for storage in that phase.

In room 3, which had dimensions of 2×1.75 m, the wooden beams and reed bundles had the same orientation as in rooms 1 and 3. In the north-west corner, where a gap was present in the reed phytoliths



Figure 9: Intentional deposit on the floor of building A4.24, perhaps associated with the closure of building A4.24, or with the foundation of building A3.4, which was built on the levelled walls of A4.24 (photo: Tell Sabi Abyad Archive).

and wooden beams, the underfloor space was filled with mud-brick debris. Here probably later levelling debris had fallen in. This opening might represent an opening in the floor, giving access to the underfloor space.

2.2.3 Building A4.27

Building A4.27 was constructed on the levelled remains of building A4.5, and still part of a cluster of joint buildings with A4.10 and A4.11. It followed the plan of building A4.5, with some internal changes. The long room in the centre was now divided in three parts, rooms 5, 7 and 8, of which only the easternmost room 5 (3.5×1.7 m) had a suspended floor.

Room 6 was divided in two compartments by a buttress and had suspended floors in both. The wooden beams, with diameters of 5 cm, were placed transverse, spanning the shortest distance, and on average 20 cm apart. In the northern row of rooms, only in room 4 fragments of a suspended floor were found.

2.3 Level A3B

2.3.1 Building A3.4

Building A3.4 (figure 7) consisted of two wings with five rooms, measuring 9×3.90 m. It was built on the levelled walls of the previous level A4A building (A4.24), which was basically a tripartite building, but with two long rows of rooms and one short one instead

of three rows with the same length. Only the two long rows (the 'wings') were rebuilt in this phase, and a suspended floor was made in one room only: room 4. The walls were levelled at 0.60 m. The wooden beams were oriented north-south, spanning 1.95×1.50 m. The beams were placed lengthwise over the room, not bridging the shortest distance, but the longer one (1.95 m), which is unusual.

In room 3, a room that did not have a suspended floor, a remarkable feature was sunk into the level A4A room fill; a shallow rectangular plastered basin measuring 1.15×0.85 m, with a flat floor. In it, an aurochs horncore, a few pottery sherds, some of which were burnt, an ovicaprid horn, two grinding stones and a token were deposited. The finds appeared in room fill about 20 cm under the level A3B floor. The basin had a depth of no more than 10 cm and, as it was sunk into levelling debris of the previous phase, the contents might represent a foundation deposit.

In the previous phase of this building (A4.24, level A4A), a host of objects was found on the floor of room 7 (figure 8), a room in the south-east corner. The finds included a scapula of an aurochs, an anthropomorphic figurine (Arntz 2022, 128), a few tokens, many stone tools, a few complete pottery vessels, pot sherds (perhaps meant to be used as tools), and ovicaprid horns, all centred around an unbaked pot stand. The room was not used as a refuse dump after abandonment, and the placement of these objects seemed intentional rather than random.

The finds were lying on the floor and covered with levelling debris on top of which the floor of room 5 of building A3.4 was laid. This may have been another intentional deposit, perhaps associated with the closure of building A4.24 or with the foundation of building A3.4. Higher up in the fill, just below the floor of level A3B, a large concentration of animal bone was found, deposited against the west wall. Several rooms in level A4A, including room 7, had white-plastered basin-shaped floors. This could mean that before the suspended floor was made in room 5 in level A3B, the building was already partly in use for storage.

2.3.2 Building A3.2

Building A3.2 is a tripartite building of 7.80 metre x 6.15 m, that was rebuilt several times on the foundations of a predecessor, in level A4B, in A4A, in A3B and possibly also in A4C (older walls with similar layout were becoming visible under phase A4B when excavations stopped). Suspended floors were constructed in level A3B, over levelled A4A walls with the same plan. The east wall of the level A3B building was founded on top the older wall but not completely, it was placed a bit more outwards than its predecessor. Apparently, the surrounding surface had risen to the foundation level of the A3B walls, but the upper part of those walls was still visible. The wooden beams and reed phytoliths of the construction (figure 6A) were found everywhere, except over rooms 6 and 9 on the south side. The northern rooms were very small, measuring around 1.25×1.10 m, the rooms in the middle were 2.40×1.25 m. Wooden beams of 5-10 cm in diameter were placed 20 cm apart in east-west direction over walls levelled to a height of 40 cm, and covered with reed bundles perpendicular to them. A mud floor was applied on top of the reed. Phytoliths of grains with husk were found in the north-west corner of room 9.

In rooms 6 and 9, where the older architecture was filled up and a floor was founded on top of that fill, remnants of three bins were found (CK, CJ and KH). Bin KH was a round clay bin, sunk into the floor. In the previous phase, a bench was present in room 8, possibly used to keep baskets or other containers above ground. Such benches or platforms preceded suspended floors in three storehouses (A4.10, A3.6 and A3.2).

The walls carrying the suspended floors had an undulating appearance in building A3.2, A3.3. and A3.7: they were lower in the middle of the rooms than at the corners, where they connected to other walls.

This was partly the result of subsidence, but most walls also had a concave shape at the top because of a gap in the mud-brick layers that may have been made on purpose. The beam holes followed this gap. Perhaps the concave floors resulting from walls that were slightly hollowed out at the top were considered advantageous for storage purposes: In buildings A4.6 and A4.10 the suspended floors had basin-shaped plaster floors or compartmentalized plaster floors.

There is also a possibility that the undulating shape was caused by erosion. This building may have been levelled to its foundations shortly after abandonment, perhaps as part of a closure ritual or simply to prevent collapse of an abandoned building. If it remained in that lowered state for some time the walls likely eroded a little. Such damaged spots could easily have been removed or repaired to straighten the foundation for the suspended floor construction, but apparently this wasn't done.

2.3.3 Building A3.7

Building A3.7 is a two-roomed building of 3.2×3 m, that was rebuilt on a levelled A4A predecessor (A4.15), and part of a cluster of buildings consisting of A3.3, A3.5, A3.6 and a platform without architecture, on the east side of a village plaza with many fire pits. Building A3.3, which was a single room, also had a suspended floor. A3.6, a multi-roomed building of which the internal walls were levelled in a later phase when it was made into a platform, had one room with a suspended floor. In the west room of A3.7 the remains of a suspended floor were found. The wooden beams were east-west oriented, and had diameters of 5-7 cm. They were placed 5-20 cm apart and covered with two layers of reed bundles in north-south direction, topped with a mud floor. In the east part of the building, where no suspended floor was present, an ovicaprid horn was left in the middle of the level A3B floor.

2.3.4 Building A3.3 (the single-roomed building)

Building A3.3 was a single-roomed building, with outer contours of 3×1.75 m. Its level A3B floor was suspended over levelled A4A walls. The beams were oriented east-west, spanning the shortest distance. The wooden beams were covered with a layer of reed bundles that covered the whole floor, and with a mud floor. The beam holes were 3 to 10 cm in diameter, and approximately 20 cm apart. In the north-west corner of the room a few collapsed mudbricks were found under the floor beams. The room was otherwise filled



Figure 10: Aurochs horn core, found in the under-floor space of building A3.3 (photo: Tell Sabi Abyad Archive).

with compact loam without any debris. In the space under the floor, on the level A4A floor, an aurochs horncore was present (figure 10), laid against the south wall of the room. The whole floor and the aurochs horncore were covered with chaff phytoliths. The floor yielded no other finds. Again, this horncore seems a deliberate deposit, that could have been made when the suspended floor was constructed or left behind intentionally when the level A4A building was at the end of its lifespan.

2.3.5 Building A3.6

Building A3.6 was a multi-roomed building in level A3B, but the internal walls were removed when the building was turned into a platform in the next phase. It was rebuilt in level A3B on top of the levelled A4A walls of building A4.20. It had a length of 6 m, with a width of 4.5 metre on the east side and 2.5 metre on the west side. Only in the western room (2.5 × 2.5 m), where the level A4A walls of building A4.20 were precisely under the level A3B walls, a suspended floor was made. The north wall of the building was constructed on top of its predecessor but stood also partly on the surrounding soil. The wooden beams were east-west oriented with diameters of around 5 cm and were placed about 10 cm apart. Two thick layers of reed bundles were laid over them, in north-south direction, and covered with a mud floor. In the previous phase, two bins (ON and OP) were standing against the north wall. They were filled up and

incorporated into a platform with a width of 1 metre alongside the north wall. This platform supported the suspended floor in addition to the walls. A similar platform was present on the east side of the building. The presence of such platforms or benches seems associated with storage activities: Building A4.10 had one too before a raised floor was constructed.

3 DISCUSSION

When these buildings were rebuilt on top of their levelled predecessors, 30 to 80 cm above the previous floor level, they were already partly buried in deposits that built up in the surrounding area over time, comprising household refuse, wall debris and wind-blown deposits. The walls must still have been visible, otherwise they could not have been repurposed as floor supports. The buildings were abandoned for some time and either in a ruined state or levelled to their foundations after abandonment. This might have been done to prevent collapse or as part of a closure ritual (Plug *et al.* forthcoming). In preparation of the suspended floor construction, they were levelled to the top of the area, if necessary, to keep the suspended floors at ground level. The spaces under the floors then were subterranean. They were previously likely filled with various deposits and had to be emptied to create the under-floor space. Under suspended floors that were still completely intact no levelling debris was found.

It appears that storage primarily took place on top of the suspended floors, rather than in the under-floor spaces. Two buildings (A4.6 and A4.10) with suspended floors in almost every room had compartmentalized plaster floors or basin-floors on top of the suspended construction.

However, it is likely that openings were present somewhere, to access the spaces below. Some possible openings were found in the floor remains, but it is difficult to say whether they were used for that purpose, because the suspended floors were not completely preserved. In building A4.26 an air vent was found just below the suspended floor. It was constructed in the older phase wall but may still have been in use after the floor was made. Air vents may have been present above the floors too, in addition to an entrance, but since most walls were levelled after use only entrances at ground level were found.

Buildings with suspended floors did not differ in their layout from other architecture in the settlements. The suspended floors were found in tripartite and other multi-roomed buildings and in a single-roomed structure. Since the walls of previous buildings were reused, the layout was determined by the layout of those predecessors, and apparently different kinds of buildings were considered suitable for storage.

Buildings that were levelled and rebuilt with suspended floors probably were already (partly) used for storage in the previous phase. Several buildings (A3.10, A3.6 and A3.2) had bins in rooms that were later levelled and reused for the construction of suspended floors, and buildings A3.2, A3.6 and A4.10 had platforms alongside walls in the previous phase. Such platforms may have been used to put baskets, sacks, or other storage containers. In the levelled rooms under building A4.25, basin-floors of white plaster were found.

Suspended floors appear to have been a successful adaptation in storage practices, since they were repeatedly constructed over a period of three to four generations. Nonetheless, they disappeared after level A3B. At this time settlement in Operation III seems to contract, but people may have moved to other parts of the site.

3.1 Deposits

In six of the storehouses (A4.6, A4.10, A4.25, A4.26, A3.3 and A3.4) deposits of tool sets, aurochs horncores or other finds were discovered, the contexts of which suggest intentional deposition. It may not be a coincidence that so many of these deposits were found

in buildings with suspended floors, that were rebuilt on the foundations of a predecessor.

In building A4.6 four flint concentrations with many stone tools were found in the sub-floor space, lying on the floor of the previous building. They seem to have been left behind intentionally when the previous phase ended and became part of the foundation of the level A4A building. In building A4.10, a bin with some stone tools inside was sealed in by a platform. The platform with this special deposit inside supported the suspended floor of the next phase. In building A3.3, an aurochs horncore buried in chaff was present in the sub-floor space, deposited on the previous floor and closed in by the suspended floor. In building A4.25 two find concentrations were discovered in small niches in the corner of a room. The niches were not particularly well made or plastered, they seemed rather like small pits dug into the walls, perhaps made there as part of a closure ritual. One contained a set of stone tools including six axes, a bead and two sets of finely worked bone clasps in the shape of animal figures, the other a collection of sling missiles. An identical animal clasp was found inside a feature in the platform in the communal plaza, a rectangular plastered bin that was sunk into it. In two corners of the bin an ovicaprid horn was placed.

We can't be certain whether these finds were intentionally left in these locations since the niches and the platform-bin were not plastered shut or sealed in by other architecture, but their context and the nature of the finds certainly suggest it.

Furthermore, in building A4.24, a host of objects was found on the level A4A floor of room 7 (figure 8). The finds included a scapula of an aurochs and an anthropomorphic figurine (Arntz 2022, 128), and were centred around an unbaked pot stand. The room was not used as a refuse dump after abandonment. In room 3 of building A3.4 an aurochs horncore, a horn of an ovicaprid and some other objects were deposited in a shallow basin, sunk into level A4A room fill before level A3B was built. Finally, in room 7 of building A4.7 a pile of animal bones was found in level A3B, in the south-east corner deposited against the west wall.

Other examples of such deposits are known from Tell Sabi Abyad, for example a find of three small alabaster jars placed in the foundation of a wall in Operation IV (ca. 6250 – 6400 BCE), and a find concentration sealed in the base of a large bin in building A4.4 (level A4C) with stone tools, an aurochs scapula and many figurines. These finds are rare, however.

3.2 Similar Constructions at Other Sites

For the Neolithic period of Southwest Asia, there are many examples of floors that were raised above ground, such as the grill-plan structures at Early Pre-Pottery Neolithic B Dja'de al-Mughara (Coqueugniot 1998; 1999), or Çayönü (Braidwood *et al.* 1971, Özdoğan and Özdoğan 1989). The suspended floors of Tell Sabi Abyad however were on ground level, placed over a subterranean space.

Parallels of this construction can be found in the much earlier Pre-Pottery Neolithic A settlements of Dhra' and Wadi Faynan (Kuijt and Finlayson 2009; Finlayson *et al.* 2003; 2011) and Gilgal I (Bar-Yosef *et al.* 2010). Of these, the granaries at Wadi Faynan and at Dhra' show the closest resemblance to the Tell Sabi Abyad storehouses.

At Dhra' (Finlayson *et al.* 2003, Kuijt and Finlayson 2009) round granaries measuring 3 × 3 metre were identified, with suspended mud floors resting on timber beams supported by notched reused grinding stones, placed in rows that were 1.2 – 1.3 metre apart. The space below the suspended floor was partly beneath ground level. The floor of building 4 at Dhra' sloped at a 7-degrees angle, which was probably intentional according to the excavators (Kuijt and Finlayson 2009:10967). A slanted floor may have been practical for collecting certain foodstuffs such as grain or legumes, but it is not very suitable for working or living. At Wadi Faynan (Finlayson *et al.* 2011) building O45 on site WF16 also had a suspended mud floor, resting on notched upright stone slabs. Building O45 was an elliptical structure of 5.5 × 4.5 m. The raised floor was suspended over a pisé-lined pit, making the sub-floor space subterranean. The floor beams were covered with layers of brushwood and reeds, supported by the notched stones, and bonded into the wall, which was standing on the ground surface.

On the suspended floor a smaller elliptical structure was present, with a floor that was compartmentalized with ridges of moulded plaster. The suspended floor with a compartmentalized part prompted the excavators to consider an interpretation as a storage facility. The wooden beams of the suspended floors of Tell Sabi Abyad were not supported by stones, but by the levelled walls of a previous building instead. They were bonded into the outside walls by placing new walls above the older levelled ones, wedging the wooden beams in between. The rooms they were suspended over were small, between 1.0 metre and 2.1 metre in width.

3.3 Increasing Adaptability by Increasing Surplus

Food storage was of vital importance to the Late Neolithic inhabitants of Tell Sabi Abyad to overcome shortages. Before the appearance of the large storehouses in level 6 of Operation I (6010-5995 BCE) it was likely organized at the household scale. The presence of gypsum- and mud-plastered bins, mostly inside houses, can be interpreted as indirect evidence for household-organized storage (*e.g.*, Kuijt and Goring-Morris 2002). At Tell Sabi Abyad, such bins were generally found without content. This is the case at other Neolithic sites as well, presumably because they contained food, that perished if it was left behind. This is confirmed by bins that happened to have been burnt with plant stores inside, for example at Pre-Pottery Neolithic A 'Ain Ghazal (Rollefson and Simmons 1986, 152, figure 9; Rollefson 1997, 291). Such bins contained charred plants with long shelf life, such as seeds, legumes, nuts or fruits, which are well suited for storage (*e.g.*, Lee 1973; Kramer 1982). Animal products could be kept for some time if they were dried, smoked or salted, but large animals such as cattle were probably shared between households and consumed quickly due to their large amounts of meat (*e.g.*, Halstead 2015).

The appearance of buildings with suspended floors may have increased the scale of food storage by increasing the amount of storage space. The number of bins or their total volume did not diminish (table 1) in comparison to previous levels. In fact, they increased, but so did the number of excavated buildings: from level A4C to level A4B the settlement seems to have grown in the number of buildings. While one large multi-roomed building (A4.1) from level A4C was no longer in use in level A4B, three new tripartite buildings appeared on the south side of the settlement (A4.22-24) together with a multi-roomed building on the north side (A4.18). A possible growing population size might have increased the need for surplus storage and it may have intensified interaction regarding food consumption.

With some exceptions, bins were found inside buildings, concealed in rooms, but not all buildings had them (figures 3 and 5). Some buildings had one or two rooms with a gypsum-plastered floor, suitable for storage of dry foods. The building cluster in the north-east (buildings A4.5, A4.10, A4.11) had suspended floors with bins in two of the buildings and multiple large bins in another. Building A4.10 had suspended floors in almost every room and may have been used for storage in its entirety.

VOLUME OF BINS AND BASINS IN LEVELS A4C, A4B, A4A AND A3B											
ID	Feature	Level	Building	Room	Length (m)	Width (m)	Height (m)	Diameter (m)	Volume (l)	Shape	Designation
1	CK	A3B	A3.01	A3.1.7	0.90	0.30	0.10		27.00	rectangular	bin
2	CJ	A3B	A3.01	A3.1.7	0.60	0.30	0.10		18.00	rectangular	bin
3	CJ	A3B	A3.02	A3.2.9	1.00	0.60	0.06		36.00	quarter-circle	bin
4	CK	A3B	A3.02	A3.2.6	0.60	0.30	0.45		81.00	quarter-circle	floor with basin-shaped part
5	HX	A3B	A3.08	A3.8.1	1.50	1.45	0.10		217.50	quarter-circle	bin
6	EM	A3B	platform	open area	1.62	1.16	0.60		1127.52	rectangular	basin
7	IK	A4A	A4.25	A4.25.5	3.10	2.30	0.20		1426.00	rectangular	floor with 3 basins
8	HV	A4A	A4.26	A4.26.2	1.45	1.15	0.16		0.27	quarter-circle	bin
9	HW	A4A	A4.26	A4.26.2	1.50	1.45	0.14		0.30	quarter-circle	bin
10	R	A4A	open area	open area	0.55	0.45	0.22		54.45	oval	bin
11	EV	A4B	A4.05	A4.5.5	1.60	0.75	0.22		264.00	rectangular	bin
12	GJ	A4B	A4.10	A4.10.5	0.85	0.60	0.76		387.60	quarter-circle	bin
13	HT/GP	A4B	A4.10	A4.10.5	4.25	2.85	0.15		1816.88	rectangular	floor, compartmentalized
14	GU	A4B	A4.11	A4.11.4	0.85	0.31	0.29		76.42	quarter-circle	bin
15	II	A4B	A4.11	A4.11.4	0.49	0.20	0.21		20.58	quarter-circle	bin
16	HL	A4B	A4.11	A4.11.4	0.65	0.50	0.16		52.00	quarter-circle	bin
17	GD	A4B	A4.11	A4.11.1	2.45	0.95	0.18		418.95	rectangular	bin
18	DB	A4B	A4.12	A4.12.7	0.54	0.51	0.69		190.03	oval	bin, in installation with DT and DU
19	DT	A4B	A4.12	A4.12.7	0.47	0.38	0.42		75.01	rectangular	bin, in installation with DB and DT
20	DU	A4B	A4.12	A4.12.7	0.47	0.32	0.29		43.62	rectangular	bin, in installation with DU and DT
21	DZ	A4B	A4.18	AA4.18.1	1.00	0.50	0.73		36.50	quarter-circle	bin
22	DW	A4B	A4.18	A4.18.4	0.45	0.37	0.03		5.00	rectangular	bin
23	AX	A4B	A4.18	A4.18.6	0.50	0.45	0.09		20.25	rectangular	bin
24	ED	A4B	A4.18	A4.18.1	0.50	0.35	0.32		56.00	oval	bin
25	BI	A4B	open area	open area	0.90	0.55	0.58		287.10	oval	bin
26	CK	A4B	open area	open area	0.65	0.45	0.05		14.63	oval	bin
27	CL	A4B	open area	open area	0.60	0.35	0.05		10.50	oval	bin
28	DP	A4B	open area	open area	1.60	1.00	0.08		128.00	oval	bin
29	CN	A4B	open area	open area	0.45	0.33	0.18		26.73	oval	bin
30	O	A4C	A4.01	A4.1.1			0.08	0.35	7.60	round	bin
31	AB	A4C	A4.01	A4.1.1			0.08	0.25	3.90	round	bin
32	P	A4C	A4.01	A4.1.1			0.08	0.45	12.70	round	bin
33	EK	A4C	A4.02	A4.2.3	0.50	0.30	0.30		45.00	oval	bin
34	GE	A4C	A4.04	A4.4.2	2.00	1.50	0.37		1110.0	rectangular	bin
35	CV	A4C	open area	open area			0.05	0.50	9.80	round	bin

Table 1: Volume of bins and basins. Dimensions are in metres, volumes in litres. In level A4C suspended floors were not yet present, the bins of this level have been added for comparison only.

The storage volume of those bins was limited, compared to the floorspace of rooms with a suspended floor, unless of course the floor space around those bins was used as well. The increase of storage space the storehouses generated may therefore have been considerable, and likely increased the scale of food storage substantially. However, it is possible that in earlier levels food was stored in other spaces besides plastered bins. We could think of baskets or other perishable containers, that were placed on benches, or hanging from the rafters (Atalay and Hastorf 2006), or even in side rooms, in abandoned buildings, on roofs, and in pits (*cf.* Ertug-Yaras 1997, 91-2). Even if the storehouses did not increase the volume of storage space, the suspended floors were still an important invention if they increased the shelf-life of stored food.

If the introduction of storehouses increased storage volume considerably, it likely exceeded what a single household would need. It has been estimated that about a ton of grain, seeds, nuts or other condensable food stuffs, would fit in a bin of 1 m³ or a 1000 litres, and this would be a sufficient staple food store for a family of 5-7 people for a year (Clark and Haswell 1966, 49; Forbes 1982, 356; Kramer 1982, 37, 121, table 2.3), not counting the much-needed reserves people in an area with high risk of crop failure would need. Verhoeven proposed that in Operation I ('the burnt village'), dated to 6010-5995 BCE, the rectangular storehouses were not used for housing, and estimated that on average around ten people lived in each of the other buildings (Verhoeven 1999, also Meijer, this volume). The buildings of Operation III at around 6455-6375 BCE tend to cluster in groups of two to five structures. Perhaps we should look at these building clusters to establish the number of households, rather than at individual edifices. Each cluster then may represent an extended family that was probably larger than 5-7 people, of which the members shared houses, courtyards, auxiliary buildings, storage facilities *etc.* (Akkermans 2013). In some levels one or two larger structures of varying layout were accompanied by smaller, auxiliary buildings. In levels 4 and 3, the clusters consisted of several tripartite, or other multi-roomed buildings of roughly the same size, that may represent one or more households. If the storehouses (buildings with suspended floors that could have been used for storage in their entirety: A4.10, A4.6, A4.26, A4.25 and A3.2) and the smaller auxiliary buildings are excluded, a very rough estimate could be made of 50 people in level A3B, about 100 people in level A4A, and

about 120 in level A4B. If not all these buildings were used to house people, this number could be significantly lower.

The bins in Operation III were generally much smaller than the 1000 litres that could provide a small family with staple food supplies for a year, and not all clusters of buildings had them, but when bins were present there was usually more than one. In building cluster A4.10, A4.11 and A4.5, the total volume added up to 1200 litres. This volume was originally larger because some bins were levelled in a later phase. In addition to the bins, suspended compartmentalized floors were present in building A4.10. Here the total storage capacity amply exceeded 1000 litres, but in other building clusters, the combined bin volume still didn't amount to that (table 1). Many of those bins were not completely preserved either, and the considerable variation in sizes and shapes makes it difficult to estimate volume. If all buildings with suspended floors were indeed used for storage however, the amount per building would easily exceed what one small family of 5-7 people would need and probably also what larger, extended, families would need. This could mean that the opportunity arose to build up more surplus and multi-year stores, a very significant advantage.

Suspended floors were not present in every building, nor in every cluster of buildings. They were found in levels A4B, A4A and A3B, in a few buildings around or close to an open area with many firepits, a village square (figure 3). This might suggest that only a few households had such a large storage facility at their disposal while others did not, which conceivably could lead, as Bogaard and colleagues propose (Bogaard *et al.* 2009), to division and strife in the community. Perhaps, however, the storehouses and their contents were shared by the community, or belonged to a few large extended families. In settlements the size of Tell Sabi Abyad in this phase, the difference between 'extended families' and 'the community' may be moot.

The storehouses were located around a large open area with many firepits used for cooking and a platform with no architecture. The spatial pattern of the storehouses around the plaza may have reflected social affiliations. Several units of extended families could have been living close to each other here, organizing their storage and preparing food together. Since the buildings were too small to accommodate meals with large numbers of people, the plaza with the firepits would be the ideal location for food sharing and daily interactions. An outside area like this, where

mundane, informal daily activities routinely and repeatedly took place, must have played an important role in maintaining and strengthening community ties in settlements like this (Makarewicz and Finlayson 2018). The platform contained remains of a previous building that was filled up with mudbricks, perhaps an ancestral house of people living around the square (Akkermans *et al.* 2011b, Akkermans and Brüning 2019; Plug *et al.* forthcoming).

Extra storage volume could suggest extra surpluses. Bogaard *et al.* (2009, 664) and Halstead (2015) propose that if private storage became competitive and social cohesion was threatened, the divisive effects could be mitigated through the sharing of surpluses, especially cattle. Sharing between groups can be a valuable form of exchange to maintain social ties (Russell 2010), reinforcing communal social cohesion. At Çatalhöyük, aurochs and horns, displayed near the entrances of houses for religious reasons, possibly also reminded people of feasts as episodes of sharing (Twiss 2008; Twiss *et al.* 2008). At Tell Sabi Abyad, no direct evidence for feasting and the associated meat sharing was found, but that doesn't mean it did not occur (Russell 2010, 268). There were some displays of animal parts that may refer to meat sharing events: A deliberate deposit of an aurochs horncore in tripartite building A4.24 (figure 6) and another in A4.16, a single-roomed building with a suspended floor. An aurochs rib was found on a floor in building A4.6. A concentration of animal bones was present in room 7 of building A4.24. Fragments of gazelle horncores were found on floors in buildings A4.9 and A4.15, and in older level A5A a gypsum-plastered bin was filled with animal bones (trench D4). These artefacts seem to have been placed there on purpose at the time of abandonment, or perhaps as part of a foundation ritual when the next phase with suspended floors was built. Besides meat sharing, surpluses of for example grain, may have helped to strengthen social ties too, and if the storehouses held more than what one household would need, it would imply cooperation between households. Social cohesion resulting from food sharing and cooperation between households would be important factors in adaptive strategies to mitigate environmental or other challenges. In this way, increased control of food stores may have contributed to people's ability to adapt.

Around the end of the 7th millennium substantial changes occurred in Late Neolithic communities in Syria, roughly coinciding with a global climate change, the so-called 8.2 ka event. This caused relatively colder

and drier conditions in the northern hemisphere (*e.g.*, Alley and Ágústsdóttir 2005; Rohling and Pälike 2005). Slightly lower temperatures are considered to have had little impact on the environment, since they were within limits of what most plant species in the region could endure (van Zeist and Waterbolk-van Rooijen 1996), but in this semi-arid region decreasing rainfall would have had an important effect on agriculture.

At Tell Sabi Abyad, change was demonstrated convincingly within the continuous sequence of seventh and early sixth millennium settlements, with the recognition of a range of coinciding innovations and adjustments in culture and subsistence patterns, happening roughly at the same time as the 8.2 ka event (Akkermans *et al.* 2010; 2011a; Nieuwenhuys *et al.* 2016). Many of these innovations were not wholly new ways of mitigating the effect of worsening environmental conditions, but adaptations of earlier mid-seventh millennium developments. These developments were the result of continuing coping mechanisms of highly resilient, adaptable people living in a marginal landscape (Akkermans 2023, 49, see also Flohr *et al.* 2016). Moreover, once innovations and adaptations started to transform society, the process of transformation by itself may have set in motion other, unintentional but useful changes (Akkermans *et al.* 2014, 253), a self-reinforcing effect that increased adaptability.

An example of this may be the appearance of storehouses with suspended floors in levels A4 and A3 of Operation III. Their development set changes in motion that, presumably, gradually led to surplus and to more communally organized storage, which may have helped pave the way for the appearance of the large multi-roomed communal storehouses of level 6 in Operation I.

The 'burnt village' of Operation I provided detailed insights into community life early in the 6th millennium (Akkermans *et al.* 2014). Among many other changes, new types of architecture were identified here: the village consisted of large multi-roomed storehouses and granaries with small circular buildings around them. It has been hypothesised that the need for such large storehouses was invoked by increasing mobility and pastoralism associated with these phases of the site (Akkermans and Schwarz 2003). In the storehouses sealed possessions of mobile people were stored in addition to grain. It is conceivable that the storehouses were also used to provide multi-year buffers for the local population or even that they were

primarily built for this purpose. Their introduction may have furthered collaboration between households and strengthened social ties. In doing so they may have been a key factor in people's general ability to adapt, which served them well when environmental conditions worsened around 6200 BCE.

The storehouses were rebuilt repeatedly on the foundations of previous buildings because the levelled remains of earlier buildings were repurposed to support suspended floors, but it also provided the community with some temporal depth. The intentional placement of aurochs horncores, toolsets and other meaningful objects under floors or in walls may have been a commemorative act. At Tell Sabi Abyad III (ca. 6850- 6700 BCE), where buildings were repeatedly built in the same locations many times over, buildings served domestic needs, but they also allowed people to form shared connections to the past (Plug *et al.* forthcoming). Sharing history of place induced cooperation between households in delayed-return economies of the Neolithic of Southwest Asia (Goring-Morris 2000). Although the buildings under consideration here were rebuilt only a few times and had an estimated lifespan of no more than one generation (20-30 years, van der Plicht *et al.* 2011; Akkermans 2013), such continuity of place is noteworthy in these settlements, where dispersal and frequent relocation was more common than spatial continuity.

4 CONCLUSION

The appearance of buildings with suspended floors may have increased the shelf-life of stored food and the scale of storage, and reinforced social cohesion by the sharing of surplus and increased collaboration between households. Ultimately, this may have been a factor that contributed to the community's ability to adapt to environmental changes, apparent in the many changes in culture and subsistence that started halfway the 7th millennium and increased and accelerated around 6300-6200 BCE.

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