

A large copper artefacts assemblage of Fazael, Jordan Valley: new evidence of Late Chalcolithic copper metallurgy in the southern Levant

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ABSTRACT – Late Chalcolithic metallurgy developed in the southern Levant simultaneously with other crafts and new social institutions, reflecting advances in social organization, cults and technology. Until recently, copper items were mostly found in the Negev and Judean Desert, while other areas, specifically the Jordan Valley, were considered poor, with limited copper finds. Recent excavations at Late Chalcolithic Fazael in the Jordan Valley yielded dozens of copper items that allow for the first time a comprehensive study of copper items from this area. The assemblage is one of the largest of any site in the Late Chalcolithic period and includes most of the known components of the Late Chalcolithic copper industry. The current paper presents the new metallurgical discoveries from the Fazael Basin and discusses their significance to our understanding of the Late Chalcolithic copper industry.

KEY WORDS – Fazael; Late Chalcolithic; copper metallurgy; Jordan Valley

Velik zbir najdb iz najdišča Fazael v dolini reke Jordan: novi dokazi o pozno halkolitski metalurgiji bakra v južni Levanti

IZVLEČEK – Pozno halkolitska metalurgija se je razvila v južni Levanti sočasno z drugimi obrtmi in novimi družbenimi institucijami, kar odraža napredek v družbeni organizaciji, kultu in tehnologiji. Do nedavnega so bakrene predmete večinoma našli v Negevski in Judejski puščavi, medtem ko so druga območja, med njimi zlasti dolina reke Jordan, veljala za prostor z omejenimi najdbami iz bakra. Nedavno so izkopavanja na pozno halkolitskem najdišču Fazael v dolini reke Jordan prinesla na desetine bakrenih predmetov, ki nam prvič omogočajo celovito študijo bakrenih izdelkov s tega območja. Ta zbir je eden največjih iz kateregakoli najdišča iz časa poznega halkolitika in vključuje večino znanih sestavnih delov industrije bakra iz tega obdobja. V članku predstavljamo nove izsledke o metalurgiji bakra iz bazena Fazael in razpravljamo o pomenu teh najdb pri razumevanju te industrije v poznem halkolitiku.

KLJUČNE BESEDE – Fazael; pozni halkolitik; metalurgija bakra; dolina reke Jordan

Introduction

The Late Chalcolithic period of the southern Levant (c. 4500–3900 cal BC) marks significant changes from its predecessors, specifically within various aspects of social organization, subsistence economy, cult and religion (*van den Brink 1998; Gilead 1988; Ilan, Rowan 2012; Joffe, Dessel 1995; Levy 1986; 2014; Perrot 1955a; Rowan, Ilan 2007; Shalem 2015*), and technologies (e.g., *Albright 1932; Ben-Yosef et al. 2016; Bourke 2001; Gilead 1992; Rosenberg et al. 2016; Rowan, Golden 2009*). Within this system there is increased evidence for the development of craft specialization, apparent primarily in the appearance of metallurgy (e.g., *Golden 2009*), standardized ceramics (*Roux 2003; Kerner 2010*), specific components in the flint (e.g., *Gilead et al. 2004; Rosen 1983; 1993; Rosenberg, Shimelmitz 2017; Vardi 2011*) and ground stone tool assemblages (e.g., *Chasan, Rosenberg 2018; 2019; Chasan et al. 2019; Rosenberg et al. 2016; Rowan 1998*), and probably also in the production of ivory objects and figurines (*Perrot 1959a; Rosenberg, Chasan in press*).

The chronology of the Late Chalcolithic is debated, but it seems that if we accept the Ghassulian as the main entity of this period then we can divide this time span into two phases (e.g., *Gilead 2011; Gošić 2015*): the earlier phase (c. 4500–4300/4200 cal BC) that consists of most strata at Teleilat Ghassul (and sites in the northwestern Negev such as Gilat, a few of the Nahal Besor sites, and Grar) and the later phase (c. 4300/4200–3900 cal BC) which is represented by sites along Nahal Beer Sheva (*Gilead 2011; Gošić 2015*). Most of the sites in the Fazaal Basin may be attributed to this later phase (see below). This later phase is characterized by extensive metallurgical activities (*Eldar, Baumgarten 1985; Perrot 1955b; Shalev, Northover 1987; Shugar 2000*), while the earlier sites show no such finds and were thus ascribed as ‘premetallic’ (*Golden 2010*).

Metallurgy seems to be the most sophisticated among the Late Chalcolithic technologies, exemplifying the extraordinary achievements of the Late Chalcolithic communities, including a high investment in raw material acquisition and technological knowhow. These Late Chalcolithic advances were unparalleled among other cultures in the area and those of the succeeding Early Bronze Age I. Furthermore, it seems that at least some of the copper objects were cultic paraphernalia that were integrated into the Late Chalcolithic cultic practices with little or no utilita-

rian function (e.g., *Bar-Adon 1980; Ben-Yosef et al. 2016; Gošić 2015; Gošić, Gilead 2015* and see *Shalem 2015* for further discussion about the motifs depicted in copper artefacts).

Late Chalcolithic metallurgy comprised two discrete production techniques that refer to the later stages production, namely the open cast technique, usually using pure copper, probably originating from Faynan (*Adams, Genz 1995; Golden 2010; Hauptmann 1989; 2007; Shalev 1991; 2008; Shugar 2003; Shugar, Gohm 2001*), and the considerably more sophisticated ‘lost wax’ technique, frequently using non-local copper-based alloys with significant arsenic, nickel, and antimony content (*Golden 2010; Goren 2014; Key 1980; Levy 1993; Levy, Shalev 1989; Levy et al. 2008; Shalev 1991; 2008; Shalev, Northover 1987; 1993; Shugar 2000; Tadmor et al. 1995*). Other metals found at Late Chalcolithic sites in the southern Levant include gold, electrum (*Shalev 1993*), and lead (*Ben-Yosef et al. 2016; Yahalom-Mack et al. 2015*). While tools such as axes, chisels, and awls were typically made using relatively pure local copper, other objects, such as maceheads, standards, and crowns were commonly made of copper alloys (*Shalev 2008*). The origin of these copper alloys is currently unknown; however, the nearest suitable ores are in the Trans-Caucasus and Azerbaijan, more than 1500km from the sites where these objects were found (however see also *Shugar 2018; Zwicker 1977*). While some studies suggest that copper production took place at the Beer Sheva sites (*Shugar 2000; 2018*), recent studies (*Goren 2008; 2014*) suggest that the final production of the copper artefacts occurred closer to the copper sources, possibly in the Judean Desert.

Intriguingly, until recently most of the knowledge regarding Late Chalcolithic copper objects stemmed from several sites in the southern parts of Israel (the Negev, Shephelah, and Judean Desert) and a few sites in Jordan. However, little or no copper was found in other areas, including the Golan Heights, the Galilee, the northern Coastal Plain, and parts of the Jordan Valley (*Buchman 2018; Rowan, Golden 2009; Shalev 2008*). Thus, it seems that our current knowledge regarding the copper industry of the Late Chalcolithic period is focused on a relatively limited geographic region, while other regions still call for further research and analyses. Recent excavations at Late Chalcolithic Fazaal in the Jordan Valley yielded dozens of copper items that allow for the first time a comprehensive study of such objects from this area. The assemblage is one of the largest of any site

in the Late Chalcolithic period, and includes most of the known components of the Late Chalcolithic copper industry.

The Late Chalcolithic of the Fazael Basin

Fazael is located in the Fazael Basin, in the central Jordan Valley (Fig. 1). The site was first described briefly by Nelson Glueck (1951). Salvage excavations were later conducted in the eastern part of the area by Yosef Porath (1985) and Yuval Peleg (2000). The area was then surveyed in the framework of the Manasseh Hill Country Survey (Zertal, Bar 2019) and further explored in the Fazael Valley Regional Project in the last 12 years (Bar 2013; 2014). Fazael is in fact a concentration of sites (Fig. 2) along the northern terrace of Wadi Fazael. While Fazael 1 was ascribed to an earlier phase of the Late Chalcolithic and Fazael 4 to the Early Bronze Age I, Fazael 2, 5, and 7 (regarded as separate sites within one large site) were attributed to the late phase of the Late Chalcolithic period, based on the lithic, pottery, and ground stone tool assemblages (Bar 2013; 2014; Bar et al. 2013; 2014; 2015). Fazael 2, 5, and 7 also yielded copper items. Interestingly, in two of the three sites (Fazael 2 and 7) Canaanite blades, a characteristic of the Early Bronze Age, were found (Pinsky 2019), although produced using Late Chalcolithic technology (Pinsky 2019; see also Bar, Winter 2010; Rowan, Levy 1994 in this regards).

Fazael 2 is located in the northern area of the greater Late Chalcolithic Fazael site (Bar et al. 2013). Stratum II of this three-stratum site was dated to a late stage in the Late Chalcolithic continuum, with radiometric dates falling within the 1st century of the 4th millennium BC (Bar 2014.319–320). The main feature discovered in Stratum II is a large courtyard house, covering an area of approx. 620m². The courtyard itself is 560m² in area (28x20m), bounded by 80–100cm thick stone walls. Most of the courtyard has not yet been excavated. One broad room (62m²; 4x15.5m) was found abutting the southeastern section of the courtyard. The room was divided into two large cells, and its entrance faced east. At least five successive beaten-earth floors were detected, all abutting the room's walls, implying a long period of habitation. The second room was excavated in the western part of the courtyard. It was 60m² in area (4x15m) and divided into two large cells. An entrance flanked by two standing monoliths was set at the southern part of the room. This room was built in the early phase of Stratum 2, and in the later phase of this stratum it went out of use, becoming

part of the main courtyard. The pottery assemblage matches other contemporaneous sites, although churns were not recovered, only one cornet was found, and the flint assemblage is also typical of the Late Chalcolithic, but with notable evidence for the presence of the Canaanite industry (Bar, Winter 2010; Pinsky 2019).

Fazael 5 is located at the middle of the presumed area of the ancient settlement (Fig. 2), c. 250m south-east of Fazael 2, and c. 70m west of Fazael 7. The area of this site was estimated to be 3ha. (Bar et al. 2015). Three layers were identified (Stratum I–III). Stratum I consists of two pits cutting most of the eastern part of a building identified in Stratum II. The finds in these pits are similar to the Stratum II assemblages, and therefore suggest that the pits were



Fig. 1. Map showing the location of Fazael and other Late Chalcolithic sites where metal items were found.

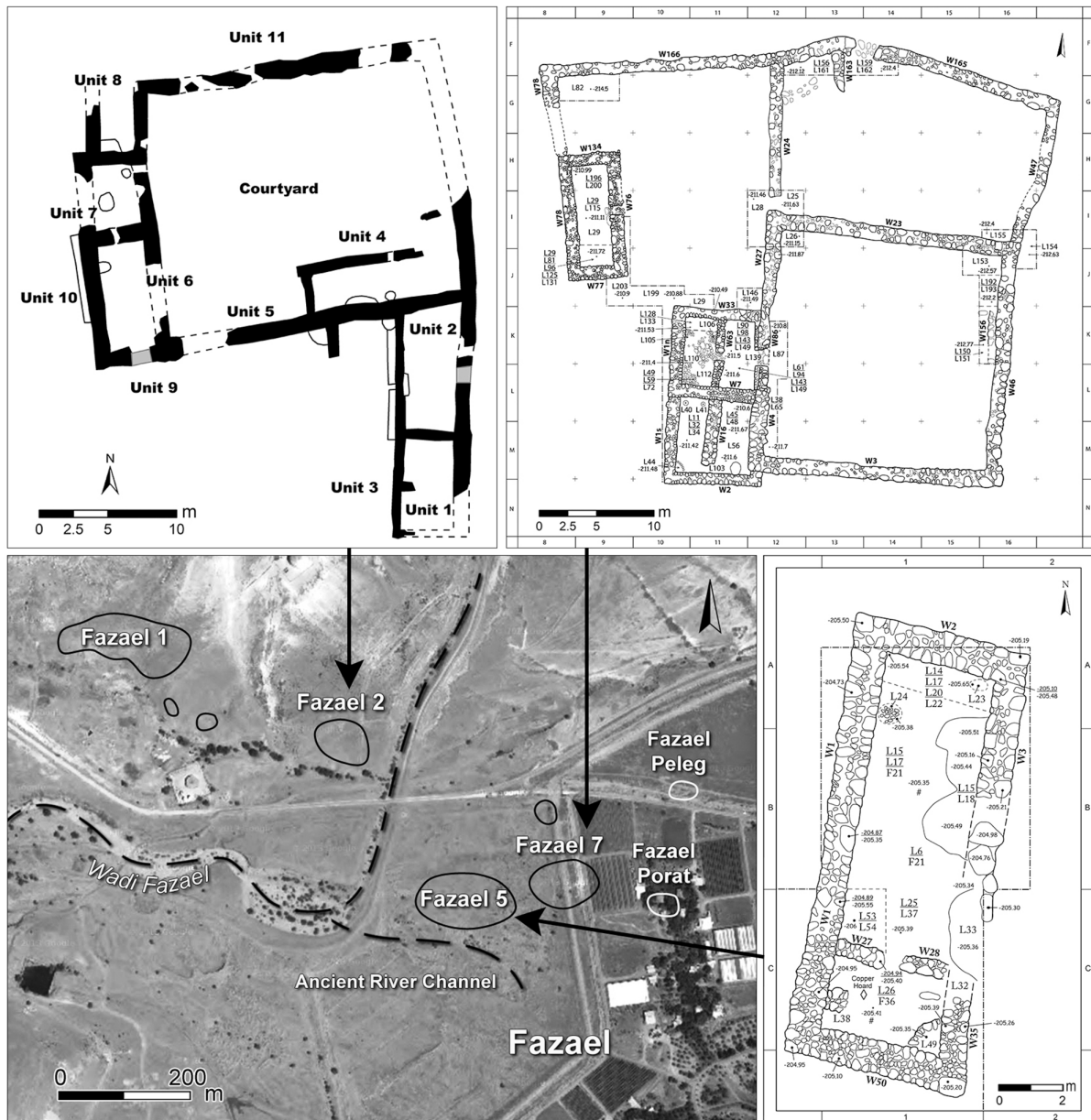


Fig. 2. The Fazael sites.

formed close to the abandonment of the Stratum II building. Stratum III was discovered in two trenches below the foundations of the Stratum II building. Pottery dated to the Late Chalcolithic period was found, but there were no architectural remains apart from a single ash pit. It seems that there was some activity here before the construction of the Stratum II broad room. Two large courtyard houses were documented in Fazael 5, including a large broad room in Stratum II, the main habitation level of the site (Bar et al. 2015). The pottery assemblage of Stratum II has many parallels to other Late Chalcolithic sites (churns and cornets, however, are missing altogether), and the flint assemblage is also typical of the period (Pinsky 2019).

Fazael 7, east of Fazael 5, exposed one of the largest architectural complexes ever uncovered in the south Levantine Late Chalcolithic (Bar et al. 2017). The architectural elements were designated Stratum II, as they are stratigraphically below a flimsy construction attributed to the Roman period (Stratum I). Two probes below the Stratum II foundation levels revealed Late Chalcolithic remains which predate the large architectural complex and were thus designated as Stratum III (Bar et al. 2017). The architectural complex in Stratum II is unique, dissimilar to typical Late Chalcolithic broad room structures, like those found at Fazael 2 and Fazael 5. The architectural complex was likely roofed, and it consists of four almost identical rectangular rooms cre-

ated by the division of two roughly square units (Fig. 2). Its overall dimensions, about 8 x 15m and 120m², make it one of the largest Late Chalcolithic structures in the southern Levant. The structure is massively built, with walls about 1m thick, preserved to more than 1m high in places and typically made of two rows of medium and large-sized fieldstones with smaller stones and sediment in between. This is surrounded by three wide courtyards, which contain a subsidiary structure and adjoin the main structure on the east and north, altogether covering an area of about 1300m². The pottery assemblage of Stratum II parallels other Late Chalcolithic sites (however, here also it lacks some of the common types such as churns and cornets), and the flint assemblage is also typical of the period, but with presence of Canaanite blades (Pinsky 2019).

A large group of copper items and a few related finds were noted (Buchman 2018). These mark an important discovery and the first copper finds found in this area. Moreover, the assemblage is one of the largest Late Chalcolithic copper assemblages in southern Levant (with only the ‘Cave of the Treasure’ in the Judean Desert and sites in the Beer Sheva Basin having more). The present paper focuses on Late Chalcolithic metalworking in the Fazaal Basin. While the chemical and isotopic analyses are ongoing, we present here the assemblage and offer preliminary insights, discussing their significance to our understanding of the management of copper items during the Late Chalcolithic period in the southern Levant.

Methodology

The copper artefacts from Fazaal were found during the 2007–2018 excavation seasons. The items were handpicked during the excavations, sometimes using the aid of a metal detector, or during sifting (5mm mesh) of the sediments. These were documented, cleaned, and studied at the Zinman Institute of Archaeology in the University of Haifa. The cleaning process was performed by plastic media blasting (PMB), using plastic particles 50 microns in size with Barcol hardness values of 40–60. The artefacts were cleaned with a Model-2 Zero Production Instrument (CYSTRIP®). After cleaning, morphometric data was obtained from each artefact using digital calipers with ±0.0mm accuracy, and each find was weighed with

laboratory scales with ±0.01g accuracy. The artefacts were then typologically classified and measured. While chemical data were collected (with pXRF) to classify the artefacts into chemical groups, this analysis should be regarded as preliminary, and a more thorough chemical analysis that includes stable lead isotope analysis that can further characterize the assemblage and its origin is ongoing.

The Fazaal copper industry

Altogether 52 copper artefacts and seven copper-related artefacts (crucibles and burnt glazed sediments with no metal processing remains) were found at Fazaal (2, 5, and 7, see Tables 1–3). These were mainly found at Fazaal 2, featuring the largest excavated area so far (n = 34 copper items), but also at Fazaal 5 (n = 4) and Fazaal 7 (n = 14). Five crucibles and two burnt glazed sediments containing no metal processing remains were also found at Fazaal 2. Excluding these, no additional tools related to metallurgy or high temperature fire sources have yet to be exposed at any of the Fazaal sites. Among the copper artefacts found, only three were found complete (a chisel, a standard, and a macehead); the rest are fragments or pieces and chunks of copper items. As these sites are near one another and represent segments of one larger site, we present and discuss the three assemblages as a single assemblage.

Following the common terminology (Bar-Adon 1980; Klimscha 2013; Levy, Shalev 1989; Shalev 2008), Fazaal’s copper assemblage (Tab. 2) includes ‘utilitarian’ objects as well as ‘prestige’ objects. These include chisels, axes/chisels, and picks/awls, as well as crown fragments, maceheads, and standards. Also included are unidentified copper tool fragments and

Site	Copper items	Crucibles	Burnt glazed sediments	Total
Fazaal 2	34	5	2	41
Fazaal 5	4			4
Fazaal 7	14			14
Total	52	5	2	59

Tab. 1. Distribution of copper and related artefacts at the Fazaal sites.

Site	Celts	Maceheads	Crowns	Standards	Unidentified fragments	Chunks	Total
Fazaal 2	3	2	6	5	6	12	34
Fazaal 5	2			1	1		4
Fazaal 7	1	1	2		1	9	14
Total	6	3	8	6	8	21	52

Tab. 2. Distribution of types in the copper assemblages of the Fazaal sites.

Cat. No.	Type	Site	Fig. No.	Dimensions (mm)				Weight (g)
				l	w	t	d	
207	axe	Fazaal 2	4.3	23.40	16.41	4.35		9.68
234	axe	Fazaal 2	4.4	25.64	16.76	7.96		15.24
240	axe	Fazaal 2	4.1	145.70	12.71	5.96		113.10
502*	axe	Fazaal 5	8	54.40	22.50	4.30		
503*	awl	Fazaal 5	8	102.00	8.50			
701	chisel	Fazaal 7	4.2	140.34	10.61	3.38–6.89		108.92
202	macehead	Fazaal 2	5.1	27.30		27.30	49.10	34.50
241	macehead	Fazaal 2	5.2	40.73	36.27		55.60	44.20
704	macehead	Fazaal 7	5.3	40.52			40.63	206.42
201	crown	Fazaal 2	6.1	61.60	49.10	6.60		53.80
210	crown	Fazaal 2	6.2	14.35	17.16	7.79		6.54
230	crown	Fazaal 2	6.3	31.2	25.56	3.95		15.26
231	crown	Fazaal 2	6.4	39.29	49.10	5.31		32.71
232	crown	Fazaal 2	6.8	29.48	23.93	3.30		10.04
238	crown	Fazaal 2	6.5	33.09	32.38	7.46		17.78
702**	crown	Fazaal 7	6.6	38.04	1.81–12.65	2.34–4.09		9.08
705	crown	Fazaal 7	6.7	50.69	29.54	32.15		67.12
203	standard	Fazaal 2	7.1	23.50	3.3		34.70	41.90
204	standard	Fazaal 2	7.2	39.96	12.90	6.74		9.76
209	standard	Fazaal 2	7.3	18.17	5.32	5.08		5.32
211	standard	Fazaal 2	7.4	14.06	20.10	5.06		7.46
217	standard	Fazaal 2	7.5	31.34	11.09	5.54		9.78
501*	standard	Fazaal 5	8	67.90			38.3	
206	unidentified fragment	Fazaal 2	9.1	20.48	19.10	6.80		9.42
212	unidentified fragment	Fazaal 2	9.2	14.17	20.21	3.50		2.81
216	unidentified fragment	Fazaal 2	9.3	10.57	7.7	4.93		1.36
220	unidentified fragment	Fazaal 2	9.4	31.66	22.25	12.07		26.11
233	unidentified fragment	Fazaal 2	9.5	24.86	24.25	8.68		22.08
239	unidentified fragment	Fazaal 2	9.6	11.53	10.21	5.56		1.2
504*	unidentified fragment	Fazaal 5	8					
703	unidentified fragment	Fazaal 7	9.7	10.5	0.79	3.11		2.4
205	copper chunk	Fazaal 2	10.1	35.84	12.82	7.11		8.92
208	copper chunk	Fazaal 2	10.2	20.27	16.22	8.32		9.28
213	copper chunk	Fazaal 2	10.3	19.34	11.96	8.72		6.32
214	copper chunk	Fazaal 2	10.4	11.23	7.84	6.27		2.14
215	copper chunk	Fazaal 2	10.5	11.43	7.3	5.59		1.18
218	copper chunk	Fazaal 2	10.6	14.1	9.13	3.25		1.52
226	copper chunk	Fazaal 2	10.7	21.61	4.73	5.66		0.92
227	copper chunk	Fazaal 2	10.8	8.84	4.45	2.76		0.22
235	copper chunk	Fazaal 2	10.9	11.45	7.64	4.75		1.02
236	copper chunk	Fazaal 2	10.10	4.22	25.71	7.32		4.22
237	copper chunk	Fazaal 2	10.11	9.58	8.96	2.96		0.22
242	copper chunk	Fazaal 2	10.12	16.70	9.83	7.60		2.26
706	copper chunk	Fazaal 7	10.13	7.89	3.66	3.29		0.10
707	copper chunk	Fazaal 7	10.14	15.55	9.66	5.11		0.68
708	copper chunk	Fazaal 7	11.1	50.29	25.71	4.81		17.86
709	copper chunk	Fazaal 7	11.2	29.20	16.35	8.93		6.40
710	copper chunk	Fazaal 7	11.3	13.56	6.26	4.51		0.34
711	copper chunk	Fazaal 7	11.4	7.38	5.10	2.35		0.10
712	copper chunk	Fazaal 7	11.5	13.66	5.42	4.15		0.24
713	copper chunk	Fazaal 7	11.6	10.59	9.02	5.43		0.54
714	copper chunk	Fazaal 7	11.7	11.84	9.79	3.39		0.42

* Part of the items found together as a group in Fazaal 5
** Ibex horn?

Tab. 3. The copper assemblages of Fazaal.

copper chunks of various sizes, shapes, and weights. A rare find from Fazael 5 is a standard in which a chisel, awl, and an unidentified bent item were inserted.

Spatial distribution of the copper items

Copper artefacts were found in various loci at Fazael 2. Some of these were found in primary contexts in the rooms and courtyard (Fig. 3). Of note is Locus 225, where three copper artefacts, four crucible fragments, and the two slags were found. The fifth crucible fragment, without traces of copper or slag, was found in the north-eastern room that also yielded an axe, two unidentified copper objects fragments, and four copper chunks. The interior room yielded seven items: three crown fragments, a chisel fragment, a macehead fragment, fragments of an un-

identified copper tool, and a copper chunk. A fragment of a standard was found hidden in wall W270. The standard with the three inserted items from Fazael 5 was found in the southern cell of a broad room, the only room so far excavated at this site. At Fazael 7, most of the copper artefacts were found in two rooms of the southwestern building, the main structure excavated in this area.

Axes and an awl

Of these, two are whole. All items in this group are characterized by a cutting edge that is wider than the body (Fig. 4, Tab. 3). Both items found at Fazael 5 – an axe and an awl – were inserted in the standard. Similar items were found at other Late Chalcolithic sites in the southern Levant and reflect a somewhat limited number of types and sub-types

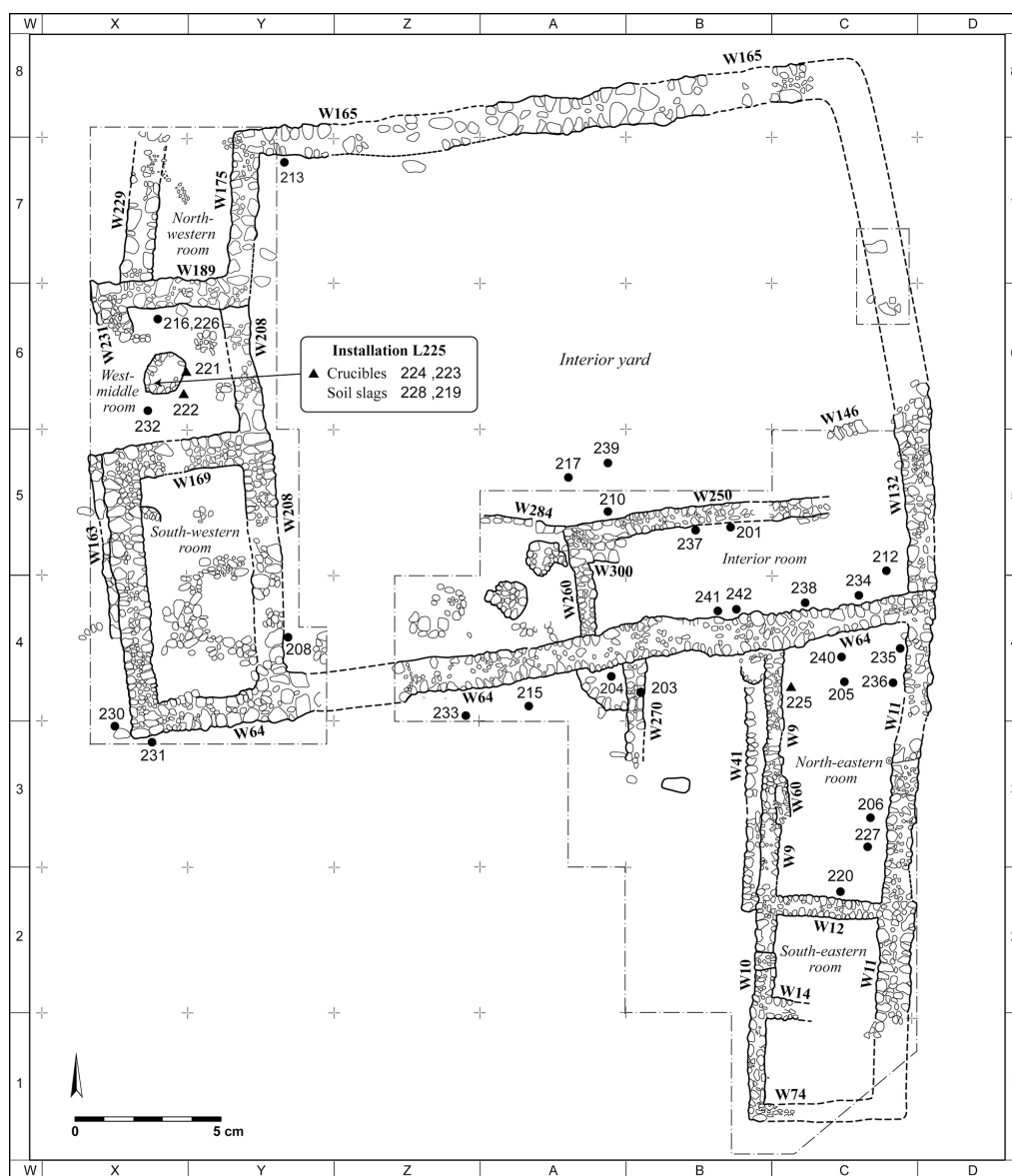


Fig. 3. Distribution of copper items at Fazael 2.

(e.g., *Bar-Adon 1980; Ben-Yosef et al. 2016; van den Brink et al. 2016; Eldar, Baumgarten 1985; Klimscha 2013; Lee 1973; Namdar et al. 2004; Perrot 1955a; 1959b; Segal, Goren 2013; Segal, Kamenski 2002*).

Maceheads

Three maceheads were recovered (Fig. 5, Tab. 3): two fragments and one complete item. The two macehead fragments (Fig. 5.1-2) are globular, and the complete item is piriform (Fig. 5.3). No core material survived in the holes. Similar items were found at other Late Chalcolithic sites in the southern Levant, reflecting a preference for specific morphologies (e.g., *Bar-Adon 1980; Ben-Yosef et al. 2016; Dothan 1959; Golden 2010; Goren 2008; Namdar et al. 2004; Perrot 1955b; 1959b; Segal, Goren 2013; Segal, Kamenski 2002* and see *Sebbanne 2009*).

Crowns

Seven flat slightly convex fragments that seem to be parts of crowns (Fig. 6.1-7) were found (Tab. 3) although not in all examples it is entirely clear that this are in fact crown fragments. A single ibex horn (Fig. 6.8) that was probably part of a crown (or a standard, see *Bar-Adon 1980*) was also found. The crown rims appear to have a rounded end, facing outward and at least one may bear some kind of decoration (e.g., Fig. 6.4). Similar finds were found at only limited additional sites (*Golden 2010; Klimscha 2013*).

Standards

Five standard fragments and one complete standard were found (Figs. 7 and 8, Tab. 3). Two fragments were parts of upper and lower disc-shaped rims with a short straight plain neck and a hollow cylindrical shaft (Fig. 7.1,4). Three other fragments were parts of a straight hollow cylindrical shaft. No decoration was observed on any of the external surfaces. Standards were found at a few additional Late Chalcolithic sites in the southern Levant (e.g., *Bar-Adon 1980; Golden 2010; Dothan 1959; Eldar, Baumgarten 1985; Israel et al. 2014; Klimscha 2013; Lee 1973; Milevski et al. 2013; Perrot 1955b; Shalev 1996*).

The complete standard from Fazael 5 (Fig. 8) contained a chisel, awl, and a bent item with a rectangular section that were insert-



Fig. 4. Copper axes.

ed into the standard through the base (the chisel and awl protrude). The standard's base was pressed, preventing the inserted items from falling out. The upper area of the standard has an opening. The standard is adorned with a large protruding nose and two eyes with three or four eyelashes. A horizontal groove encircled the body near the base. This standard bears some resemblance to the famous figurine-standard from the Cave of the Treasure (*Bar-Adon 1980.49*); however, clear stylistic differences in the standard morphology and figure design are

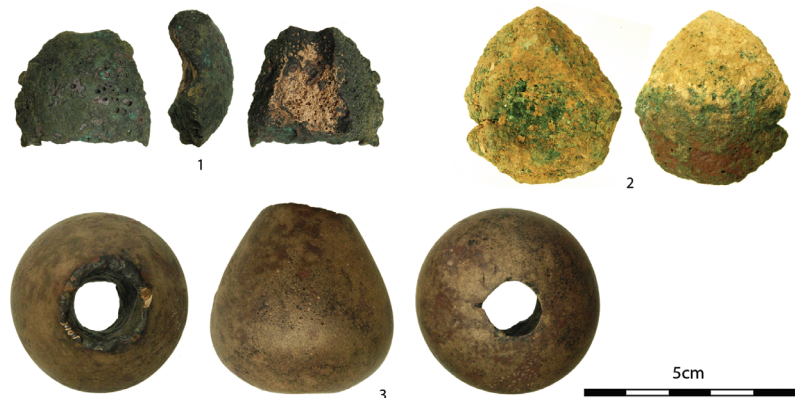


Fig. 5. Copper maceheads.

noted as well, including two elongated protrusions on the sides (ears?), the remains of a third one on the back of the head, and a potential mouth.

Unidentified fragments

These comprise fragments and various copper pieces that could not be included in the former groups (Fig. 9, Tab. 3). These fragments vary in size, shape, and density. One of these is a bent fragment that was found inside the standard at Fazael 5 (seen through the hole in the standard head and in an X-ray image).

Copper chunks

Copper chunks could be remnants of the casting process (Figs. 10 and 11, Tab. 3). They are of various sizes and shapes.

Crucibles

Among the pottery assemblage of Fazael 2, there are five crucible fragments (Fig. 12, Tab. 4). The Fazael crucibles are similar to finds from the Negev (*Eldar, Baumgarten 1985; Notis et al. 1984; Shalev, Northover 1987*). Four of the crucible fragments were found in close proximity to installation Locus 225, located in one of the western rooms of Fazael 2, and they contained slag and copper remains. The fifth crucible fragment was found on the eastern side of Fazael 2 and contained no slag.

Burnt glazed sediments

The two burnt glazed sediments (Fig. 13) are characterized by melted or partially melted local sediment that contacted an extremely hot heat source (for similar burnt glazed sediments see *Notis et al.*

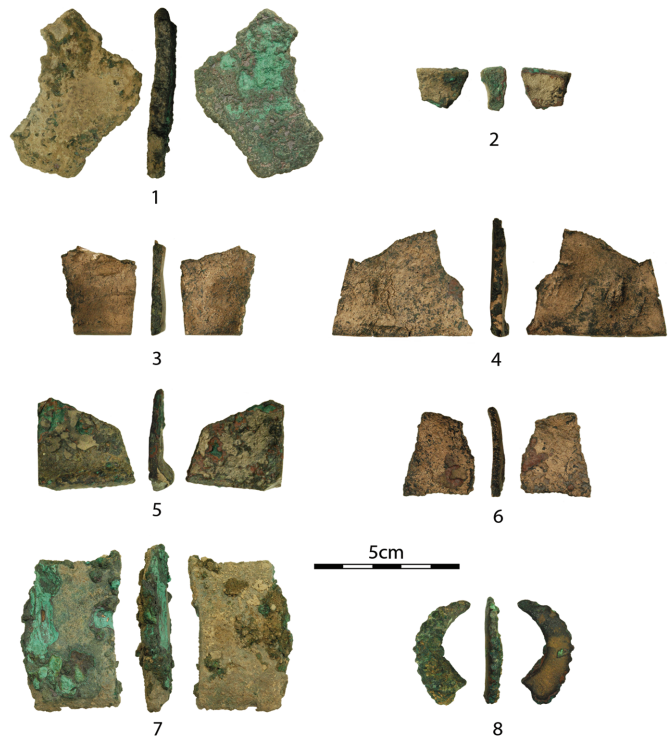


Fig. 6. Copper crown fragments.

1984; Shalev, Northover 1987). These were found in installation Locus 225 (which contained no signs of fire or ash remains). They are porous, and the cross-section is black in colour.

Preliminary chemical analysis of the copper artefacts

While still preliminary, it seems that the copper artefacts from Fazael show a clear division into two main chemical groups (*Buchman 2018*). The groups are characterized by the absence or differences in quantities of elements in the copper alloys. Group I

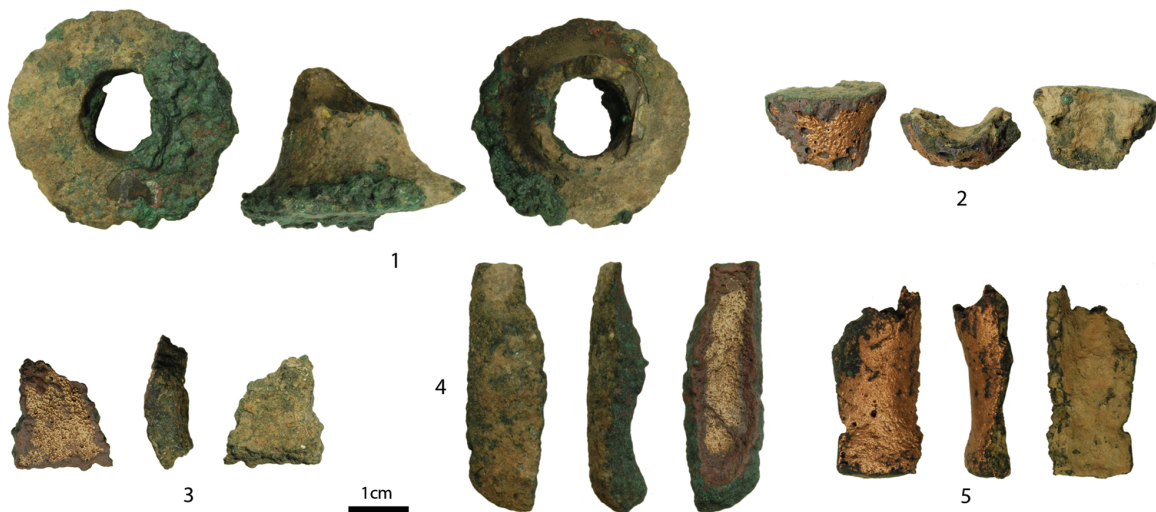


Fig. 7. Copper standards.

Cat. no.	Dimension (mm)		Internal wall coating	Depth (mm)
	inner rim diameter	external rim diameter		
221	58.60	82.00	slag	45-30
222			slag	
223	65.00	81.00	slag + copper	43.65
224	65.40	87.80	slag	
225				

Tab. 4. Crucibles.

is characterized mainly by copper and iron, while arsenic, antimony, and nickel are absent. The concentration of iron and iron oxides depends mainly on the purity of the copper in the alloy. Group II is characterized by copper alloys, and it can be further separated based on typology and chemical composition (see *Buchman 2018*). In a few artefacts in this group, the concentration of some elements (e.g., arsenic, bismuth, lead, and antimony) seems higher than in the natural ores, however, in general the average concentrations of antimony, arsenic, lead, and nickel are lower than those found in natural ore (*Buchman 2018*). The lack of control over the copper composition of some of these (nine items) produced copper alloys that differed from those produced directly from the copper ore, and seems to suggest recycling of copper artefacts (*Buchman 2018*).

Most of the analysed ‘prestige’ objects at Fazeal have lead concentrations higher than about 0.5wt.% and the artefacts that generally contain high lead concentrations lack one of the other elements (nickel, arsenic, or antimony). In this regard, *Miriam Tadmor et al. (1995)* suggested that the exotic copper-arsenic-antimony alloys were chosen to facilitate production using the lost wax technique, which requires highly fluid liquid metal that can be obtained using alloys. The metallic lead was probably obtained from dif-

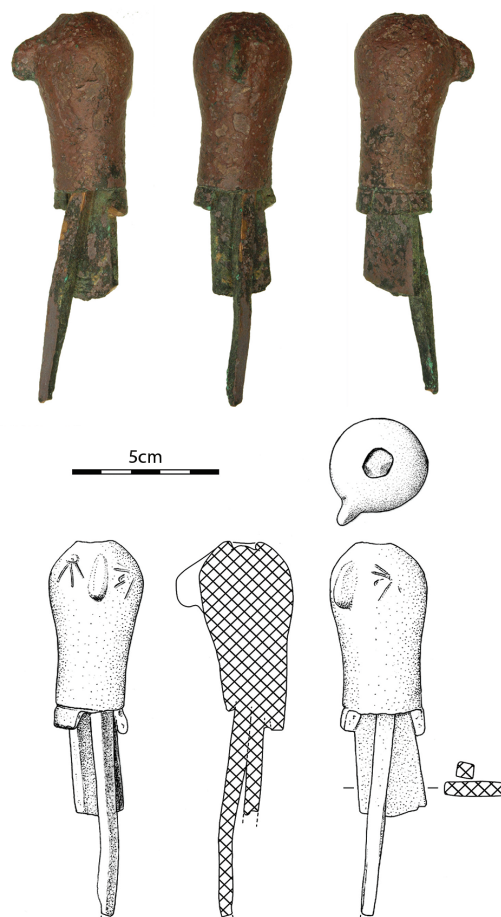


Fig. 8. The copper standard containing copper objects from Fazeal 5.

ferent sources than the polymetallic ore used for the copper-arsenic-antimony alloys (e.g., *Yahalom-Mack et al. 2015*). Our preliminary chemical analysis also seems to suggest that in the Fazeal copper assemblage some artefacts have lead or bismuth added to pure copper or copper alloys. This may have been used to improve the quality of the final alloys; alternatively, this may represent a break in the trade of

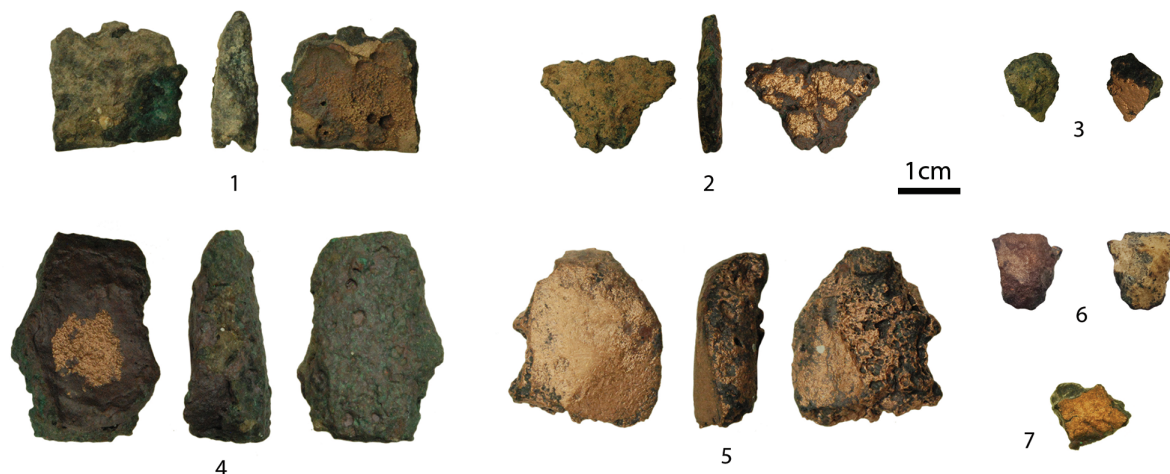


Fig. 9. Unidentified fragments of copper items.

copper-arsenic-antimony alloys and an attempt to find alternatives (see also *Ben-Yosef et al. 2016*). At Fazael, four items contain lead in concentrations above 1.2wt.%. However, only one item (an unidentified tool fragment) contains mainly copper and lead, while another item, a chunk, contains 2.76wt.% bismuth.

The distinction between copper objects with more ‘utilitarian’ characteristics and more prestigious and less utilitarian forms is still debated (e.g., *Barkai 2011; Golden 2009; Kerner 2001; Potazkin, Bar-Avi 1980; Shalev, Northover 1987*). Our preliminary chemical study shows that the traditional classification of copper items into these two typological groups, characterized by different manufacturing techniques and chemical compositions (e.g., *Key 1980; Shalev 1991; Shalev, Northover 1993; Tadmor et al. 1995*), does not always apply. This pattern, while characteristic of most of the Late Chalcolithic copper industry, is challenged by the presence of copper items (such as a few of the Fazael objects) that are commonly associated with one functional group (‘utilitarian’ or ‘prestige’) yet are produced from ore typically associated with the other functional group. Similar examples are observed at Giv’at Ha-Oranim (*Namdar et al. 2004*), Peqi’in Cave (*Segal, Goren 2013*), and the Cave of the Sandal (*Segal, Kaminski 2002*). It is interesting to note that most of the objects that cross the proposed guidelines are (unalloyed) maceheads, and this may relate to their function.

Discussion and conclusion

The new information accumulated from the recent excavations in the Late Chalcolithic Fazael Basin sites adds critical evidence for the dispersal of copper metallurgy into the Jordan Valley and furthers our understanding of this time span and its reflection in this region. The Fazael sites are characterized by large court-

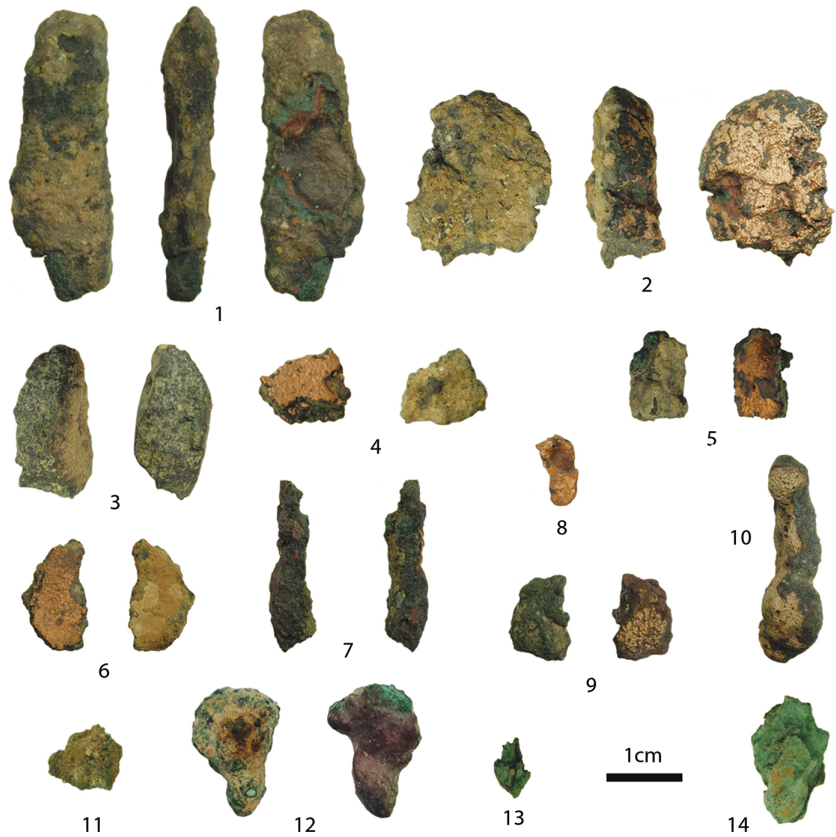


Fig. 10. Copper chunks.

yard structures, pottery assemblages that lack certain key components (e.g., churns and cornets), minimal basalt vessels, Canaanite blades typical of the Early Bronze Age and the later stages of the Late Chalcolithic period (*Pinsky 2019; Rosen 1997*), perforated discs that are found mainly in the Golan, northern Jordan Valley, and Galilee (see *Rosenberg, Shimelmitz 2017*), and the general absence of bifacial tools and ivory objects, the later are found mainly in southern Israel (see *Rosenberg, Chasan in press*). Based on the available data, all three sites (Fazael 2, 5, and 7) had a phase that pre-dates the construction of the large courtyard houses. Notably, in the more extensively researched sites of Fazael 2 and 7 these layers were rich in finds, including com-

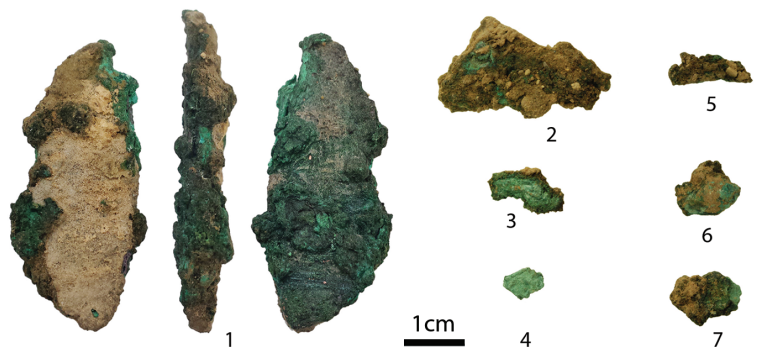


Fig. 11. Copper chunks.

plete vessels and a few copper artefacts. Although we should be cautious in stating this, as the division between the pre-architecture and the main architecture phases is not always clear, this suggests that copper artefacts may have been present in the Fazael Basin sites before the onset of the major construction phases.

The significance of the new copper assemblage found at Late Chalcolithic sites in the Fazael Basin lays in its size and geographic location, as well as in its composition and chemical attributes. The assemblage is currently one of the largest copper assemblages for the Late Chalcolithic period in the southern Levant, and Fazael is the richest site in copper objects beyond the borders of the northern Negev and the Judean Desert. The Fazael assemblage reveals that typologically varied copper objects and waste materials (*e.g.*, copper chunks) found their way to Fazael, probably as scrap metal, reflecting the complexity of this industry in the region at the very end of the Late Chalcolithic period. The results of the current study and our preliminary chemical analysis indicate that Fazael is the first Late Chalcolithic site in the Jordan Valley with evidence for a local metallurgical industry, one that probably involved the recycling of copper items that were produced or, at least in some cases, brought from elsewhere to Fazael when they went out of use. This conclusion is based on the large number of fragments and pieces of copper objects, as only a few items were found whole or undamaged, and on our preliminary chemical analysis. It is further supported by the many copper chunks found as well as the presence of the crucibles and burnt glazed sediments.

Thus, the results suggest that the Fazael Basin was well integrated into the circulation of copper objects during the very end of the Late Chalcolithic period, and Fazael also seems to have been an important site for copper objects that were no longer suitable for use in their original function, possibly in cultic activities. While the social, economic, and technical

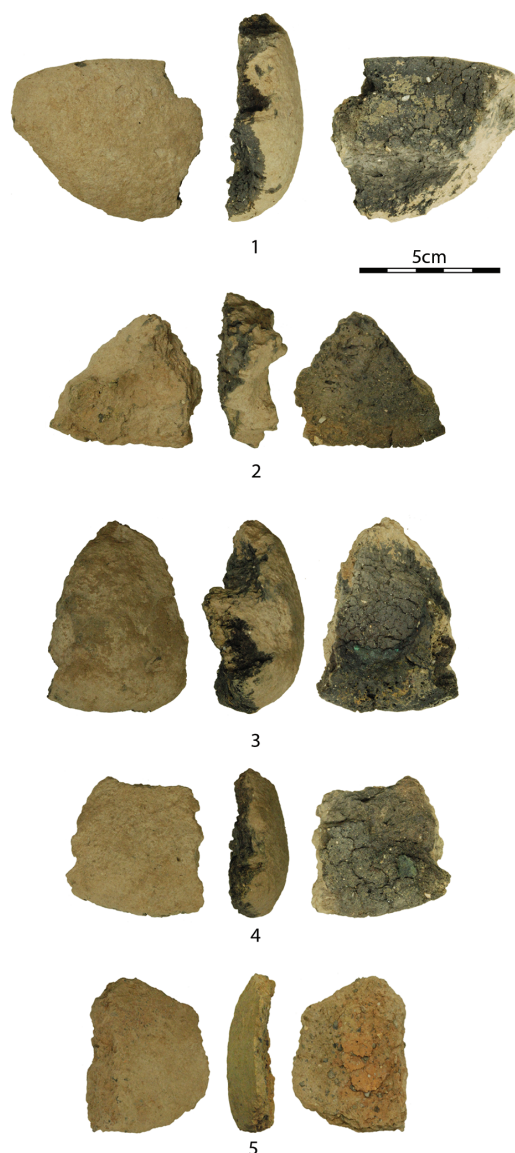


Fig. 12. Crucibles from Fazael 2.

mechanisms behind the extensive metallurgical industry must await further study of the site, the present study reflects the complexity and centrality of the copper industry in the Fazael Basin. The copper assemblage found at Fazael expands the distribution of Late Chalcolithic copper metallurgy into an area nearly devoid of copper objects, while the typologi-



Fig. 13. Burnt glazed sediments from Fazael 2.

cal variability and discard patterns of the assemblage, its size, and chemical characteristics suggest that Fazael was an important depot in the production/recycling of copper objects during the period. This accumulated data combined with the massive architecture suggests that the site, located along the main trading routes, had special significance within the Late Chalcolithic social and economic systems.

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