

## Notice

The Editorial Board of the Journal of Lithic Studies would like to note that it has recently come to our attention that the archaeological activities described in this paper took place in the Fazael Valley (also known as Fasa'il and Phasael Valley) without a permit from the Ministry of Tourism and Antiquities, Palestine (responsible for issuing permits for the Fazael Valley) - among the various permits and approvals needed for this research. Had we been aware of this we would have asked for sight of the permit and would not have published the article without seeing the permit.

The Editorial Board has carefully considered the paper and decided to leave it online but with this notice indicating that this paper does not comply with our publication policy.

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*Ground stone tool assemblages at the end of the Chalcolithic period: A preliminary analysis of the Late Chalcolithic sites in the Fazael Valley*

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# Ground stone tool assemblages at the end of the Chalcolithic period: A preliminary analysis of the Late Chalcolithic sites in the Fazael Valley

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## Abstract:

The very Late Chalcolithic sites of the Fazael Valley exhibit changes in settlement patterns and material culture. This paper presents the analysis of the ground stone tool assemblages of these sites, and includes the combination of attribute analysis, functional typology, and spatial and contextual analyses, allowing comparisons both between the different sites and between different phases within the sites. The assemblages of the late sites of Fazael 2 and Fazael 7 show similar use of raw materials and tool design, which is clearly different from the assemblage of the earlier typical Ghassulian Chalcolithic site of Fazael 1. In Fazael 2, two phases revealed a shift from the use of large grinding tools to mortars and small grinding tools. In both the earlier and the later phases, the separation of activity areas within the site is clear. Grinding activity in both phases is restricted to the western side of the site, while mortars and spindle whorls were found only in the south-eastern part. Finally, a comparison with Fazael 1, as well as with other Late Chalcolithic sites, such as Gilat, 'Ein Hilu and 'En Esur, show that the large number of mortars found in Fazael 2 and Fazael 7 is unique, and may hint at a shift to different subsistence strategies appearing in this region in the latest phases of the Chalcolithic period.

**Keywords:** Fazael; Jordan Valley; Late Chalcolithic; functional analysis; ground stone tools

## 1. Introduction

The site of Fazael is located in the central Jordan Valley 20 km north of Jericho (map reference: Israel New Grid 2413/6618) (Figures 1 and 2). First described briefly by Porath (1985), and extensively surveyed in 2006 within the framework of the Manasseh Hill Country Survey (Zertal 2012), the site proved to be a concentration of sub-sites along the northern terrace of Wadi Fazael. These sites, named Fazael 1, 2, 5, and 7 (Bar 2013; Bar *et al.* 2013; Bar 2014a; Bar 2014b; Bar *et al.* 2014; Bar *et al.* 2015), Fazael Porath (Porath 1985) and Fazael Peleg (Peleg 2000), make up an aggregation of Chalcolithic settlements, all probably part of one large site, located on the perimeter of the fertile alluvial fan of Wadi Fazael which drains the steep Samarian hills.



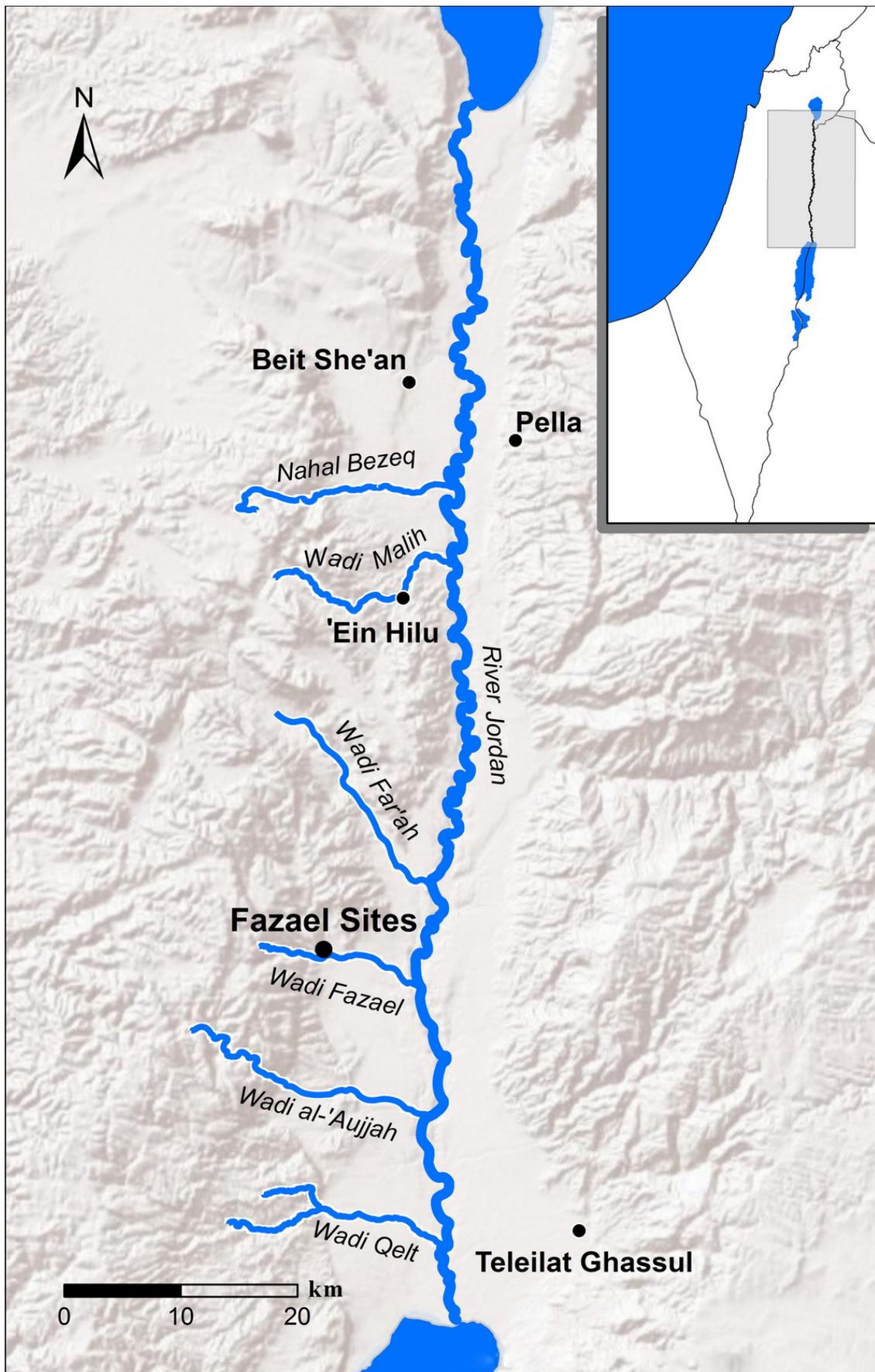


Figure 1. Map showing the published Chalcolithic sites in the Lower Jordan Valley. (Background by ESRI sources 2014: ESRI, USGS, NONA.)

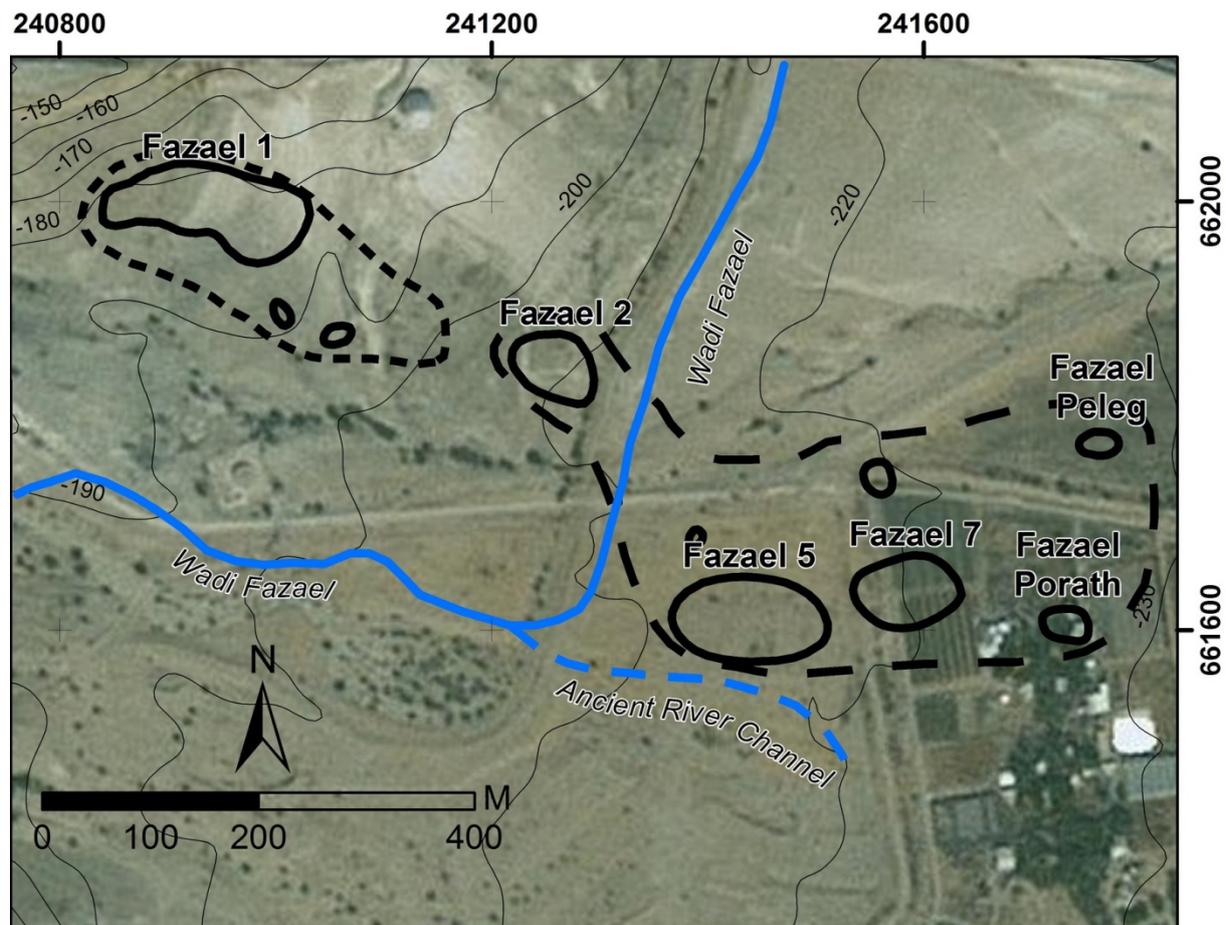


Figure 2. Late Chalcolithic sites identified in the Fazeal Valley and the presumed area of the ancient settlement marked within the dashed lines. (Background by ESRI sources: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, Swisstopo, and the GIS User Community.)

Surveys and excavations conducted in the last nine years in this cluster of settlements have revealed groups of very large dwelling complexes widely spread over an estimated area of at least 14 ha (Bar 2014b). Each dwelling complex has at least one large courtyard house consisting of a large broad room, with up to three adjacent open courtyards. Each complex has an estimated area of between 660 and 1500 sq. m, the largest known from this period. The dwelling complexes are separated by large empty open areas, whose function remains unknown. Radiometric dates from one of the complexes suggest that it was inhabited in the first century of the 4<sup>th</sup> millennium BCE (Bar *et al.* 2013).

The excavations of the various sub-sites support the assumption that all the architectural complexes found at the different Fazeal sites, excluding Fazeal 1, are part of one large site dated to the very late Chalcolithic (Bar 2014b). This assumption is based on the architectural similarities between the domestic complexes (large courtyard houses, square architecture), the location on adjacent hillocks on the bank of the same river, and the similar masonry (measurements of walls and installations, modes of construction, *etc.*). The similarities of the ceramic, flint and copper assemblages are very clear, and add support to such an assumption. An almost complete absence of bifacial tools in all the flint assemblages is a very important indicator of the later date suggested for these sites. Furthermore, in all the sites that were extensively excavated (Fazeal 2, Fazeal 7 and Fazeal Porath) Canaanite blades were found (*e.g.*, Bar & Winter 2010). The presence of these blades is one of the important cultural links showing that all sites functioned at the same time.

Fazael 1 has a different location from the other sites - at a distance from the bank of the river, and on the lower slopes of the mountain. The site shows dense occupation, and its architecture, masonry, and ceramic and lithic assemblages are different from those of the lower sites. Four occupational phases were found in Fazael 1, and it seems that it was settled earlier in the Chalcolithic period in the Fazael Valley (Bar *et al.* 2014). This site was abandoned at some point during the Chalcolithic period, and the settlement shifted to the large separated complexes discovered closer to the river.

## 2. Methodology

The ground stone tool assemblages of Fazael 2, Fazael 5, and Fazael 7 comprise 162 items. 126 items were found in Fazael 2, while Fazael 5 and Fazael 7 were excavated on a much smaller scale, yielding 8 and 28 items respectively.

The methodology used for the analysis of the ground stone tools is described in detail elsewhere (Cohen-Klonymus 2014; Cohen-Klonymus & Garfinkel 2016). The analysis generally follows the methodological structure set out by Adams (2002), which reconstructs item life histories by attribute analysis. Adam's methodology was adapted to the ground stone tool assemblages of the southern Levant, although some categories and attributes were added, changed, or redefined in order to allow additional perspectives for the examination of the assemblage.

Attribute analysis allows us to divide item characteristics into categories. In each category the item is described by consistent, pre-defined nominal, ordinal or continuous attributes. Categories of nominal and continuous attributes are well-known, and are commonly used in ground stone tool descriptions. Nominal attributes include the description of raw material, morphology, type of use wear, maintenance, and context of finding, while continuous attributes include item measurements.

Ordinal attributes describe the level of design, level of wear, state of preservation, and to some extent also the secondary use of items. For example, item level of design refers to intentional modification of the outer surfaces of the item (and see Adams 2002: 21; and Cohen-Klonymus 2014: 112), as opposed to its use surface.

Level of design can be defined as:

- A. Expedient, if it was modified only by use.
- B. Simply designed, if any other modifications were made, but not enough to be considered at a higher level of design.
- C. Moderately designed, if any arrangement of base or grip was set, or if having only one of the characteristics of a highly designed tool.
- D. Highly designed, if it had at least two of the following characteristics: a base or a grip shaped beyond what is needed for basic positioning or handling; intentionally aligned or symmetrical modifications; evenly well-abraded, smoothed or polished outer surfaces; or decorative motifs on the inner or outer surface.

Ordinal attributes may allow us, considering the archaeological context, to group similar attributes as one, for example, in order to compare a unified group of expedient and simply designed tools with a group of moderately and highly designed tools.

A functional typology was used, based mainly on the general functions determined by use-wear analysis (*e.g.*, grinding, pounding, polishing, no use, *etc.*), as well as by clear use signs left on items; but also with the use of other attributes relevant to each tool type. For example, reciprocal or circular strokes, each causing a development of a different use surface section, were used to distinguish grinding stones and grinding slabs from querns; a minimum of length and width was used for defining two-handed grinding stones and grinding slabs; symmetry and weight was considered for spindle whorls; and raw material was considered

when defining handstones as abraders, as opposed to one-handed grinding stones. The attribute analysis, already set by clear constant terms, was used as common ground for constant, well-defined typological types.

However, it should be noted that while attributes were used to define the typological scheme, and can be used to describe the typological types, they were by no means limited to use only within the typological group. The sum of attributes in each category, as well as the cross-checking of categories, was used as an independent ‘typology’, for example, when checking the correlation of the raw material to the level of design or weight, or when comparing level of design and the level of use wear. In many cases, the typological scheme was used as an extra category of nominal attributes within such cross-checks.

Individual attributes, typological types, and cross-checks of attributes were also examined in spatial analysis and within the archaeological context, in order to recognize defined activity areas or other differences in the ground stone tool assemblages between strata and between sites.

This preliminary report of the ground stone tool assemblages of Fazael 2 and Fazael 7, accompanied by a short reference to the already published small assemblage of Fazael 5, is an attempt to determine whether the change in the settlement pattern between the later sites and Fazael 1 can also be observed in the ground stone tool assemblage. This shift from dense occupation to large compounds, taking place at the end of the Chalcolithic period in the Fazael Valley, should be seen as a sociological and economic change, which is likely also to be reflected in the ground stone tool assemblages.

### 3. Results

#### 3.1. Raw materials

The use of raw materials in the Fazael sites appears in the left-hand columns of Table 1 and in Figure 3. The Late Chalcolithic Fazael sites are situated at the foot of the eastern slopes of the Samaria Mountains. *Mishash* flint, chalk, and various types of limestone and dolomitic limestone are found in the immediate vicinity of the sites, including the geological groups of Mount Scopus and Judea, and the Adulam formation (Figure 4).

Table 1: The use of raw materials for utilitarian ground stone tools in various Late Chalcolithic sites (Rowan 2006; Rowan *et al.* 2006; Bar *et al.* 2008; Bar *et al.* 2014). The most common raw material in each site is in **bold font**.

	Fazael 2	Fazael 7	Fazael 1	Gilat	'Ein Hilu	'En Asur IV
Basalt bowls	37 (29.4%)	1 (3.6%)	(0%)	296 (20.2%)	3 (6.3%)	12 (27.3%)
Other basalt items	13 (10.3%)	2 (7.1%)	5 (16.1%)	56 (3.8%)	<b>22 (45.8%)</b>	<b>20 (45.5%)</b>
Limestone and chalk	<b>57 (45.2%)</b>	<b>21 (75%)</b>	<b>21 (67.7%)</b>	293 (20%)	14 (29.2%)	9 (20.5%)
Flint	4 (3.2%)	1 (3.6%)	1 (0%)	25 (1.7%)	(0%)	1 (2.3%)
Haematite	1 (0.8%)	0 (0%)	(0%)	9 (0.6%)	(0%)	(0%)
Sandstone	13 (10.3%)	3 (10.7%)	1 (3.2%)	25 (1.7%)	6 (12.5%)	(0%)
Beachrock	0 (0%)	0 (0%)	(0%)	<b>711 (48.6%)</b>	(0%)	1 (2.3%)
Other	1 (0.8%)	0 (0%)	3 (0%)	49 (3.3%)	3 (0%)	1 (0%)
<b>Total</b>	<b>126 (100%)</b>	<b>28 (100%)</b>	<b>31 (100%)</b>	<b>1464 (100%)</b>	<b>48 (100%)</b>	<b>44 (100%)</b>

Large limestone river rocks, cobbles, and pebbles can be found scattered on the plains around the site and in the Fazael stream itself. Sandstone can be found about 15-20 km east of the sites, while a purple variant of sandstone probably originated from an outcrop located next to the closest basalt deposit, about 30 km to the north, in Wadi Malih, near the site of 'Ein Hilu.

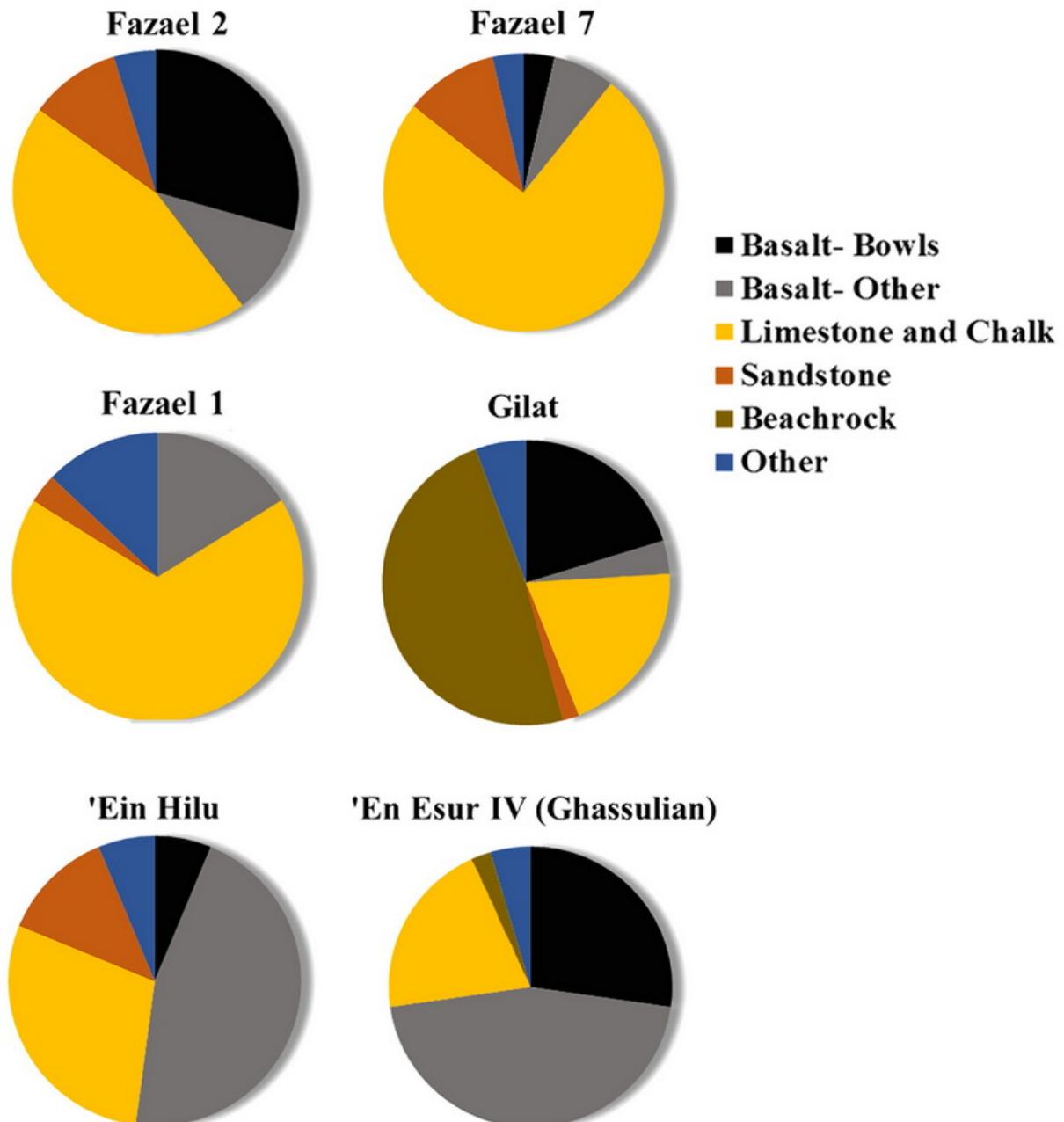


Figure 3. Raw materials for utilitarian ground stone tools in various Late Chalcolithic sites (data source, see Table 1).

### 3.2. Fazael 2

Fazael 2 is located in the north-western area of the settlement, situated at the foot of the mountains, which start their rise to the west. About 500 m<sup>2</sup> of the site were excavated in 2007-2015, with most of the items found no more than 20 cm below the topsoil level. The main phase of occupation in Fazael 2 (Stratum II, Figure 5) includes a large courtyard, about 560 m<sup>2</sup> in area, with a set of three rooms closing its western part (Units 6-8), and an exterior broad house abutting it near its southeastern corner (Units 1-2). An open area west of the broad house contained a rich accumulation of finds (Unit 3). In the southeastern part of the courtyard there was a room opening to the east (Unit 4).

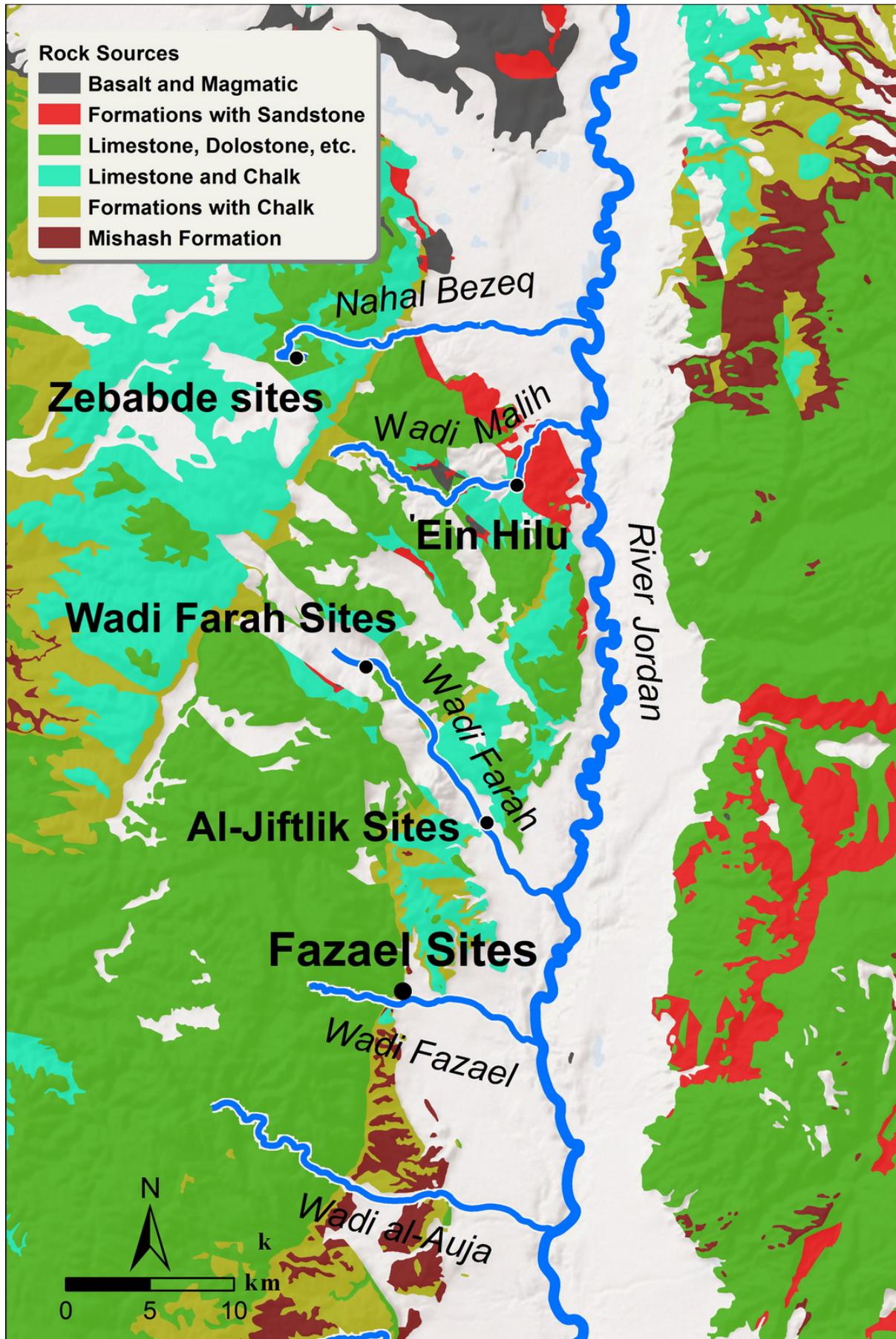


Figure 4. Simplified Geological Map of the Fazael Valley and its vicinity (data source, see Sneh *et al.* 1998).

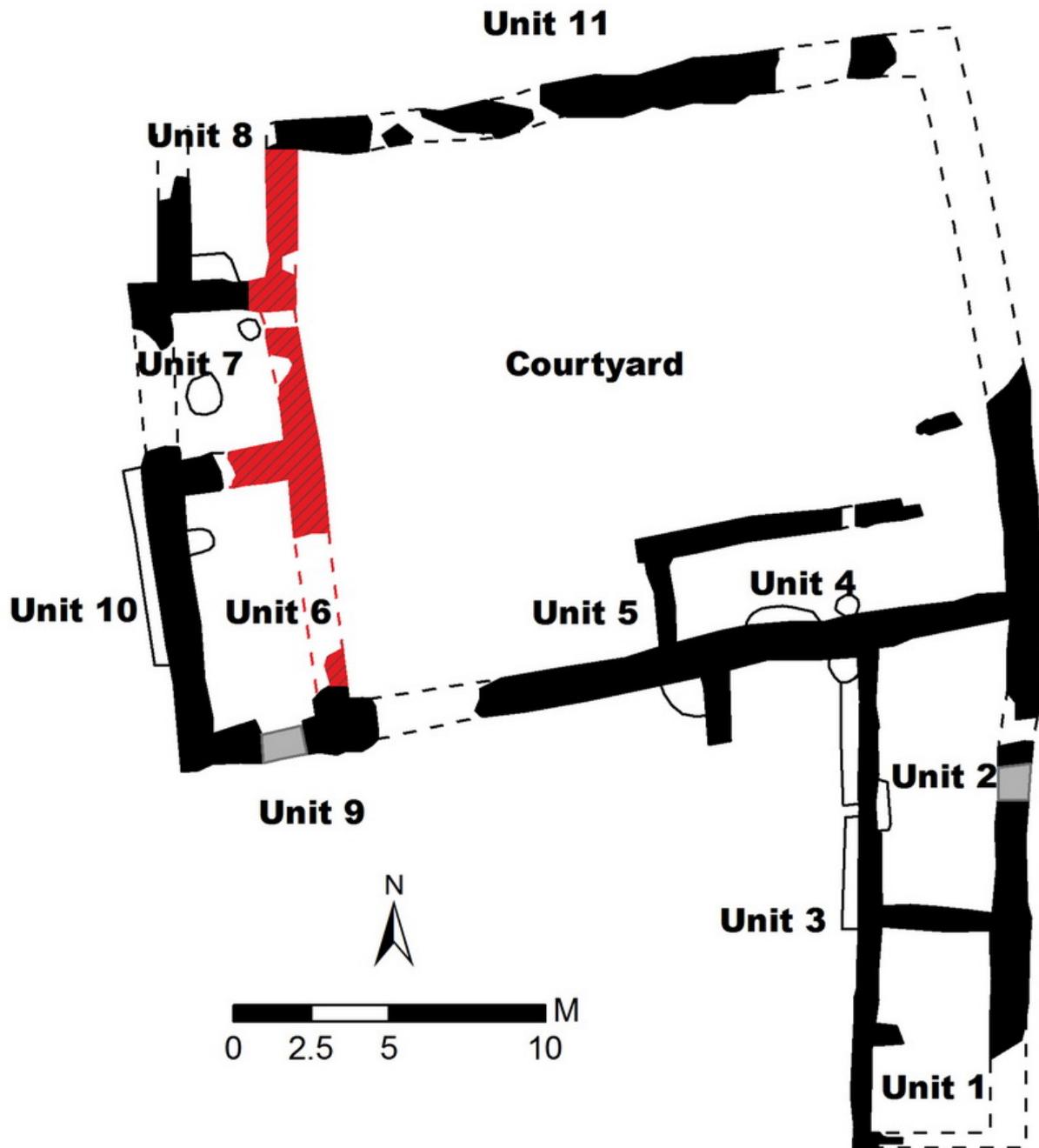


Figure 5. Schematic plan of Fazael 2. The eastern walls of Units 6-8 covered by an upper floor level are shown in hatched red.

An upper floor level in Units 6-8 covered the rooms and their eastern walls, thus cancelling the rooms and opening them to the courtyard (Stratum IIa). On the other hand, the excavation under Unit 2 uncovered a large round plastered disposal pit containing large jar shards, which predated the broad house (Stratum III). It is therefore possible that the construction of the broad house (Units 1-2) occurred at the same time as the covering of the inner set of rooms (Units 6-8). Stratum I post-dated the abandonment of the Stratum II courtyard and building. It appears mainly in Unit 5, but is found throughout the site as installations built with large stones scavenged from the Stratum II courtyard walls.

### 3.2.1. The ground stone tool assemblage of Fazael 2

Of the 126 items found in Fazael 2, 96 can be related to the main occupational phase in the site (Stratum II), making them the focus of this discussion. The distribution of tool types by strata is shown in Table 2. Half of the items, of which only 19 were complete, were found on floors. Coupled with the relatively small number of complete pottery vessels, this demonstrates that the site was probably abandoned in an orderly manner. Therefore, even though all ground stone tool types needed for daily activities were found in Fazael 2, it is probable that this assemblage does not represent the full scale of activity at the site, so the spatial analysis presented here should only be seen as preliminary until the study of the other finds might confirm it.

Table 2: Distribution of ground stone tool types across strata in Fazael 2. Abbreviations: Str. - strata.

Tool type	Site surface	Str. I	Str. I-or-II	Str. II	Str. II-or-III to III	Total
Unidentified grinding tools			1 (6.25%)	1 (1.04%)		2 (1.59%)
Lower grinding tools	2 (20%)	1 (50%)	2 (12.5%)	8 (8.33%)		13 (10.32%)
Upper grinding tools	2 (20%)	1 (50%)	2 (12.5%)	22 (22.92%)		27 (21.43%)
Mortars			2 (12.5%)	11 (11.46%)		13 (10.32%)
Pestles				1 (1.04%)		1 (0.79%)
Vessels and bowls	4 (40%)		6 (37.5%)	26 (27.08%)	1 (50%)	37 (29.37%)
Work tools	1 (10%)		1 (6.25%)	22 (22.92%)		24 (19.05%)
Maceheads			1 (6.25%)	1 (1.04%)		2 (1.59%)
Door pivots	1 (10%)			2 (2.08%)		3 (2.38%)
Spheroid (unused)			1 (6.25%)	1 (1.04%)	1 (50%)	3 (2.38%)
Unknown				1 (1.04%)		1 (0.79%)
<b>Total</b>	<b>10 (100%)</b>	<b>2 (100%)</b>	<b>16 (100%)</b>	<b>96 (100%)</b>	<b>2 (100%)</b>	<b>126 (100%)</b>

#### 3.2.1.1. The earlier phase of occupation of Stratum II

On the lower floor level of Unit 6, in the northwestern corner of the room, a large grinding slab (about 20 kg) and a large saddle quern (about 10 kg) made of sandstone were both found upside down (Figure 6). The tools had quite similar designs, but the first was used with flat reciprocal strokes, creating a concave use surface, while the other was used with circular strokes, creating a sunken use surface. Nearby a nearly worn-out two-handed upper grinding stone made of purple sandstone, an expedient palette made of limestone river rock, and two expedient limestone pebble mortars were recovered. All were found complete or almost complete, except for one of the pebble mortars. This tool set probably lacks a few items, but still seems to indicate an activity area. The items were found next to a semi-circular installation and a pavement made of pebbles, which was covered by a thick accumulation of ash.

The upper floor level of Unit 6 covered this room and cancelled it, opening it to the courtyard, while covering the complete items and the work area with a layer a few centimetres thick. It seems as though the abandonment of the western set of rooms, which possibly occurred when the inhabitants moved to a different location around the compound, included a ceremonial or ritual activity consisting of turning over the large grinding tools and leaving them there intentionally. Similar behaviour has already been noted and interpreted for the site of el-'Arbain by Freikman (2014: 173-181; 2015), as well as by Wright (2008: 138-139) and Adams (2008). The discard of these tools cannot be seen as a result of an occupational gap for the following reasons. First, the new floor level covered Units 6, 7 and 8 at a similar level, which shows an intentional adaptation of this part of the courtyard to a new use. Second, the

natural accumulation of soil is very slow in this region, and sites can remain visible for decades without being covered naturally. Finally, if the site was abandoned, it is unlikely that newcomers would miss the opportunity to reuse the large well-made grinding tools, or reuse the non-local raw materials.

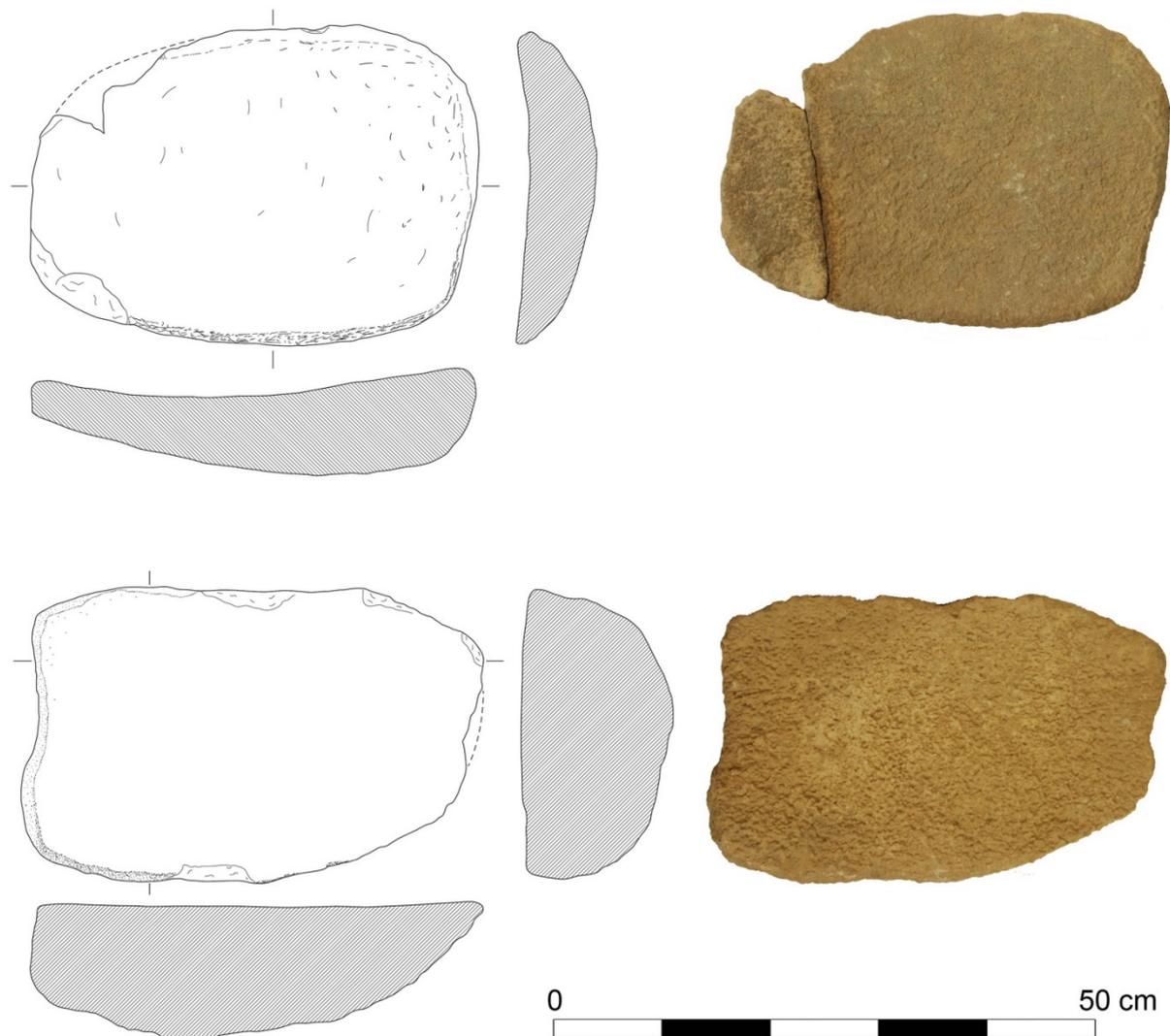


Figure 6. A large sunken saddle quern and a large concave grinding slab found in the lower phase of Unit 6, Fazael 2.

### 3.2.1.2. The later occupation phase of Stratum II

The stratigraphic relations between Units 1-3, Units 4-5 and Units 6-8 are still obscure; but if we consider the uppermost layers of activity in the southeastern part of the site (Units 1-4) as parallel to the later phase seen in Units 6-8, a few remarks can be made. First, grinding activity continued in Units 6-8, but using the much smaller lower grinding stones which were found in Units 6 and 7 (both are broken, but even as complete items they weighed no more than 5 kg each). Grinding does not appear in Units 1-4, and only few upper grinding stones were found, most in fills and loci of floor makeup. Secondly, although found broken and not on the floors, large mortars appear only in the eastern part of the compound, in Units 1-4, and are all related to the uppermost layers in these units (Figure 7: 1-3).

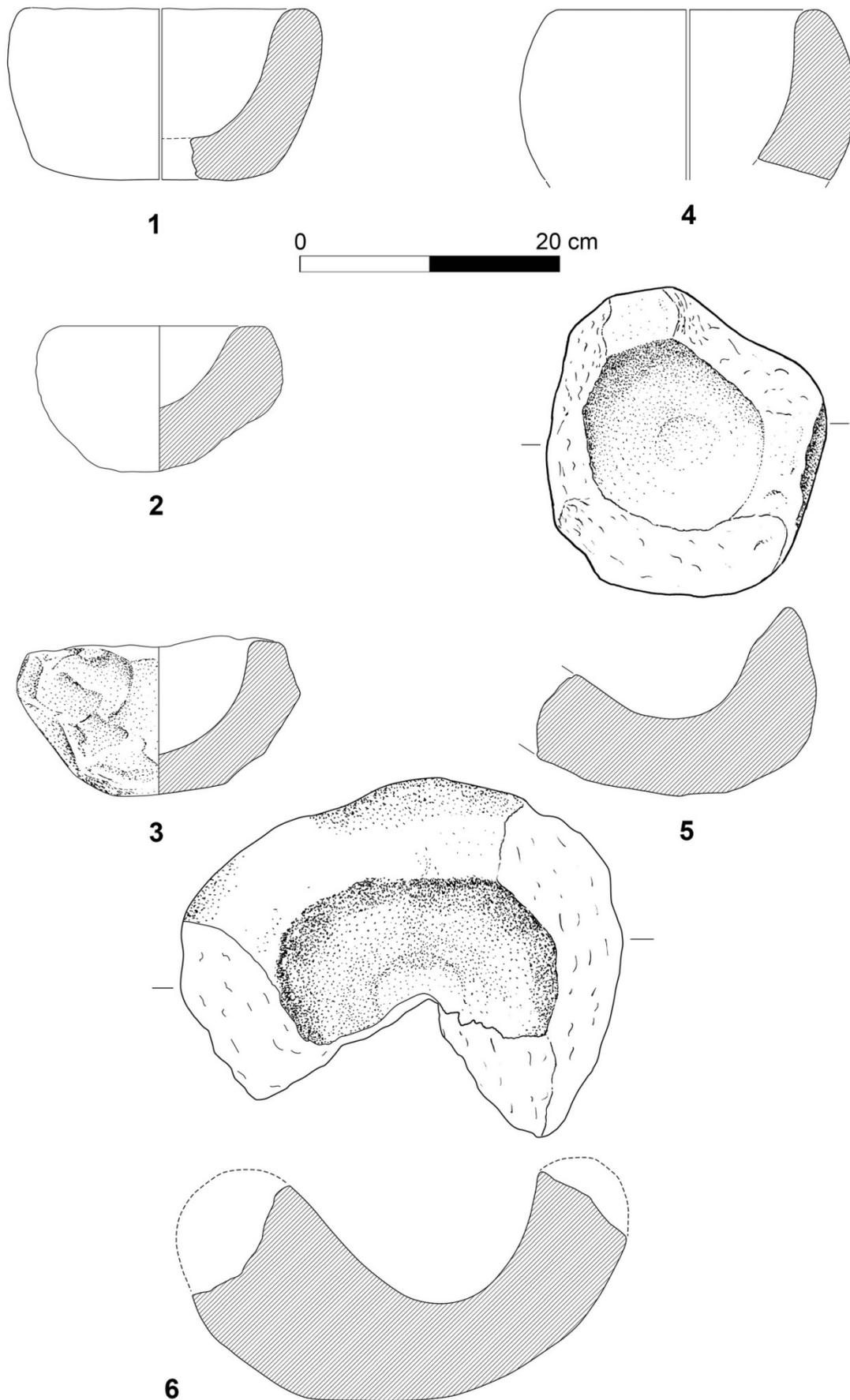


Figure 7. Mortars from Fazael 2 (items 1-3) and Fazael 7 (items 4-6).

This may show a shift from large wide grinding tools in the lower phase, allowing better grinding efficiency, to large mortars and small grinding stones in the later phase. Such a difference can be interpreted as a different technique for processing the same plants and substances, or as a more profound economic change, possibly showing different plants or food types being processed. The concentration of grinding activity near the western wall of the site can be seen as being related to the strong westerly winds, which are very common in this area during the afternoon for at least five months of the year (Saaroni *et al.* 1998). It is noteworthy that the use of the vesicular type of limestone for grinding tools and bowl mortars appears only in the later phase.

Another phenomenon may be seen in the comparison of the upper phase of Units 6-8 to Units 1-4 when analysing the distribution of moderately or highly designed items (defined hereafter as ‘highly designed’ or as ‘strategically designed’) compared to simply designed and expedient tools (defined hereafter as ‘simply designed’). It appears that the eastern set of rooms held significantly larger numbers of highly designed tools (Table 3 and Figure 8). This distinction is sustained even when excluding spindle whorls, which must be strategically designed, and were found only in the eastern part of the courtyard, and basalt bowls, which are highly designed by definition.

Table 3: Distribution of ground stone tool level of design in Fazael 2 by units and phases (excluding basalt bowls and spindle whorls, which are strategically designed by definition).

	Units 6-8 (lower phase)	Units 6-8 (upper phase)	Units 1-4	Total
Highly designed tools	5 (47.1%)	9 (47.4%)	31 (75.6%)	45 (62.5%)
Simply designed tools	7 (58.3%)	10 (52.6%)	10 (24.4%)	27 (37.5%)
<b>Total</b>	<b>12 (100%)</b>	<b>19 (100%)</b>	<b>41 (100%)</b>	<b>72 (100%)</b>

The compound seems to have hosted a family or an extended family and related activities linked to their subsistence. The distinction highlighted by the spatial distribution between the eastern part of the compound, with many more well-made items, as well as a concentration of mortars and spindle whorls, and the western area, with more simply-made items and a concentration of grinding activity, may indicate a separation of activity areas.

### 3.3. Fazael 7

Fazael 7 is situated approximately in the middle of the settlement, close to the ancient stream. About 300 m<sup>2</sup> of the site was excavated in 2009-2015. The main phase of occupation in Fazael 7 (Stratum II) included a very large broad house, about 120 m<sup>2</sup> in area, which was divided into four rooms. Three large courtyards were set around it, with a total area of about 1240 m<sup>2</sup>. Unlike other building activities in the Fazael sites, this is the only building showing a massive stone superstructure (Figure 9). The house was preserved up to ten courses high, and dense thick stone collapse layers filled the rooms and were found scattered around it.

#### 3.3.1. The ground stone tool assemblage of Fazael 7

Of the 28 ground stone tools found in Fazael 7, 23 can be related to Stratum II (for tool types see Table 4). Only ten items, of which only two were complete or almost complete, in Stratum II (43%) were found on the floors of the building and the courtyards. Therefore, it seems that, similarly to Fazael 2, this site was abandoned in an orderly manner. Unlike Fazael 2, the assemblage of Fazael 7 probably does not represent a complete set of activities.

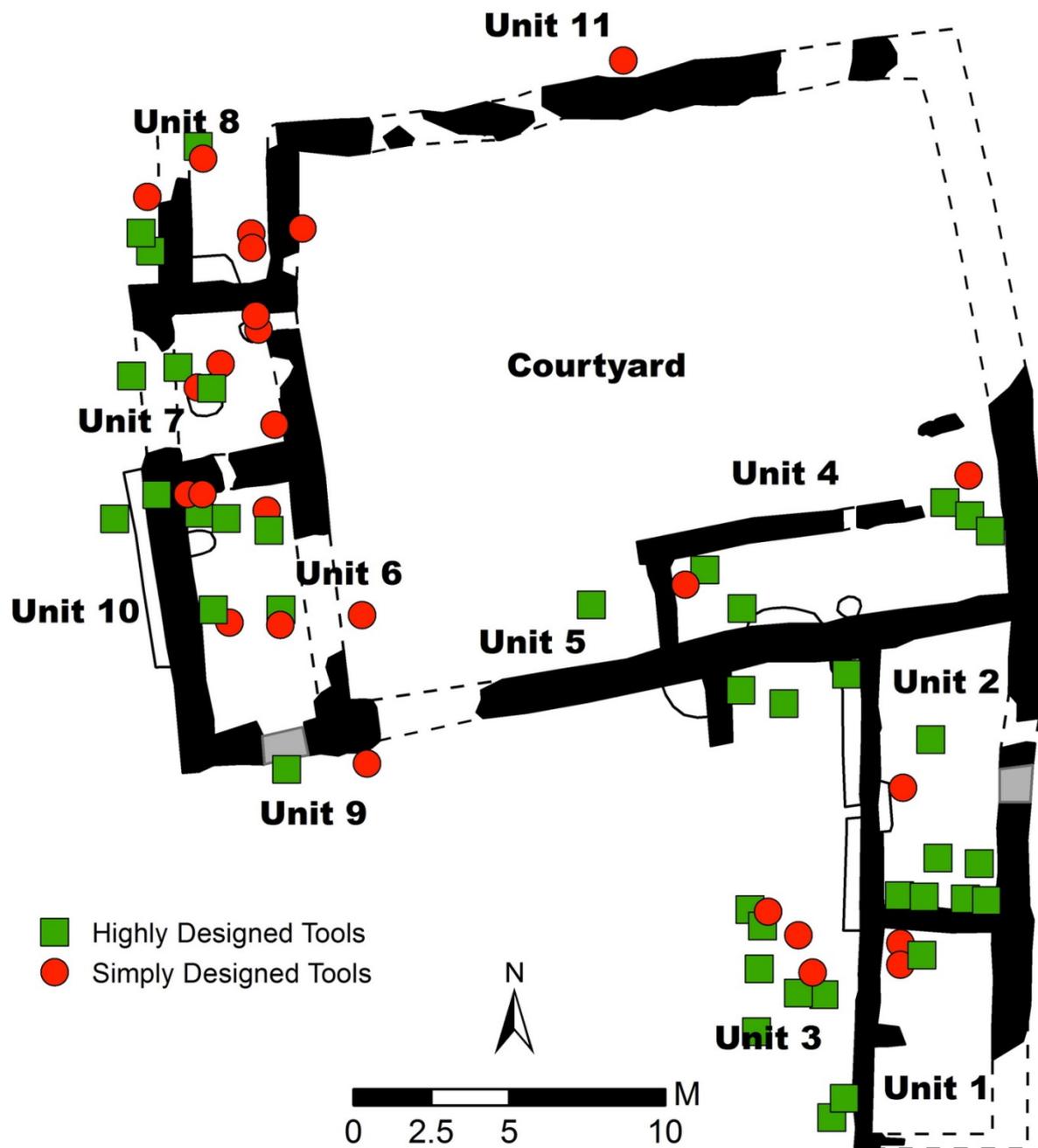


Figure 8. Distribution of ground stone tool level of design in Fazeal 2 (excluding basalt bowls and spindle whorls, which are strategically designed by definition).

Four large tool fragments were found within the dense collapse that covered the rooms of the large building in Fazeal 7. Among them, it is worth mentioning one very large bowl quern, more than half of which was restored from two fragments - one found in the collapse in the northeastern room, and the other in the collapse filling the southeastern room (Figure 7: item 6). These four items seem to come from broken bowl querns and mortars recycled as building material for the walls, which later collapsed and filled the rooms. It is therefore possible to see them as representing an earlier phase, while items found on the floors and below the collapse can be seen as a later phase.

A comparison between the items of the earlier and later phases shows that the earlier items are made of hard limestone, while the later items are made of a vesicular variant of limestone. Estimated reconstruction of the item weights shows that items appearing in the

earlier phase are larger and heavier, some weighing more than 20 kg (for example, Figure 7: item 6), while later tools are slightly more portable, estimated as weighing no more than 15 kg (for example, Figure 7: item 4). The use of vesicular limestone in the later phase also occurred in Fazael 2. Two of the bowl mortars from the later phase are almost identical in raw material, section, wall thickness and finishing to two bowl mortars found in Fazael 2. However, as only eight items in the earlier and later phases are compared, four in each phase, these conclusions can only be seen as preliminary. Furthermore, no clear chronological correlation between the different phases in Fazael 2 and Fazael 7 has been established.



Figure 9. The northwestern room of the main building in Fazael 7 (looking northeast).

Table 4: Distribution of ground stone tool types across strata in Fazael 7.

Tool type	Site surface	Str. II	Str. III	Total
Unidentified grinding tools		2 (8.7%)		2 (7.14%)
Lower grinding tools		5 (21.74%)		5 (17.86%)
Upper grinding tools		5 (21.74%)	2 (100%)	7 (25%)
Mortars	2 (66.67%)	7 (30.43%)		9 (32.14%)
Vessels and bowls		1 (4.35%)		1 (3.57%)
Work tools	1 (33.33%)	1 (4.35%)		2 (7.14%)
Unknown		2 (8.7%)		2 (7.14%)
<b>Total</b>	<b>3 (100%)</b>	<b>23 (100%)</b>	<b>2 (100%)</b>	<b>28 (100%)</b>

The Fazael 7 ground stone tool assemblage has many similarities with the Fazael 2 assemblage. First, a large number of mortars appear in Fazael 7, similar to the large number in the later phase of Fazael 2. These mortars are made of similar raw materials, including hard

limestone and vesicular limestone, some of it being biogenic limestone containing fossil remains. Secondly, some bowl mortar designs and finishing are similar between the two sites. Lastly, the correlation between raw materials and tool types is identical, as well as the use of purple sandstone for grinding tools. However, it should be noted that the bowl querns found in Fazael 7 are absent from Fazael 2.

### **3.4. Fazael 5 and its ground stone tool assemblage**

Fazael 5 was excavated on a small scale during seasons 2009 and 2012-2014. The site seems to include at least two large broad houses and adjacent large courtyards. Excavation was concentrated inside one of the broad houses. Only eight ground stone tools were found (Bar *et al.* 2015). However, even with such a small number of items in Fazael 5, the similarity with Fazael 2 and Fazael 7 is shown by the presence of a bowl mortar and a lower grinding stone made of purple sandstone.

### **3.5. Comparison with the ground stone tool assemblage of Fazael 1**

The finds from Fazael 1, including a broad description of its ground stone tool assemblage, have been presented previously (Bar *et al.* 2013). Analysis of the later sites of Fazael 2, Fazael 5 and Fazael 7 shows significant differences from Fazael 1, although both the earlier and later assemblages have several distinct Late Chalcolithic characteristics, as noted below.

Grinding tools at Fazael 1 were loaf-shaped, with a few showing a slightly trapezoidal section, but maintaining the general elongated shape. Almost all the lower grinding stones and the two-handed upper grinding stones were made of porous biogenic limestone. This is in contrast to the lower grinding tools in the later Fazael sites, which were saddle-shaped; and lower grinding stones as well as the two-handed upper grinding stones show a wider variety of raw materials: basalt, flint, hard limestone pebbles, and sandstone, including purple sandstone, which appears in all the later Fazael sites.

Mortars do not appear in Fazael 1, while in the later Fazael sites they comprise 50-65% of the lower processing tools (Figure 10). Interestingly, the vesicular limestone, used for grinding tools in the earlier Fazael 1 site, becomes the dominant raw material for mortars in the later Fazael sites. Pestles also seem to show differences: in Fazael 1 they are made of porous basalt and have a short cylindrical shape, while in Fazael 2 and Fazael 5 they are elongated, round-headed conical items made of dense basalt.

The presence of two-handed upper grinding stones and short pestles at Fazael 1 may hint at the presence of compatible lower tools, such as mortars and large grinding slabs.

It is premature to assume how pestles were used in Fazael 1 as compared to the later site. Ethnographic references show that pounding tools were used in a wide variety of tasks. Cereal processing is common, but the processing of fruits, meat, spices, and minerals is also well known (Kraybill 1977; Wright 1992; Gopher & Orrelle 1995; Adams 2002; Ertug-Yaras 2002; Rowan & Ebeling 2008; Rosenberg 2011; Hamon & Le Gall 2013). Wooden pestles and mortars are also well-noted in the ethnographic records, as well as the use of pestles against grinding slabs, palettes, well-made bowls, and even on the ground, on bedrock or on a blanket (Kraybill 1977; Ebeling 2001: 89-91; Adams 2002: 138; Yahalom-Mack & Panitz-Cohen 2009: 725; Rosenberg 2011: 74-75). Therefore, the different shape of pestles, as well as the shift in the later phase of Fazael 2 to smaller grinding tools, side-by-side with the appearance of limestone mortars, probably hint at a different intended use for pestles in the later Fazael sites.

### 3.6. Comparison with other Late Chalcolithic sites

Unfortunately, most of the reports about ground stone tools of the Late Chalcolithic period concern sites far from the Jordan Valley. However, interesting phenomena can be noted in terms of use of particular raw materials and the quantities of grinding and pounding tools. In both the earlier and the later sites of the Late Chalcolithic period in the Fazael Valley, the use of the local limestone and chalk is dominant, and is accompanied by the use of basalt and sandstone, both of which can be found about 30 km to the north near the site of 'Ein Hilu. The proximity to basalt sources explains why in 'Ein Hilu (Bar *et al.* 2008), as well as in Stratum IV of 'En Esur (Rowan 2006), the use of basalt is much more dominant. In Gilat (Rowan *et al.* 2006), on the other hand, beachrock is the most common raw material, and was used for almost all grinding tools, and as the raw material for many other tool types (Table 1 and Figure 3).

It seems, however, that the similarity between the Chalcolithic sites should not be based on the use of similar raw materials for utilitarian ground stone tools, but rather on the predominant preference for local raw materials, found no more than 10 km from the site. The use of raw materials situated even as far as 20-30 km from the site (a day's walk in each direction) is very limited, and in the later Fazael sites was mostly limited to lower grinding tools and some of the two-handed grinding stones.

The relative lack of distant raw materials for utilitarian ground stone tools should not be seen as indicating low levels of trade. Very large numbers of thin-walled basalt bowls were found in Fazael 2 (about 25% of the assemblage), putting it in line with the number of basalt bowls known from other Late Chalcolithic sites (for example, see the number of basalt bowls from Gilat and 'En Esur in Table 1). Also noteworthy is the use of basalt and sandstone for well-designed tools other than vessels. These include a few upper and lower grinding tools, and may show that trade was in final products rather than in raw materials.

A marked difference is seen when comparing the relative numbers of mortars as part of the lower processing tools. In the later Fazael sites, mortars are significantly more common in the assemblage than lower grinding tools, while in Fazael 1, as well as in other Chalcolithic sites, the number of mortars is remarkably low (Figure 10).

Another important difference is the significantly large number of upper grinding tools in Fazael 2, which was not found in other sites (Figure 11). Even excluding the six expedient one-handed grinding stones found in Fazael 2, which might have been misidentified in the field in other sites, the ratio of upper to lower grinding tools in Fazael 2 remains high.

## 4. Discussion and conclusions

The very Late Chalcolithic settlement in the Fazael Valley is analysed here mainly from the perspective of the ground stone tool assemblages of Fazael 2 and Fazael 7. It shows a clear economic and sociological change from the earlier Late Chalcolithic settlement of Fazael 1. The change in settlement pattern, moving to larger courtyard houses set well apart, as well as moving closer to the Fazael stream, might be seen to be accompanied by a change in the methods of food processing using much smaller grinding stones while intensifying the use of mortars. However, this change does not seem to come in the same phase as the change of settlement pattern, as the large lower grinding tools used in the earlier phase of Fazael 2 might indicate.

The meaning of this change needs further investigation. The Fazael sites are situated in an arid area, with a yearly average rainfall of 150-200 mm. Even in humid periods, average rainfall did not exceed 250 mm, and some years were extremely dry (For a detailed discussion see Bar 2014a: 14-18; and also Gat & Karni 1995). This means that most agriculture had to rely on a constant supply of spring water, such as the perennial springs of 'Enot Fazael, or on

occasional floods, as may still occur today due to heavy one-day rainfalls. It is possible that this shift of settlement location was a response to a drier climate and fewer floods.

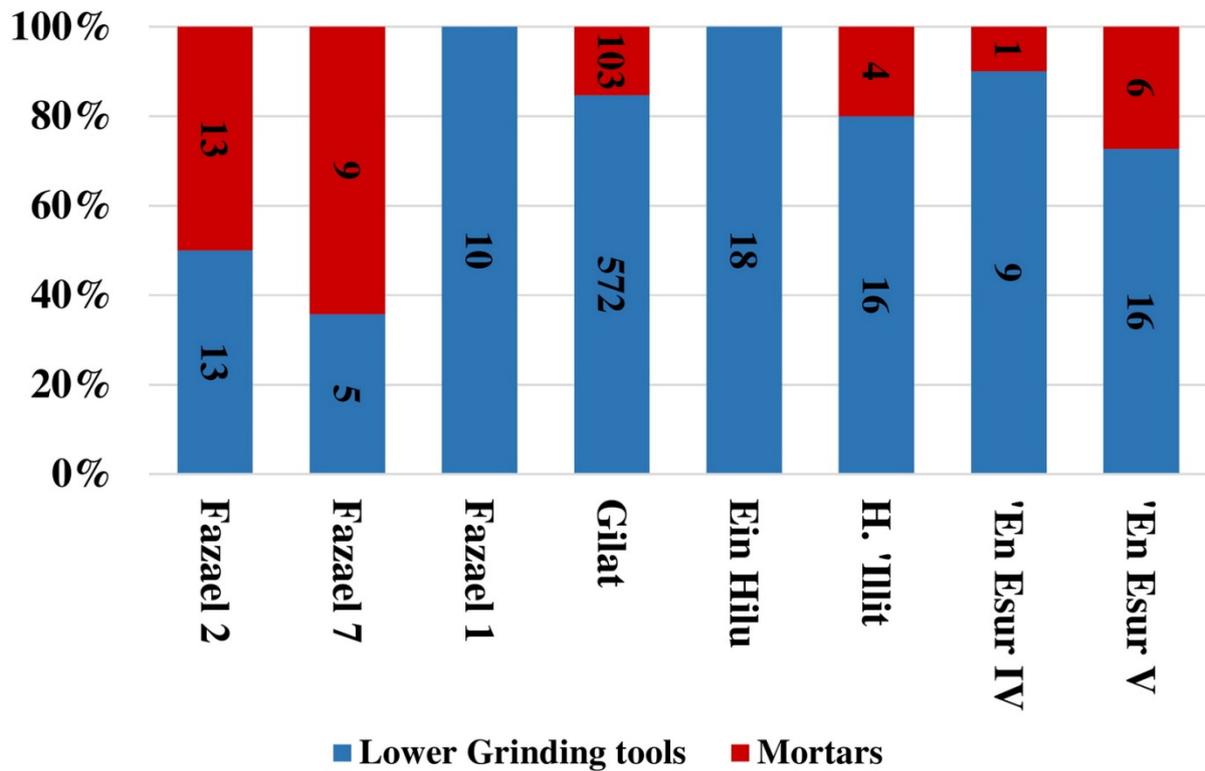


Figure 10. Frequency and quantities of lower grinding tools and mortars in Fazael 2 and Fazael 7, compared with Fazael 1 and other Late Chalcolithic sites (Rowan 2006; Rowan *et al.* 2006; Bar *et al.* 2008; Bar *et al.* 2014).

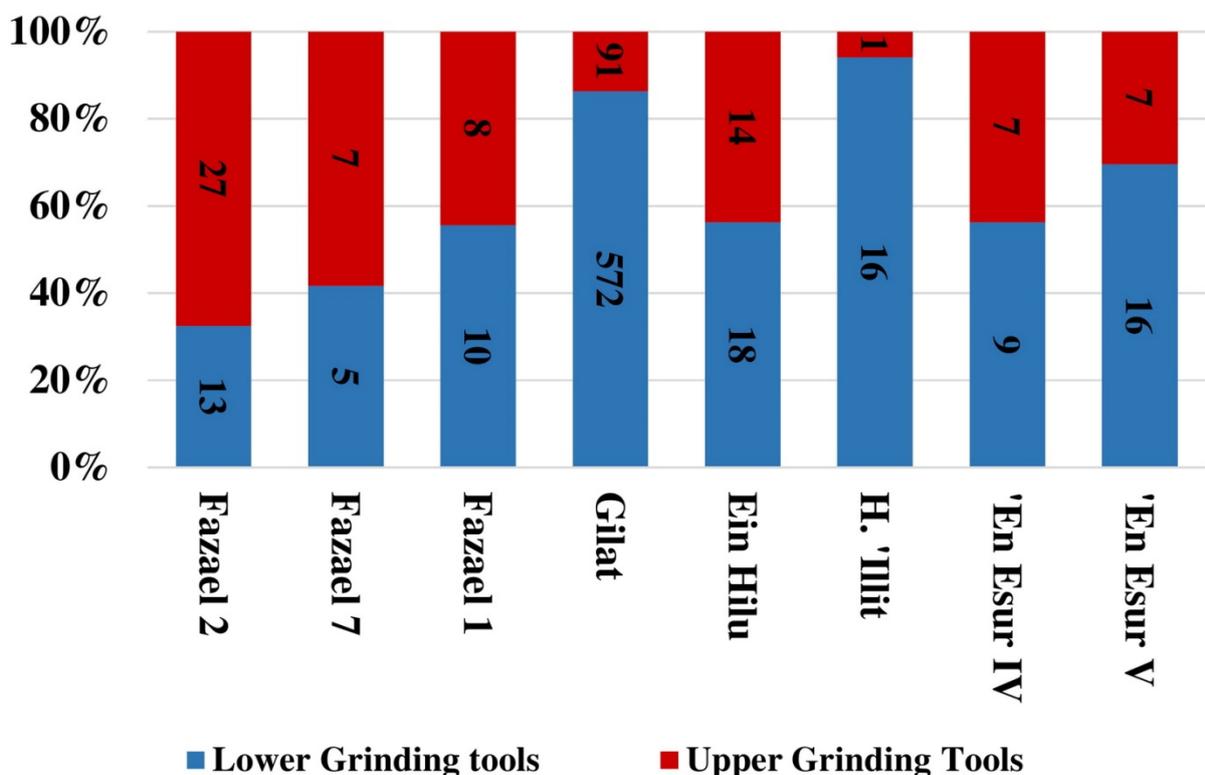


Figure 11. Frequency and quantities of lower and upper grinding tools in the Fazael sites, compared with other Late Chalcolithic sites (Rowan 2006; Rowan *et al.* 2006; Bar *et al.* 2008; Bar *et al.* 2014).

No clear correlation can be made between tool type, size or shape and the substance processed with it. Wheat, barley, legumes, vegetables, fruits, and nuts can all be processed with either large or small grinding tools or pounding tools (Kraybill 1977; Wright 1994; Ertug-Yaras 2002; Rosenberg 2011: 5). Based on current evidence, it is not yet possible to decide whether the changes in the processing tools, as is seen between Fazael 1 and the later sites, or within the two phases of Fazael 2, hint at the processing and consumption of new or different food types. Nevertheless, climate changes in an arid area can cause profound changes in the availability of food and the subsistence strategy, and it is likely that the shift to mortars and smaller grinding tools is a consequence of such a change.

The comparison of Fazael 2 and Fazael 7 with other Chalcolithic sites shows the internal development seen in the Fazael sites. No other ground stone tool assemblages of the very late phases of the Chalcolithic period have been published, and thus it is premature to see this change as being more than regional.

Although different in several aspects from other Late Chalcolithic sites, both the ground stone tool assemblages of Fazael 2 and Fazael 7 show several characteristics of the typical Late Chalcolithic period, as do their pottery and flint assemblages. On the contrary, typical features of ground stone tools mostly noted in the subsequent Early Bronze Age period are absent from the Fazael Valley.

Basalt vessels are common in Fazael 2, showing V-shaped bowls and fenestrated bowls typical of the Late Chalcolithic period. Diagonal decoration appears on four bowl rims, resembling a degenerated type of the chevron decoration well known in other Late Chalcolithic sites (Koeppel 1940: 261-262; Rowan 2006: 216-221; Rowan *et al.* 2006: 597-602).

Spindle whorls in all Fazael sites are quite similar, including disc-shaped whorls with rectangular sections, and elliptical types, both common in other Chalcolithic sites (for example, see Rowan *et al.* 2006: 593-594, fig. 12.30). On the other hand, out-curved basalt bowls and well-made small basalt rings with a large hole, both common in Early Bronze Age sites (for example, see Rowan 2006; Yannai 2006: 257-258; and Rosenberg & Golani 2012), are absent from all Fazael assemblages.

The preliminary analysis of the ground stone tool assemblage in Fazael 2 and Fazael 7 shows that the adaptation to a different settlement pattern in the Fazael Valley at the end of the Chalcolithic Period was seemingly followed by a change in the subsistence strategy, which caused a corresponding change in processing tools. Whether this change was only regional, or was affected by broader changes occurring at the end of the Chalcolithic Period, is yet to be determined.

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