
Research Article

From Chalcolithic to Early Bronze Age: A view from Abu Hof Cave 22 (Israel)

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Abstract - Archaeological cultural taxonomy is a practical necessity. It singles out more or less coherent patio-temporal entities and facilitates scholarly exchange and communication. However, these practical conventions tend to take an independent life of their own, and sometimes constrain creative research endeavors. It is well known that “the name is not the thing”. Archaeological cultural taxa are relatively flexible entities, not perfectly self-contained units. Despite this realization, change documented from one archaeological culture to the next is generally framed in term of ‘transition’, a legacy of classic gradualism. This paper addresses the issues of change and the nature of the Chalcolithic/Early Bronze Age interface in the Southern Levant, from the vantage point of a small cave located in the Nahal Tillah valley in Northern Negev, Israel. Genomic and intra-site archaeological data suggest the situation to be a robust illustration of punctuated equilibrium, without evidence of continuity between the ending Chalcolithic and the emerging Early Bronze Age societies.

Keywords: Chalcolithic; Early Bronze Age; Evolutionary modeling; Transition; Punctuated equilibrium; Northern Negev; Israel.

Introduction

As the saying goes, the devil is in the details. There is an interesting debate on the nature and characteristic of cultural change as assessed through archaeological data. What is the meaning of an archaeological ‘culture’ and how does it change? Does the idea of 1.5 million years long ‘Acheulean Culture’ make sense? Routine archaeological research – equivalent of Thomas Kuhn ‘normal science’ (Kuhn 1996) – relies on accepted conventions to advance knowledge on past societies. The dominant lexicon and concepts are applied within that frame, research proceeding as ‘business as usual’ with some questions considered legitimate and others deemed irrelevant. The challenges triggered by new research fields, as is the case for aDNA and genomics, are either ignored or considered a fashionable distraction with inconsequential developments. Although difficult, these new developments need to be incorporated in archaeological explanation in order to unwrap past social dynamics. Humans are biological entities that produced cultures. Both biological and cultural aspects are equally relevant for balanced investigations of human past, making it necessary to meld the distinct data sets. Sampling issues are paramount in contributions with multidisciplinary ambitions, different research field relying on different sampling protocols. The reliance on genomic data to reconstruct past populations dynamics is optimal in regions with substantial aDNA coverage. However, when such coverage is lacking, as is the case for the study presented in this paper, the data available are predominantly use to highlight plausible scenarios.

The evolutionary models relied upon to make sense of southern Levant long-term cultural developments are predominantly gradualist. The construct of ‘transition’, i.e. ‘passage or evolution from one stage to another’, is deeply imbedded in the scientific lexicon to refer to the succession of chronological cultural cohorts (Blackham 2002, Braun 2011, Braun and Roux 2013, Burton and Levy 2011, Gilead 1990, Lovell and Rowan 2011, Levy *et al.* 1997, Milevski 2013, Rowan and Levy 1994, Rowan and Golden 2009). In physics “transition is the alteration of a physical system from one state to another” (Britannica 2009). In archaeology, it tends to be synonymous with ‘succession’, with all long-term cultural changes enacted through transitions. There are cascades of transitions, from the Lower to the Middle Paleolithic, the Middle to the Upper Paleolithic, ...the Late Neolithic to the Chalcolithic, the Chalcolithic to the Early

Bronze Age, the Bronze Age to the Iron Age, etc. to the present. There are however cases of abrupt successions – such as colonial take-over - that do not result from a transitional process. “The name is not the thing” (Bateson and Bateson 1987). The names given to archaeological taxa are practical conventions. They are constructed through a scholarly process to subsume more or less coherent and repetitive data-sets, and as such can be deconstructed through conjecture and refutation when they become a hurdle to research progress (Kuhn 1996, Popper 2002).

The Chalcolithic/Early Bronze Age interface: What’s at stake?

The current approach to the shift from the Chalcolithic to the Early Bronze Age is anchored on the idea of gradual change in material culture and population distribution resulting in the demise of the former on the one hand, and the emergence of the latter (Bar and Winter 2010, Joffe 2018, Milevski 2011) on the other hand.

Relying on the presence of Canaanite blades in different Chalcolithic sites, Bar and Winter (2010) suggest this technological development to be part of the onset of the transition to the Early Bronze Age and assert that “based on current evidence, Stratum 2 at Faza 2 should be regarded as a very late Chalcolithic site — one of the latest in the southern Levant. It may signify the end-phase of a Chalcolithic/EBI transitional phase, stretching from *ca.* 3900 to 3600 BCE, the latter date being the earliest accepted for the EB1a.” (Bar and Winter 2010: 46).

Despite its ‘common sense’ appeal, i.e., the passage from Culture A to Culture B, the implication of the concept of ‘transition’ is problematic. It does not address the processes involved in the change from one culture to the other and assumes some kind of continuity with cumulative modifications. The ‘archaeological culture’ taxonomy is part of the problem (Holl 2019). It generates the construction of successive spatio-temporal ‘blocks’ – cultures -, which in their turn, constrain researchers to rely on the concept of ‘transition’ to explain the passage from the prior ‘block’ to the following one.

Joffe’s (2018) ‘New models for the end of the Chalcolithic in southern Levant’ is an interesting and illustrative case. It represents the most explicit, elaborate, and ‘creative’ version of the transition from the Chalcolithic to the Early Bronze Age in the southern Levant. In his view, “religion and ritual, magic and totem defined and constituted Chalcolithic culture; they touched every aspect of life, behavior, belief, and

practice.” (Joffe 2018:4). The demise of the Chalcolithic is accordingly attributed to a grand scale ritual failure that took some 200-300 years to complete. The ritual debacle resulted in the emergence of Early Bronze Age culture(s), based on different organizational principles. The earliest evidence for EB I settlement, found in a series of sites in different regions and in small exposures at large sites, have elements that may well represent the elusive ‘transition’ (Joffe 2018: 24). Securely dated sites with superimposed Chalcolithic/EBI levels are however missing, forcing Joffe to revise his earlier observations on settlement continuity.” The best we can say is that a number of Chalcolithic sites, particularly in regions like the Jordan valley and the Beth Shean valley, were *reoccupied* in the EBI” (Joffe 2018: 24, emphasis in the original). Despite this correction, Joffe re-asserts the “settlement continuity” idea in the next page: “To me the implications are that ‘transitional’ Chalcolithic-EB I settlements exist. Indeed, some of these have already been excavated without being clearly identified, precisely because the archaeological inclination has been to look for clearly continuous or discontinuous development in material culture.” (Joffe 2018: 25). In other words, like the famous ‘missing link’, - the hypothetical half-ape/half human creature of 19th century human palaeontology thinking -, the critical transitional sites exist, but they are yet to be identified.

Along with the assumption of settlement continuity, and relying on Tangri *et al.* (1994), Joffe (2018: 14) also posits a population continuity. “For the moment it appears there was population continuity between the Chalcolithic and the Early Bronze Age”. Tangri *et al.* (1994) paper examines biological and archaeological evidence from the Levantine Chalcolithic to settle the debate on the racial origin of the Chalcolithic population. There is no single mention of the Bronze Age in their discussion. Joffe’s (2018) new models require settlement and population continuity to back his conception of the transition from the Chalcolithic to the Early Bronze Age. Despite being aware of Lazaridis *et al.* 2016 and Harney *et al.* 2018 works and the growing aDNA and genomic literature on the Southern Levant population genetics, Joffe is forced to ignore the challenging results from this new research field detrimental to his favored views.

This brief presentation of the canonical model of the transition from the Chalcolithic to the Early Bronze reveals a situation of ‘crisis’ (Kuhn 1996). The model is unable to integrate and make sense of the widespread settlement discontinuity documented in the southern Levantine archaeological record. Population continuity is assumed despite mounting evidence to the contrary. Recent and ongoing archaeological

research at Chalcolithic cave sites in the Judean desert by [Uri Davidovich \(2013\)](#) suggests that these caves served as refuges for human populations, possibly from the northern Negev desert, during and/or following the collapse of settlement systems in the Beersheva valley and neighboring upland regions. Davidovich (personal communication) is carrying out a radiocarbon dating project of these cave sites that will bring more precision to documenting this process. These data conform to [Levy's \(2003\)](#) model for the end of Chalcolithic settlement in the northern Negev. Today, exciting and challenging population genetics data obtained from important aDNA and genomic research for late prehistoric sites in the Southern Levant need to be factored into all archaeological analyses.

In many respects, terms such as Chalcolithic and Early Bronze Age, are names without essence ([Bateson and Bateson 1987](#)). On the regional southern Levant scale, use of terms such as 'Ghassulian' for Chalcolithic sites throughout the region implies an evolutionary trajectory out of the Jordan valley, where the 'type' site for Levantine Chalcolithic was first identified ([Levy 1986](#)). They are arbitrarily assigned to an entity and accepted by convention for 'operational' reasons. Archaeological research could easily be done without the cumbersome and misleading inertia of prehistoric/protohistoric cultural taxonomies. Such an approach would account for flexible regional variations without having to expect a whole "culture block" to change all at once over its entire territorial extent.

In this perspective, by the middle of the Holocene, Late Neolithic mixed-farming communities spread in different Near-Eastern environmental settings, with some starting to adopt the production and use of copper artifacts. There was no transition but differential and punctuated shifts to new cultural practices [equivalent of *Speciation event*] that were widely adopted, spread all over the Near-East [equivalent of *Adaptive radiation*], and resulted in the Chalcolithic "Stasis" [equivalent of *Founder effect* followed by new expansion]. Identifying and tracing the dynamic evolutionary processes that drive and sustain complex adaptive systems is the core mission of anthropological archaeology research. In evolutionary terms, biological and cultural systems follow comparable dynamic paths made of four successive steps: 1) Speciation/new settlement/new invention; 2) Adaptive radiation/expansion in new territory/local adaptation; 3) Founder Effect/successful adaptation/growth/widespread adoption of new technology; and finally, 4) New expansion/diversification/demise ([Holl 2022](#)).

An approach that can parsimoniously integrate all the data pertaining to major material and cultural change is the optimal way to address the question of the shift from the Chalcolithic to the Early Bronze Age. The increasing contribution of aDNA and genomic research to the reconstruction of Post-Pleistocene southern Levantine population dynamics ([Agranat-Tamir et al. 2020](#), [Haber et al. 2017](#), [Harnay et al. 2018](#), [Lazaridis et al. 2016](#)) point to punctuated equilibria models ([Barta 2018, 2019](#); [Ben-Yosef et al. 2019](#), [Elredge and Gould 1997](#), [Gould and Eldredge 1977](#)) as the most appropriate theoretical approach to the long-term cultural evolution of the Southern Levant. Punctuated equilibrium can robustly account for the rapid emergence and formation of new socio-cultural entities, their development and expansion for a certain time - stasis -, and their collapse and extinction, without continuity from one cycle to the next. Such a cyclical view of the evolution of civilization – also framed as philosophy of history - was already formulated by [Ibn Khaldun \(1994\)](#) in his “*Muqaddimah: An Introduction to History*” written in 1375. The social evolutionary trends that crisscrossed the Northern Negev during the Later Holocene is investigated in this paper, from the vantage point of Abu Hof Cave 22, a small spot on the Northern Negev Chalcolithic country map that features as a microcosm for the demise of the Chalcolithic and its aftermath.

Abu Hof Site complex: Place and time

This study is based on two field-seasons at Abu Hof in July-August 1995 and 1996 carried out by the University of California, San Diego Nahal Tillah Regional Archaeology Project directed by Thomas E. Levy and the late David Alon ([Burton and Levy 2011, 2012](#), [Kansa and Levy 2002](#), [Kansa et al. 2005](#), [Levy et al. 1997](#), [Levy and van den Brink 2002](#)). The “project focuses on the excavation and geophysical survey of cave sites adjacent to Abu Hof, a large Chalcolithic settlement at the beginning of the Nahal Tillah drainage and excavation at the Silo-Site” ([Levy et al. 1997](#): 3).

Abu Hof is a *ca.* 10 ha Chalcolithic site made of two distinct areas: a low area on the colluvial plain and a hillside area, on the north bank of Nahal Tillah, a northeast tributary of the main Nahal Grar ([Fig. 1](#)). The site complex was located in an environmental area favorable to dry farming, with a present-day 250-350 mm average

annual rainfall, and increased precipitation (+/- 100 mm) during apex of Chalcolithic settlement in the Northern Negev ([Bar-Matthews et al. 2017](#); [Goodfriend 1991](#); [Rosen 2007](#); [Rosen and Rosen 2017](#)).

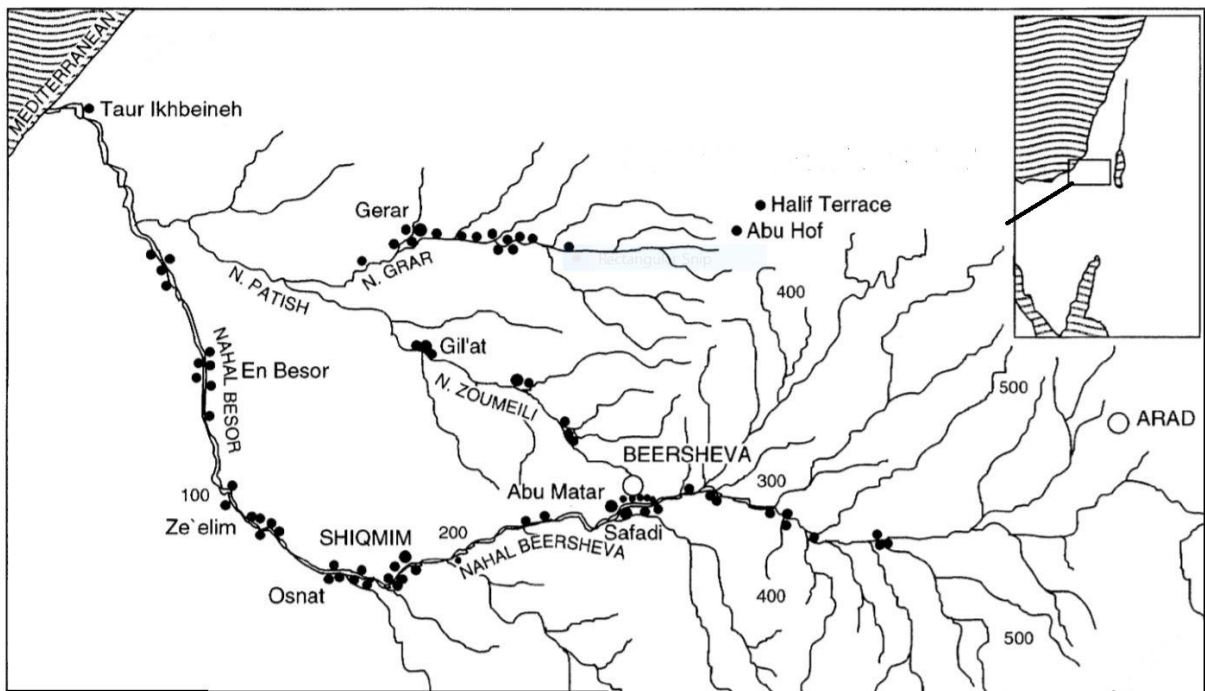


Fig. 1: Distribution of Northern Negev Chalcolithic sites (source: [Burton and Levy 2012](#)).

An excavation probe measuring 175 m² was sunk in the site, revealing 4 strata occupation sequence: I, II, IIIA, B, and C ([Fig. 2](#)). The initial occupation evidence recorded in stratum IIIC consists only of 2 post holes dug into the virgin soil ([Burton and Levy 2012](#): 142), with the Chalcolithic occupation confined to stratum IIIA-C. The final stage of the Chalcolithic occupation in stratum IIIA is dated to 4930+/-120 BP (Beta-167489), (3970-3510 Cal BCE), a reading considered inaccurate as the authors suggest “the occupation of Abu Hof village may fall somewhat late within the c. 4500-4000 BCE interval” ([Burton and Levy 2012](#): 179).

The whole site occupation sequence thus includes in addition to the Chalcolithic IIIA, B, C strata, an Early Bronze (EB) IV/Middle Bronze (MB) I occupation in stratum II, and finally, EB IV/MB I, Byzantine, and Ottoman occupation in stratum I. Many small natural caves in the Eocene limestone were recorded on the eastern hill flank of

the site in the Lahav forest. Abu Hof Cave 22, looted by tomb-robbers, already surveyed and visited by David Alon being one of them.



Fig. 2: View of Abu Hof Village 2 (Photo: T. E. Levy)

Abu Hof cave 22: Dissection of a small cave Occupation

Abu Hof Cave 22 is one of a series of natural or human made caves located on the hill slope south of Abu Hof Chalcolithic Village site, in the Lahav forest, reforested beginning in 1952 by the Keren Kayemeth LeIsrael (Jewish National Fund). Three potential caves were identified, surveyed and tested without success during the first week of the summer 1995 field season. Another cave located at approximately 25 m East of Abu Hof Cave 22 was also plundered by tomb-robbers. At the end of its use-life,

the Abu Hof Cave 22 entrance, located in the south/southwest, was carefully sealed with a large rock block and wadi cobbles (**Fig. 3**). The tomb-robbers un-sealed the cave, excavated a *ca.* 3 m in diameter area right at the entrance, triggering a sediment shift that resulted in significant post-depositional disturbance of the cave burials as will be shown below.



Fig. 3: Abu Hof Cave 22 entrance (Photo: T. E. Levy)

The stratigraphic sequence.

The cave use-sequence consisting of 4 occupations is presented after geologists' systematics, from the oldest to the youngest deposits. In its final stage, Abu Hof Cave 22 measured 9-10 m in maximum diameter, 9 m north-south, 10 m west-east, and 2.75 m in ceiling height. Abu Hof Cave 22 stratigraphy is 2.75 m thick from the bedrock to the ceiling (**Fig. 3**). The Cave deposit is accumulated on the bedrock and includes 4 successive layers with 3 living floors.

1 – Layer 1 consists of a thin brown-yellow silt deposit, 0.05-0.10 m thick accumulated by natural depositional agencies on the basal bedrock and supports Living floor 1.

2 – Layer 2, 0.15-0.25 m thick, is made of dark-grey ashy silt accumulated on Living Floor 1. The floor is a plastered well-crafted and smooth surface on small cobbles, with straightforward evidence of human occupation. The limestone used to plaster the floor was very likely carved from the cave walls as will be shown later.

3 – Layer 3, 0.10-0.20 m thick, is grey ashy silt sediment deposited on Living Floor 2, also a well-crafted and smooth plastered surface.

4 – Layer 4, 0.20-2.20 m thick accumulated on Living Floor 3, is made of loose brown and dusty silt and fills most of the cave to the ceiling. It resulted partly from roots decay, combined with infiltrated water sediment accumulation. It contains the semi-circular burial monument abutting the thick southern cobble wall. Topped and overlaid with wadi cobbles (Fig. 4).

The sedimentological homogeneity of Layer 4, in and out of the burial monument, suggests a significant time lag between the final use of Living Floor 3 and the burial episode that preceded the definitive sealing of the cave. The tombs-robbers excavation at the cave entrance, mostly in the top loose brown silty sediment, triggered the partial slump westward of burial half-tumulus leaning on the east wall. The lateral movement of sediment resulted in significant disturbance of the contained tombs that were rolled westward. These post-depositional disturbances were very well understood during the 1995 field season with three recorded burials.

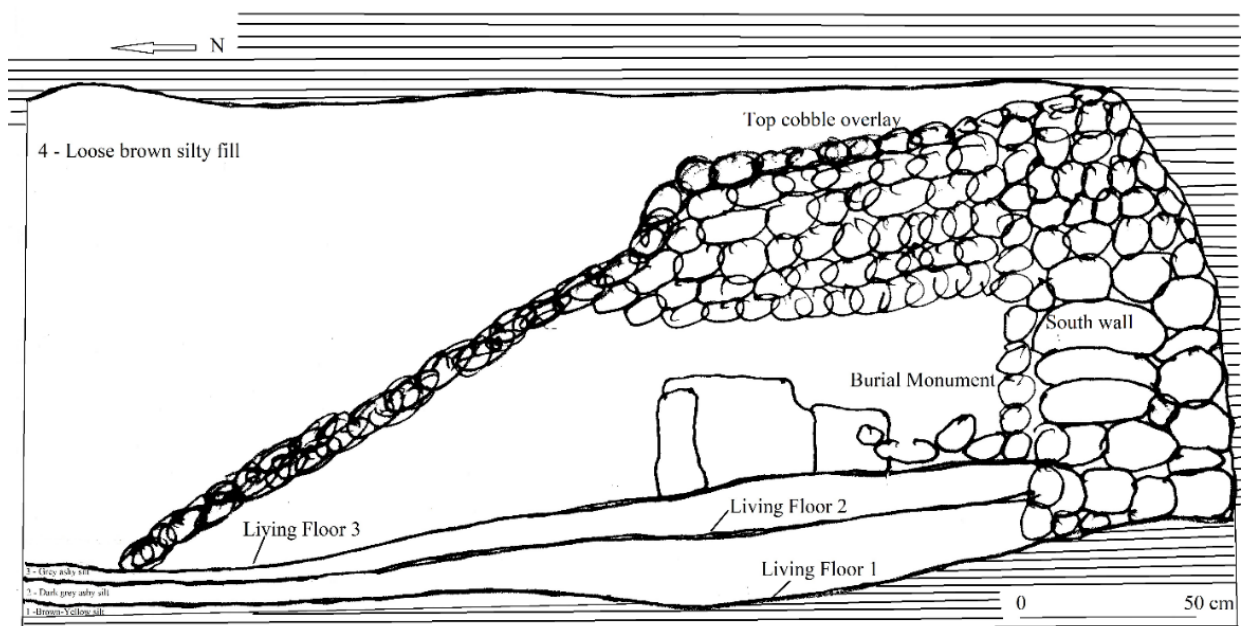


Fig. 4: Schematic stratigraphic profile of Abu Hof Cave 22, North-South section

Layer 2: Occupation 1

Occupation 1 is immediately adjacent to the entrance in the Southeast of the Cave (**Fig. 5**). Fortunately, it was not reached by the tomb-robbers excavation and features the initial size of the small natural cave. The entirely plastered exposed living surface measures 3 m west-east and 3.5 m north-south. A wall made of wadi cobbles was built along its southeast side, east of the entrance. The built installations include a horse-shoe shaped hearth-oriented NE-SW, a fire-place next to a rectilinear stone line, a stone slabs lined square installation, very likely used for storage, and finally a small circular pit in the southeast. All these combined elements point to an ordinary, probably intermittent dwelling units. The pervasive presence of ash, the dominant component of Layer 2, points to a sustained repeated use of the cave.

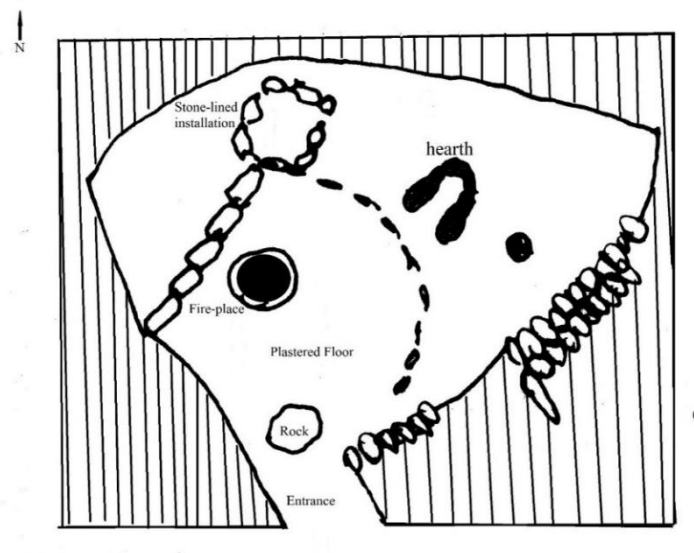


Fig. 5: Plan view of Abu Hof Cave 22 Occupation 1 installations

Layer 3: Occupation 2

The cave is expanded significantly eastwards through limestone quarrying (**Fig. 6 and 7**) and covers a *ca.* 5 m diameter area, 5 m west-east and 4.5 m north-south. Occupation floor 2 is entirely plastered. The occupation 2 deposit was heavily but only partially disturbed by the tomb-robbers near the cave entrance. The plundered area, relatively modest, measures about 3 m in diameter. The recorded features include the southeastern one-course wall east of the entrance, a fire pit 0.40 m in diameter and 0.25 m deep most likely used for heating, a limestone quarry delineated by quarried limestone slabs, and finally a small circular offering pit (L. 114), 0.34 m in diameter and 0.15 m deep. The offering contained in the pit included faunal remains (a mandible,

articulated lower legs, scapulae and other small bones) of sheep/goat, a complete mother of pearl shell and a small ceramic vessel (cup-like) containing red ochre. In contrast to occupation 1, occupation 2 seems to have focused on limestone extraction, and as such was a dual-use place, a quarry and seasonal camping place (**Fig. 7**).

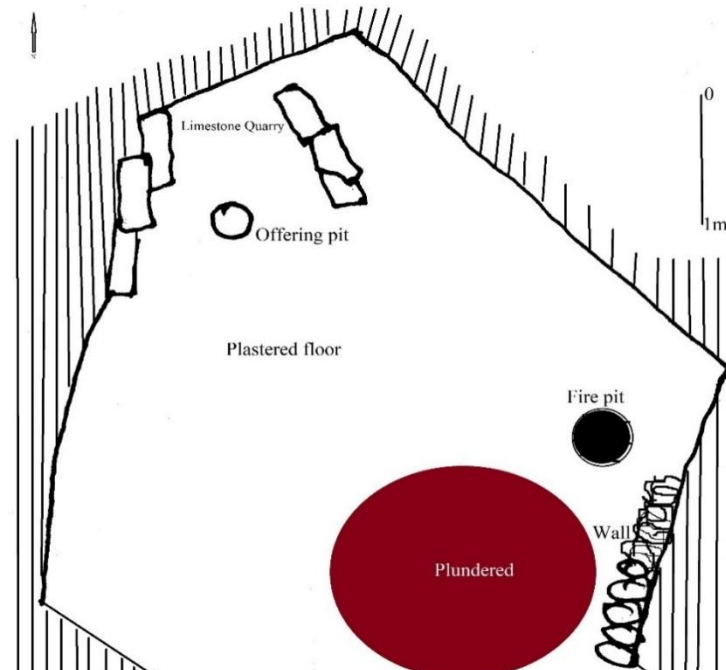


Fig. 6: Abu Hof Cave 22 occupation 2



Fig. 7: Abu Hof Cave 22 plastered floor of Occupation 2 (Photo: T. E. Levy)

Layer 4: Occupation 3

The cave went through significant expansion during occupation 3 (**Fig. 8**), reaching 7 m in length SW-NE and 6 m in maximum width W-E. It was then shaped as a relatively large two-rooms complex. A massive wall combining limestone blocks and wadi cobbles was built along the southwest side of the cave, backing and consolidating the previous occupation 2 wall. A storage area with a series of large but crushed vessels was carved at the Northeast end of the cave. A series of four post-holes, 0.20 m in diameter and 0.15 m deep, with their respondent in the cave-ceiling delineates a *ca.* 3 m in diameter circular installation, that may have been a raised ‘sleeping platform’. Unfortunately, the tomb-robbers excavation impacted all the installations and features that may have been located inside the circular installation. Numerous large sherds from the crushed vessels were recovered in the cave Northeast end on the plastered floor, contained in a light brown silty fill overlain by a thick layer of roof fall. Two superimposed living surfaces were recorded in the Northeast portion of the cave, suggesting careful maintenance and probably sustained use as dwelling unit. Occupation 3 pottery sample is the largest of the Abu Hof Cave 22 excavation, and consists of typical Chalcolithic wares: a large flat base bowl or small basin, a large globular pot with painted horizontal white and red bands, and numerous sherds of V-shape bowls (**Burton 2004**).

Occupation 4

Abu Hof Cave 22 reached its maximum extent during Occupation 4 (**Fig. 9**) when it served as special purpose site, this time as a burial cave. Despite post-depositional disturbances caused by the tomb-robbers excavation, it was still possible to determine the location, orientation, and the general outlines of the represented burials. The excavation conditions were basically low-technology, with human remains exposed with the assistance of kerosene lamps.

As will be demonstrated below in the analysis of Occupation 4 human remains, there were at least 5 individuals buried in this cave, in a jointly used burial monument, made of a semi-circular half tumulus leaning against the east wall, covered with wadi cobbles and quarried limestone slabs. The perimeter of the tumulus, oriented north-southeast delineates a 9 m arch, and contained 5 inhumations in a north-south linear arrangement (**Fig. 9**). There is no evidence of burial pit having been dug in the hard-

plastered occupation 3 floor below. The deceased were buried in the brown dusty silt sediment, very likely sequentially, during a relatively short period.

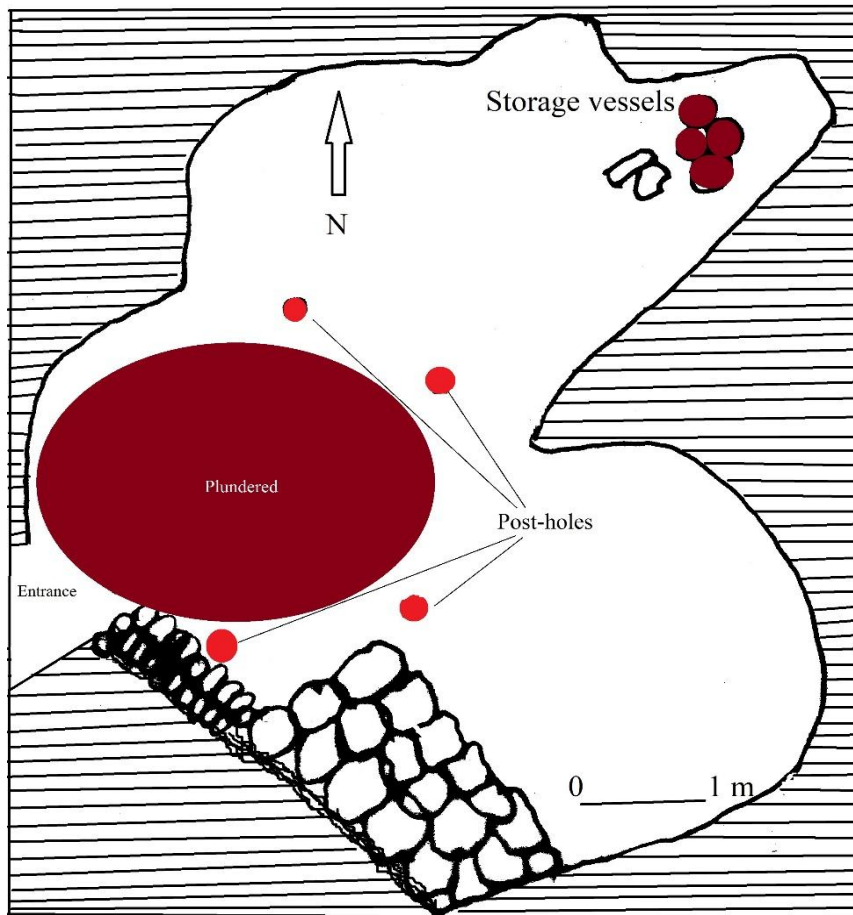


Fig. 8: Plan view of Abu Hof Cave 22 Occupation 3

Burial AH-95-1 [Locus 101, Elevation: top/bottom 394.77/394.60 m above sea level (asl)], the southernmost specimen was contained in a small cist chamber delineated on two sides by limestone slabs (**Fig. 9**). This burial was nonetheless badly disturbed: the left side of the body rolled northward and down the slope of the limestone floor. The skeleton is complete except for the cranium (only one fragment recovered). The deceased, an 11-year old child (based on mandibular dental and root development ([Kerley and Ubelaker 1978](#)), was inhumated in a flexed position, laid on the right side, head in the south, facing the cave wall. The recorded grave-goods include a long Canaanean blade, a sea-shell (Mediterranean), and a sheep/goat scapula.

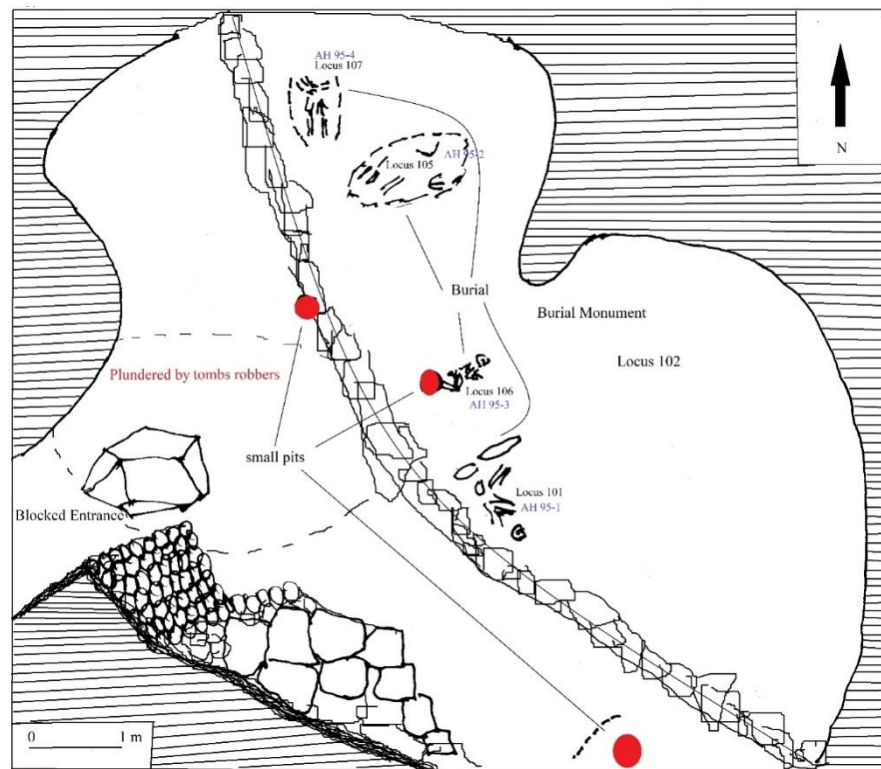


Fig. 9: Plan view of Abu Hof Cave 22 Occupation 4

Burial AH-95-2 (Locus 105, Elevation: top/bottom 394.77/394.60 m asl), located in the northern half of the burial cluster (**Fig. 10**), was heavily disturbed and incomplete. Based on epiphyseal fusion of the metacarpals, metatarsals, and phalanges, this individual was a young adult of unknown sex. The position and orientation of the bones suggest He/she was laid on the left side, facing west.

Burial AH-95-3 (Locus 106, Elevation: top/bottom 394.52/394.33 m asl), located at the cave center (**Fig. 9**), is a 16-17 years old adolescent, based on the size and development of the long bones as well as dental eruption (development of the third molar), of unknown sex. The burial is incomplete with only the upper post-cranial and several teeth in situ. It is assumed to have been a primary flexed interment due to the articulation of the radius, ulna and humerus, and the radius and ulna being crossed indicating a bent arm. A possible burial position may be extrapolated based on the position of the articulated arm and the location of the teeth and vertebrae. This individual was laid on the left side, oriented northeast, facing the center of the cave.



Fig. 10: View of Abu Hof Cave 22 Burial AH-95-2, Locus 105 (Photo: T. E. Levy)

Burial AH-95-4 (Locus 107, Elevation 394.70-394.50/394.38 m asl) was found badly disarticulated and disturbed under roof-collapsed slabs at the northern end of the burial cluster (**Fig. 9**). However, due to the articulated vertebrae and the close proximity of the skeletal remains to the correct anatomical position, the deceased was inhumated in a flexed position, on the left side, facing west. Based on dental development (full eruption of the third molars) and the degree of dental attrition and degenerative changes seen in the post-cranial skeleton, this individual was an older adult, and the presence of a single mental protuberance on the mandible suggests female. The grave-goods consisted of a Canaanean blade and a sea-shell pendant.

Burial AH 95-5 is represented by a clavicle, fragments of the radius, ulna, and humerus, and two phalanges. During the excavation of AH 95-4, several upper post-cranial remains were recovered in a semi-articulated state (Table 1).

Despite the significant disturbance caused by the tomb-robbers, it was possible to find evidence of the extension of the cave southern wall, initiated to seal the burial cave (**Fig. 9**). The additional construction connects the previous southeast wall segment to the cave entrance and consists of two parallel large stone courses of a 0.45 m thick wall, with the interstice space filled with smaller stone blocks. The large stone block (**Fig. 9**) used to seal the cave entrance was removed by the tomb-robbers.

Table 1: Additional Human remains recovered from non-defined burial contexts (recovered from the sieve)

Locus	Basket No	Anatomic part
Locus 100	B. C513 16.07.95	Parietal fragment, distal metatarsal epiphysis, rib fragment, 2 proximal phalanges (epiphyses unfused), proximal phalanx epiphysis
	B. C519 17.07.95	Maxillary central incisor (root nearly complete), terminal 1 st phalanx, cuneiform fragment?
	B. C530 19.07.95	1 st proximal phalanx, mandibular condyle (AH95-1?)
Locus 102	B. C540 23.07.95	Rib fragment, proximal 4 th metacarpal
	B. C544 24.07.95	2 rib fragments, proximal phalanx
	B. C560 28.07.9	Cuneiform fragment, small shaft fragment, right proximal 3 rd metatarsal.
Locus 103	B. C543 24.07.95	Femur shaft and distal epiphysis fragments, left 2 nd proximal metacarpal.
	B. C549 25.07.95	Occipital fragment, 1 st proximal phalanx (pitting on the proximal articulation surface), rib and vertebrae fragments, sternal end of a clavicle
	B. C563 28.07.95	Rib fragments, long bones shafts fragments

The mortuary program implemented in Occupation 4 burials features significant coherence (Table 2). The deceased were deposited sequentially in shallow graves dug in a loose sedimentary fill. Their orientation varies from one case to the next, but they are all buried in flexed position, predominantly on the left side, with almost identical grave-goods – Canaanite blade and sea-shell – in two cases. A truncated half tumulus was finally built over the graves. The age and sex composition of the buried population point to the possibility of a tightly knit social unit.

Table 2: Abu Hof Cave 22 burials

Site	Locus	Burial #	Age/Sex	Position	Grave-goods
Cave 22	101	AH 95-1	Child 11 yrs	Flexed, Right Side	Canaanite blade, Sea-shell, and Sheep/Goat scapula
Cave 22	105	AH 95-2	Young Adult	Flexed? Left Side	
Cave 22	106	AH 95-3	Adolescent (16-17 yrs)	Flexed, Left Side	
Cave 22	107	AH 95-4	Adult Female	Flexed, Left Side	Canaanite blade and Sea-shell pendant
Cave 22	103/107	AH 95-5	Adult	Unknown	

The skeletal remains

The site experienced significant post-depositional disturbance triggered by the tomb-robbers intrusion. It is therefore important to re-assemble the excavated human remains as reliably as possible and provide an accurate description of the studied skeletal remains. AH 95-1 was represented by a complete post-cranial skeleton. The mandible was recovered in two pieces and a single cranial bone, the temporal bone, was recorded. AH 95-2 post-cranial skeleton was almost complete, but poorly preserved and very fragmented, with most hand and foot bones absent. Numerous large cranial fragments as well as three mandible pieces were recorded. The majority of the skeletal remains of AH95-3 were recovered from the sieve and from the associated tumulus (locus 102). AH 95-4 is represented by several large cranial fragments and a complete mandible. The post-cranial remains are, however, incomplete. And finally, AH 95-5 is represented by a clavicle, fragments of the radius, ulna and humerus, and two phalanges.

Dentition and pathological conditions

Dental remains represented primarily by mandibles and loose maxillary and mandibular teeth were recovered from 4 of the 5 burial contexts. A variety of pathological conditions were evident in the skeletal and dental remains of 4 of these individuals. Dental conditions included attrition (wear), congenital absence of third molars, linear enamel hypoplasia, and dental calculus, with several skeletal pathological lesions also recorded.

AH 95-1 presents evidence of dental attrition on the deciduous canine and second molar, exposure of dentin present on the right and left central and lateral incisors, and slight wear (polishing) on the right canine and right and left molars. AH 95-2 has the mandibular third molars missing, a congenital absence as there is no room in the arcade to suggest ante-mortem loss. There is some calculus on the lingual and buccal inferior surfaces of right and left second molars. In addition, a variety of skeletal lesions and conditions have been recorded: a proximal femoral lesion approximately 10 mm wide by 30 mm long, a parietal lesion 15 mm x 20 mm, specific thickening of the frontal bone 10 mm thick near the orbit decreasing to 6 mm at the coronal suture, with similar thickening evident in several parietal bone fragments. The AH 95-3 burial locus was greatly disturbed. Dental attrition reflects this individual's younger age. The mandibular canine presents some linear enamel hypoplasia. AH 95-4 presents a remarkable difference in the dental attrition of the right and left mandibular molars. The left first molar is completely worn out with only the root remaining, whereas the right first molar crown reveals coalescing patches of exposed dentin. Dental calculus is present on most of the dentition, involving the labial, lingual, and buccal surfaces.

The human remains described above document a significant shift in the use of Abu Hof Cave 22. The buried individuals were, very likely, part of a tightly knit Early Bronze Age IA social unit, with access to exotic goods. The mortuary program documented in this case departs very significantly from the Chalcolithic one. The latter is articulated upon multi-stage inhumations – also known as secondary burial – in which selected anatomical parts are picked, deposited or not in clay containers -ossuaries-, and buried either in collective monuments in cemeteries or put in subterranean caves depending on regions (Levy and Alon 1982, Perrot and Ladiray 1980, Nativ and Gopher 2011, Shalem *et al.* 2013). There are significant regional and areal variations in Early Bronze Age mortuary practices, from monumental rock-cut to modest primary burials, including multi-phase individual and collective deposits in natural and human-modified caves. Cist burials in tumuli were predominant in the Negev and Transjordan (Ilan 2002). The data recorded from Abu Hof Cave 22 occupation 4 with its 5 burials in a cobble-lined half tumulus fits perfectly in the Negev variant of Early Bronze Age I burial monuments.

aDNA, genomics, and Post Pleistocene Southern Levant population dynamics

This section of the paper deals with a longitudinal sample of aDNA and genomic research spread over the last 13-10,000 years in the southern Levant ([Agranat-Tamir et al. 2020](#), [Haber et al. 2017](#), [Harney et al. 2018](#), [Lazaridis et al. 2016a, 2016b](#)). The goal is to single out distinct admixture scenarios that have presided over southern Levantine population genetic make-up during the Holocene.

[Lazaridis et al. \(2016a, 2016b\)](#) offer a genomic insight into the origins of farming in the Near-East through two complementary data sets with implications for the Chalcolithic period discussed here. First, genome-wide data from 45 individuals from Armenia, Turkey, Iran, Israel, and Jordan dated from 12,000 to 1,400 BCE; and, second, a data set of 281 individuals sampled from published reports. Their analyses show (1) a widespread Basal Eurasian ancestry in the Ancient Near-East; (2) followed by high, then reduced differentiation over time; (3) with continuity between Late Pleistocene Hunter-Gatherers and Early Holocene farmers; and finally, (4) extensive admixture in Ancient Near-East. “Almost all ancient and present-day West Eurasians have evidence of significant admixture between two or more ancestral populations” ([Lazaridis et al. 2016](#): 423). The Levant early farmers for example have 2/3 ancestry from Natufian Hunter-Gatherers and 1/3 related to Anatolian farmers; while the Levant Bronze Age population, as shown by Ain Ghazal sample -2490-2300 BCE–, displays 56% Levantine PPN agriculturalists and 44% Iranian Chalcolithic ancestry.

[Harney et al. \(2018\)](#), relying on the hypothesis that the advent and decline of the Chalcolithic Culture was influenced by populations movements, focus on the role of population mixtures in cultural transformation in the Chalcolithic period (4500-3900 BCE). Genome-wide aDNA generated from 22 individuals from Peqi’in Cave points to a relatively homogeneous population with 57% ancestry derived from local Levant Neolithic, 26% from Anatolia Neolithic, and 17% from Iran Chalcolithic. These groups are shown to have contributed very little to the southern Levant Bronze Age population, whose genetic make-up “can be modeled as a mixture of Levant_N (Neolithic) (58%) and Iran-Chl (Chalcolithic) (42%)” ([Harney et al. 2018](#): 8). The Levantine Chalcolithic and Early Bronze Age genetic discontinuity is strongly backed by significant shifts in settlement patterns, burial practices, and symbolic behaviors, showing “that profound

cultural upheaval, leading to the extinction of populations, was associated with the collapse of the Chalcolithic Culture in this region” (Harney *et al.* 2018: 8).

Haber *et al.* (2017), relying on 5 whole-genome samples from the ancient Canaanite city-state of Sydon [3750-3650 years ago] and 99 present-day Lebanese, explore the genetic make-up of Ancient Canaanite in relation to present-day Lebanese. They found the Canaanite ancestry to derive from mixture between local Neolithic populations (Levant_N (48.4%) and Chalcolithic Iranians (Iran_ChL (51.6%). These results, similar to those of three Early Bronze Age individuals from Ain Ghazal in Jordan and supporting previous finds by Lazaridis *et al.* (2016), suggest “that people from highly differentiated urban culture on the Levant coast and inland people with different modes of subsistence were nevertheless genetically similar” (Haber *et al.* 2017: 277).

Agranat-Tamir *et al.* (2020) address the genomic history of the Bronze Age (BA) in Southern Levant that lasted from ca. 3500 to 1150 BCE. The Bronze Age, through its successive cycles generated the Urban Revolution in Israel, Jordan, Lebanon, the Palestinian territories, and parts of Syria, ending with impressive civilization and demographic collapse (Cline 2014). Agranat-Tamir *et al.* (2020:1149) research has three main objectives: (1) assess the genetic homogeneity of Canaanite site populations; (2) outlines the precise timing, extent and origins of the Zagros/Caucasus gene flow in Southern Levant BA; and (3) evaluates the impact of additional gene flow in the region since the BA. To achieve these goals, they carried out genome-wide aDNA analyses for 93 individuals from BA and Early Iron Age Southern Levantine sites, with samples collected at Tel Megiddo, Tel Hazor, Tel Abel Beth Maacah, Yehud (Israel) and Baq’ah (Jordan).

The results show two different but complementary trends. The Canaanite population genetic make-up was derived from 2 sources: the Earlier Local Neolithic populations on the one hand and Chalcolithic Zagros or BA Caucasus one on the other hand, with the non-local contribution increased over time. “These observations point to a degree of population turn-over in the Chalcolithic-Bronze Age transition, consistent with archaeological evidence for a disruption between local Chalcolithic and Early Bronze cultures” (Agranat-Tamir *et al.* 2020: 1147). As far as the genetic make-up of the modern Levantine population is concerned, it is shown to have substantial ancestry from the Chalcolithic Zagros and Southern Levant BA.

In summary and as evidenced by current genomic research, the Southern Levant presents versatile population genetic profiles during the Holocene. There is continuity between Late Pleistocene Hunter-Gatherers and Early Holocene farmers (Lazaridis *et al.* 2016a, 2016b), with Levant farmers 2/3 ancestry from Natufian Hunter-Gatherers and 1/3 from Anatolian farmers. The Chalcolithic population genetic make-up features 57% ancestry from local Levant Neolithic, 26% from Anatolia Neolithic, and 17% from Iran Chalcolithic (Harney *et al.* 2018). BA or Canaanite population genetic make-up resulted from mixture between local Neolithic (Levant_N (48.4%) and Chalcolithic Iranians (Iran_ChL (51.6%) (Haber *et al.* 2017) or 56% Levantine PPN agriculturalists and 44% Iranian Chalcolithic ancestry in Ain Ghazal sample dated to 2490-2300 BCE (Lazaridis *et al.* 2016). And finally, the southern Levantine BA populations genetic make-up is derived from yet another mixture of Earlier local Neolithic and Chalcolithic Zagros or BA Caucasus, with the non-local contribution increasing over time (Agranat-Tamir *et al.* 2020).

The population dynamics outlined above provides a robust and elegant illustration of punctuated equilibria with varying stasis. Gene flows reflect ‘mating networks’. Humans as individuals, small, or large groups are constantly on the move. The term ‘migration’ can be misleading if used carelessly. The local Levant Neolithic population contributing 57% via mixture with Anatolian Neolithic and Iranian Chalcolithic to the genetic make-up of the Chalcolithic population is logical and straightforward. The same cannot be said on the scenario presiding over the formation of the Canaanite, or Bronze-Age population.

This having been said, the increasing demonstration of constant human biological inter-connectedness puts material culture into a new light, that of a ‘dependent variable’ of population dynamics. Ways of doing and using things, emerged at specific time and place, were learnt, adopted, spread, peaked, then decreased, and became extinct. That is the inexorable cycle of material culture applicable to any stage of human cultural evolution as will be shown below with our South Levantine example.

The Chalcolithic/Early Bronze Age interface: A punctuated shift.

As is the case for Nahal Tillah/Halif Terrace (Burton and Levy 2011, 2012, Levy *et al.* 1997), Abu Hof Cave 22 features evidence of Late Chalcolithic and Early Bronze Age occupations. Abu Hof Cave 22 occupation 1-3, pointing to a differentiated use of

the site, are clearly Chalcolithic. Occupation 1 is a modest cave shelter, with a plastered floor, a hearth (cooking), a fireplace (heating), and a stone-lined storage installation. Occupation 2 features an expanded cave, a dual use place, possibly a limestone quarry, with intermittent seasonal occupation. And occupation 3, with evidence of storage, a raised sleeping platform and successive flooring, was a more elaborate habitation episode of the cave. Occupation 4 attests to a significant shift in the use of the cave, this time as a burial place. “Within the context of sedentary societies, caves were often regarded as liminal landscapes, in accord with their evident environment and structural deviation from open-air settlement sites.” (Davidovich *et al.* 2018: 113).

The relative slow-paced accumulation by infiltrated water and plants roots decay of layer 4 brown dusty silty sediment on occupation floor 3 in which occupation 4 burials were dug suggests a relatively long-time lag between these successive Chalcolithic occupations and the use of the cave for burial purposes. This reading of the evidence is supported by the cave archaeological record.

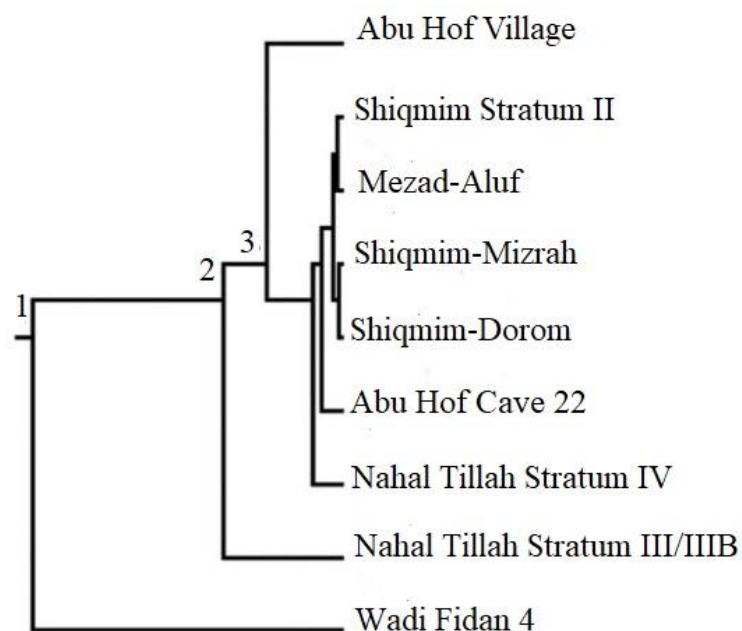


Fig. 11: Connectivity graph of Northern Negev Chalcolithic Pottery (Source: Burton and Levy 2011).

On the one hand, a Chalcolithic pottery connectivity analysis carried out by Burton (2004) and Burton & Levy (2011) illustrates two distinct but complementary trends: (1) a low connectivity level between Nahal Tillah/Halif Terrace Stratum IV and Abu Hof Cave 22 and Abu Hof Chalcolithic Village; and (2) a very high connectivity

level between Nahal Tillah/Halif Terrace Stratum IV and Abu Hof Cave 22 and the Shiqmim Chalcolithic settlement cluster of the Beer-Sheva valley ([Fig. 11](#)).

The increased number of higher precision radiocarbon dates suggests the Northern Negev Chalcolithic period to have lasted from 4500 to 39/3800 BCE, not 3500 BCE as considered initially. In this perspective, the Chalcolithic occupation of Abu Hof Village 1 and 2 is thought to “fall somewhat late within the c. 4500-4000 BCE interval” ([Burton and Levy 2012: 179](#), [Braun et al. 2013](#)). In other words, the Later Chalcolithic occupation of Abu Hof Cave 22 took place after the demise of Abu Hof Village 1 and 2.

Two of the Abu Hof Cave 22 occupation burials, AH 95-1 and AH 95-4 were furnished with Canaanite blades as grave-goods. Despite the presence of some Canaanite blades in Chalcolithic sites ([Bar and Winter 2010](#), [Rowan and Levy 1994](#)), it is generally considered that in the Southern Levant the “Canaanite industry appears with the beginning of the Early Bronze Age (EBA-I) and lasts to the end of the Intermediate Bronze Age” ([Zutovski and Bar 2017: 1](#), [Rosen 1985](#)). As is the case for Nahal Tillah/Halif Terrace Stratum IV, Abu Hof Cave 22 Occupation 4 belongs to the EBA-IA. It features coeval Negev EB-I mortuary practices represented by cist burial in tumulus. Depending on sites, the EBA-IA started around *ca.* 3600-3500 BCE. The terminal Chalcolithic occupation of Abu Hof Cave 22 may have taken place after the abandonment of Abu Hof Village, between *ca.* 4000 and 3900-3800 BCE. The cave was abandoned for a few centuries, and re-occupied for burial purposes during the EBA-IA, possibly by Nahal Tillah/Halif Terrace inhabitants, for a relatively short time segment in the middle of the 4th millennium BCE, around 3600-3500 BCE.

The demise of the Northern Negev Chalcolithic polities and population downturn resulted in the formation of scattered small epi-Chalcolithic communities, living in “small habitation loci with ephemeral architecture or natural caves”,..... described by some scholars as representing a “degenerated or terminal Chalcolithic stage” ([Burton and Levy 2011: 180](#)). Genomic data point to genetic discontinuity between the Chalcolithic and the Early Bronze periods ([Harney et al. 2018](#)) and/or a degree of population turn-over at the Chalcolithic-Bronze Age interface ([Agranat-Tamir et al. 2020: 1147](#)). As far as the Abu Hof settlement complex reviewed in this paper is concerned, the marked punctuated population and cultural shift cannot be equated with a transition. It is an undisputable punctuation: the demise and extinction of the Chalcolithic populations on the one hand, and the emergence and expansion of new

Early Bronze Age IA populations on the other hand, without solution of continuity between the former and the latter.

There was a “profound cultural upheaval, leading to the extinction of populations, associated with the collapse of the Chalcolithic culture” (Harney *et al.* 2018: 8) in the Southern Levant. Events of similar magnitude happened two millennia later with the end of the Late Bronze Age (*ca.* 1200-1150 BCE), “a formative period in the Southern Levant - Israel, Jordan, Lebanon, Palestine and SW Syria - which ended in large scale civilization collapse across this region,[and] shaped later periods both culturally and demographically” (after Agranat-Tamir *et al.* 2020: 1146, Cline 2014). In fact, such profound population upheavals are well known in human history. Examples include the expansion of farmers from the Anatolian plateau to Europe with some admixture with and extinction of Mesolithic hunter-gatherers, the expansion of Bantu speaking farmers from northwest Central to Eastern and Southern Africa, the expansion of Chadic speaking herders from Eastern to North-Central Africa, and the expansion of speakers of Austronesian languages from Taiwan to Hawaii and the Easter Island in the Eastern Pacific, Polynesia and New Zealand in the south, and the Comoros archipelago and Madagascar in western Indian Ocean, to mention but a small number of most salient cases (Holl 2022a, 2022b). To build on the contributions of the growth in ‘big data’ over the past two decades in archaeological research, ancient textual studies, and aDNA research to understand the origins of people in the ancient Near East, what is needed is the contribution of historical linguistics to help decipher the evolutionary dynamics of Southern Levantine Chalcolithic societies. The northern Negev region was part of the ancient Near Eastern cradle of proto-semitic languages. A pioneering historical linguistics study by Kitchen *et al.* (2009) applied Bayesian phylogenetic analyses to Semitic languages to identify an Early Bronze Age origin of these ancient Near Eastern languages. According to these researchers,

“The importance of Semitic dates back at least 4350 years before present (YBP) to ancient Sumer in Mesopotamia, where the Akkadian language replaced Sumerian From this time forward, archaeological evidence for Semitic among the Hebrews and Phoenicians in the Levant and the Aksumites in the Horn of Africa.... suggests that Semitic-speaking populations and their languages underwent a complex history of geographical expansion, migration and diffusion tied to the emergence of the earliest urban civilizations in these regions..... Uncertainties about key details of this history persist despite

extensive archaeological, genetic and linguistic studies of Semitic populations” (Kitchen *et al.* 2009: 2703).

This study has problems that need to be considered when assessing its utility today. For Hebrew Bible scholarship, the Kitchen *et al.* (2009) equate ‘language’ with written artifacts. According to W. Schniedewind (personal communication 2021), Kitchen *et al.* mix two linguistic areas: the linguistics of language (spoken) and the linguistics of writing systems. Furthermore, the primary nature of Akkadian likely has to do with its use as a *written* lingua franca that probably began in the late third millennium. It was the use of Akkadian as a written lingua franca that makes it a primary language in the history of Semitic. There is some relationship between the use of the written language and the spread and influence of spoken languages, but we may ask does the data warrant this linkage, and if so, by how much? For Assyriologists, there are also problems applying the phylogenetic approach to Semitic language origins. According to Y. Cohen (personal communication 2021), some of the basic premises of Kitchen *et al.* are debatable, e.g., Akkadian is the basis of the Semitic language group (and which Akkadian is that?). The earliest Semitic language(s) in Babylonia was/were probably not Akkadian; and the Akkadian of Sargon of Agade is not Akkadian at all. In 2009, the construction of a diachronic chart for Semitics, unlike Indo-European, which split into distant and distinct groups, was problematic, and according to Cohen (*ibid.*) especially difficult for its beginning. People were constantly on the move and intermingled with each other. Language contacts with Hurrian and Sumerian complicates the picture even more, and shared basic words across the Mediterranean show how much the situation is opaque. With these caveats, it is important to bring the innovative phylogenetic research of Kitchen *et al.* (2009) into new discussions of late Levantine prehistory as done here.

The concept of Canaanite may at first glance seem confusing to archaeologists as it is used to subsume very diverse social formations included in the Bronze Age I-IV taxa. It is nonetheless a well delineated linguistic category pointing to the emergence of early Hebrew during that same period in the southern Levant (Almarri *et al.* 2021, Kitchen *et al.* 2009). Processes of population expansion, admixture, and extinction are well documented in human evolutionary history. The key theoretical problem as far as the study of the Levantine Chalcolithic-Early Bronze Age IA shift is concerned is the ‘straight-jacket’ imposed by the current archaeological culture taxonomy. Local

northern Negev Early 4th millennium BCE communities can be expected to have adjusted differentially to the global patterns of change. Some communities may have inherited Chalcolithic material culture, along with similar and/or different languages. Others may have adopted new ways totally different from Chalcolithic precedents. Population extinction is not synonym to population annihilation. Extinction can happen through absorption by a more dynamic group through hypergamy in case of contact between dominant and dominated groups. The cycling of China dynasties is an interesting example with the Mongol take over during the Yuan Dynasty (1271-1368) and the extensive but short-lived Mongol Empire and the Manchu Qing Dynasty (1644-1912). In Central Africa for example, all the Humid Equatorial Forest foragers lost their original languages and adopted Bantu idioms of their neighbors ([Holl 2022b](#)).

Conclusion

The traditional gradualist evolutionary scheme based on cumulative incremental changes presiding over the passage from one ‘archaeological culture’ to the next via a transition cannot account for the demise of the Chalcolithic and the emergence of the Early Bronze Age societies in the Southern Levant. This rationale cannot integrate the results of well targeted aDNA and genomic research that point to genetically different populations cohorts. Settlement patterns, sites structures, and material cultures are so different and distinctive, that researchers are at pain to find evidence for continuity. These two taxonomic entities, the southern Levantine Chalcolithic (4500-39/800 BCE) and the Early Bronze Age (36/3500-3000 BCE) ([Regev et al. 2012](#)), resulted from successive but independent evolutionary cycling, initiated by abrupt punctuations, followed by sustained growth, then stasis, and finally demise. In fact, the lexeme ‘transition’, used in traditional evolutionary discourse as a synonymous to ‘succession’ has no explanatory implications.

Conflicts of Interest

The authors declare no conflicts of interest.

Authors' contributions

L. Dawson participated to Abu Hof cave excavation, analyzed mortuary evidence, wrote the Human remains section, and read and reviewed the manuscript. A.F.C. Holl directed the excavation of Abu Hof cave, designed the paper, made the illustrations, and wrote the initial draft of the paper.

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References

Agranat-Tamir L., Waldman S., Martin M.A.S., Goghman D., Mishol N. *et al.* 2020. The Genomic History of the Bronze Age Southern Levant. *Cell* 181: 1146-1157.
DOI: <https://doi.org/10.1016/j.cell.2020.04.024>

Almarri M.A., Haber M., Lootah R.A., Hallast P., Al Turki S., Martin H.C., Xue Y. and Tyler-Smith C. 2021. The genomic history of the Middle East. *Cell* 184: 4612–4625.
DOI: 10.1016/j.cell.2021.07.013

Bar S. and Winter H. 2010. Canaanite flint blades in Chalcolithic Context and the possible onset of the transition to Early Bronze Age: A Case study from Fazaal 2. *Tel Aviv* 37(1): 33-47. DOI: 10.1179/033443510x12632070179423

Bar-Matthews M., Ayalon A., Vaks A., and Frumkin A. 2017. Climate and Environment Reconstructions Based on Speleothems from the Levant. In *Quaternary of the Levant: Environments, Climate Change, and Humans*, edited by Ofer Bar-Yosef, and Yehouda Enzel, pp. 151-164. Cambridge; Cambridge University Press.

Barta M. 2018. Heraclitus law, punctuated equilibria and the dynamics of contemporary world. Punctuated Equilibria Paradigm and Security in the Modern World. *Terrorism Journal* 1-7.

Barta M. 2019. Introduction - Why to deal with a collapse? Considerations on Seven Laws underlying dynamics of civilisations. In *Civilisations: Collapse and Regeneration - Addressing the Nature of Change and Transformation in History*, edited by M. Barta, and M. Kovar, pp. 19-29. Academia, Prague.

Bateson G and Bateson M.C. 1987. *Angel's Fears: toward an epistemology of the sacred*. Bantam Books.

Ben-Yosef E., Liss B., Yagel O.A., Tirosch O., Najjar M. and Levy T.E. 2019. Ancient technology and punctuated change: Detecting the emergence of the Edomite Kingdom in the Southern Levant. *PLoS ONE* 14(9): e0221967):
DOI: [https://doi.org/ 10.1371/journal.pone.0221967](https://doi.org/10.1371/journal.pone.0221967)

Blackham M. 2002. *Modelling Time and Transition in Prehistory: The Jordan Valley Chalcolithic*. BAR International Series.

Bourke S.J. 2001. The Chalcolithic period. In B. Macdonald, R. Adams, & P. Bienkowski (eds.) *The archaeology of Jordan*.(pp. 107–63). Sheffield Academic Press.

Braun E. 2011. The transition from Chalcolithic to Early Bronze in the Southern levant: a ‘lost horizon’ Slowly revealed. In Eds J. L. Lovell and Y. M. Rowan (eds.) *Culture, Chronology and the Chalcolithic: Theory and Transition*. (pp. 160-77) Oxford; Oxbow.

Braun E. and Roux V. 2013. The Late Chalcolithic to Early Bronze Age I transition in the southern Levant: Determining continuity and discontinuity or “Mind the Gap”. *Paleorient* 39(1): 15-22.

Braun E., van den Brink E.C.M., Regev J., Boaretto E. and Bar S. 2013. Aspects of Radiocarbon Determinations and the Dating of the Transition from the Chalcolithic Period to the Early Bronze Age I in the Southern Levant. *Paleorient* 39:23-46.

Britannica T. Editors of *Encyclopaedia*, 2009. "transition." *Encyclopedia Britannica*, April 14, <https://www.britannica.com/science/transition-atomic-physics>.

Burton M. 2004. Collapse, Continuity, and Transformation: Tracking Protohistoric Social Change Through Ceramic Analysis. Case Studies of Late 5th-Early 4th Millennium Societies in the Southern Levant. Ph.D. dissertation. Department of Anthropology, University of California, San Diego. UMI.

Burton M. M. and Levy T. E. 2001. The Chalcolithic Radiocarbon record and its use in southern Levantine Archaeology. *Radiocarbon* 43(3): 1223 – 46.

Burton M.M. and Levy T. E. 2011. The end of the Chalcolithic Period (4500–3600 BC) in the northern Negev desert, Israel. In J. L. Lovell and Y. M. Rowan editors *Culture, Chronology and the Chalcolithic: Theory and Transition*. (pp. 178-191). Oxbow.

Burton M.M. & Levy T.E. 2012. Chalcolithic Social Organization Reconsidered: excavations at Abu Hof Village, northern Negev, Israel. *Journal of the Israel Prehistoric Society* 42:137-92.

Cline E.H. 2014. 1177 The Year Civilization collapsed. Princeton: Princeton University Press.

Davidovich U.M., Ullman B., Langford A., Frumkin D., Langgut N., Yahalom-Mack J. Abramov, and Maro N. 2018. Distancing the Dead: Late Chalcolithic Burials in large maze caves in the Negev desert. *Bulletin of the American Schools of Oriental Research* 379: 113-52

- Dawson L., Levy T.E. and Smith P. 2003. Evidence of interpersonal violence at the Chalcolithic Village of Shiqmim (Israel). *International Journal of Osteoarchaeology* 13: 115–119.
- Eisenmann S., Bánffy E., van Dommelen P., Hofmann K.P., Maran J., Lazaridis I., Mittnik A., McCormick M., Krause J., Reich D. & Stockhammer W. 2018. Reconciling material cultures in archaeology with genetic data: The nomenclature of clusters emerging from archaeo-genomic analysis. *Scientific Reports* 8:13003.
- Eldredge N. and Gould S. J. 1997. On punctuated equilibria. *Science* 276: 337-41.
- Epstein C. 1998. The Chalcolithic culture of Golan. Jerusalem: Israel Antiquities Authority.
- Futato E.M. 1996. Early bronze III Canaanite blade/scrapers from tell Halif, Israel. In *Retrieving the past: Essays on archaeological research and methodology in honor of Gus W. Van Beek*. J. D. Seger ed. Eisenbrauns: Winona Lake, pp. 61–74.
- Gilead I. 1988. The Chalcolithic period in the Levant. *Journal of World Prehistory*, 2, 397–443.
- Gilead I. 1989a. Chalcolithic sites in Beit Netofa Valley, Lower Galilee, *Israel. Paleorient* 15(1): 263–7.
- Gilead I. 1989b. Grar: A Chalcolithic site in the Northern Negev, Israel. *Journal of Field Archaeology*, 16, 377–94.
- Gilead I. 1990. The Neolithic–Chalcolithic transition and the Qatifian of the Northern Negev and Sinai. *Levant*, 22, 47–63.
- Goodfriend G.A. 1991. Holocene Trends in O-18 in Land Snail Shells from the Negev Desert and their implications for changes in Rainfall Source Areas. *Quaternary Research* 35(3): 417-426.
- Goren Y and Gilead I. 1986. Stations of the Chalcolithic Period in Nahal Sekker, Northern Negev. *Paleorient* 12: 83-90.
- Gould S.J. and Eldredge N. 1977. Punctuated Equilibria: the Tempo and Mode of Evolution Reconsidered. *Paleobiology* 3: 233-7.
- Greenberg R. 2019. *The Archaeology of the Bronze Age Levant: From Urban Origins to the Demise of City-States, 3700–1000 BCE*. Cambridge: Cambridge University Press.
- Haber M., Doumet-Serhal C., Sheib C., Xue Y. *et al.* 2017. Continuity and admixture in the last five millennia of Levantine History from Ancient Canaanite and present-day Lebanese genome sequence. *The American Journal of Human Genetics* 101: 274–282. DOI: 10.1016/j.ajhg.2017.06.013

[Harney É.](#), [May H.](#), [Shalem D.](#), [Rohland N.](#), [Mallick S.](#), [Lazaridis I.](#), [Sarig R.](#), [Stewardson K.](#), [Nordenfelt S.](#), [Patterson N.](#), [HersHKovitz I.](#) & [Reich D.](#) 2018. Ancient DNA from Chalcolithic Israel reveals the role of population mixture in cultural transformation *Nature Communications* 9: 3336.

[Holl A.F.C.](#) 2019. The Chalcolithization Process: Dynamics of Shiqmim Site-cluster (Northern Negev, Israel). *International Journal of Archaeology* 7(2): 30-46.

[Holl A.F.C.](#) 2022a. The Mobility Hypothesis: A Global Evolutionary Archaeology Model. *Journal of Anthropological & Archaeological Sciences* 7(1) [MS.ID.000254](#). DOI: 10.32474/JAAS.2022.07.000254

[Holl A.F.C.](#) 2022b. The Mobility Imperative: A Global Evolutionary Perspective on Human Migration. New-York/London; Lexington Press.

[Ibn Khaldun](#) 1994. The Muqaddimah: An Introduction to History. Princeton: Princeton University Press.

[Ilan D.](#) 2002. Mortuary practices in Early Bronze Age Canaan. *Near Eastern Archaeology* 65(2): 92-104.

[Joffe A.H.](#) 2018. New models for the end of the Chalcolithic in the Southern Levant. Paper presented at “Transitions during the Early Bronze Age in the Levant: Methodological problems and interpretative perspectives” Conference. Albright Institute; Jerusalem, May 16-18, 2018.

<https://www.researchgate.net/publication/325763271>.

[Joffe A.H.](#), and [Dessel J.P.](#) 1995. Redefining chronology and terminology for the Chalcolithic of the southern Levant. *Current Anthropology* 36: 507–518.

[Kansa Eric C.](#), and [Levy T.E.](#) 2002. Ceramics, Identity, and the Role of the State: The View from Nahal Tillah. In *Egyptian-Canaanite Interaction-From the 4th through 3rd millennium, B.C.E.*, eds Edwin C.M. van den Brink, and Thomas E. Levy, London: Leicester University Press, pp. 190 - 212.

[Kansa Eric C.](#), [Kansa S.](#) [Whitcher](#) and [Levy T.E.](#) 2005. Eat Like an Egyptian? - A Contextual Approach to an Early Bronze I "Egyptian Colony" in the Southern Levant. In *Integrating Zooarchaeology*. ed. M Maltby, pp. 77 - 93.

[Kerley E.R.](#) and [Ubelaker D.H.](#) 1978. Revisions in the microscopic method of estimating age at death in human cortical bone. *American Journal of Physical Anthropology* 49(4): 545-6.

[Kitchen A.](#), [Ehret C.](#), [Assefa S.](#) and [Mulligan C.J.](#) 2009. Bayesian Phylogenetic Analysis of Semitic languages identifies an Early Bronze Age Origin of Semitic in the Near East. *Proceedings of the Royal Society, Biological Sciences* 276: 2703-2710

- Kuhn T.S. 1996.** The Structure of Scientific Revolution. 3rd edition; Chicago: Chicago University Press.
- Lazaridis L. et al. 2016a.** Genomic Insights into the origin of farming in the Ancient Near East. *Nature* 536: 419-26.
- Lazaridis I., Nadel D., Rollefson G., Merrett D.C., Nadin R. et al. 2016b.** The genetic structure of the world's first farmers. *BioRxiv*: 059311.
DOI: <https://doi.org/10.1101/059311>
- Levy T.E. 1986.** Archaeological Sources for the Study of Palestine: The Chalcolithic Period. *The Biblical Archaeologist* 49(2): 82-108.
- Levy T.E. 2003.** Cult, Metallurgy and Rank Societies - Chalcolithic Period (ca. 4500 - 3500 BCE). In *The Archaeology of Society in the Holy Land*, edited by T.E. Levy, pp. 226-244. London; Continuum
- Levy T.E. ed. 2005.** Archaeology, Anthropology, and Cult: The Sanctuary at Gilat, Israel. London: Routledge.
- Levy T.E. and Alon D. 1982.** The Chalcolithic mortuary site near Mezad Aluf, Northern Negev Desert: A preliminary Study. *Bulletin of the American School of Oriental Research* 248: 37-59.
- Levy T.E. and Holl A. 1988a.** Les Premières chefferies de Palestine. *La Recherche* 203: 1166-74.
- Levy T.E. and Holl A. 1988b.** Les Sociétés Chalcolithiques de la Palestine et l'émergence des Chefferies. *Archives Européennes de Sociologie* 29: 283-316.
- Levy T.E., Alon D., Grigson C., Holl A., Goldberg P., Rowan Y., and Smith P. 1991.** Subterranean Negev Settlement. *National Geographic Research and Exploration* 7: 394 – 413.
- Levy T.E., Alon D., Goldberg P., Grigson C., Smith P., Buikstra J.E., Holl A., Rowan, Y. and Sabari P. 1993.** Protohistoric Investigations at Shiqmim Chalcolithic Village and Cemetery: Interim Report on the 1988 Season. In *Preliminary Excavation Reports*. Association of American Schools of Oriental Research. Ed. W. G. Dever, volume 51: 87-106.
- Levy T.E. et al. 1997.** Egyptian-Canaanite Interaction at Nahal Tillah, Israel (ca. 4500-3000 BCE). *Bulletin of American Schools of Oriental Research* 307: 1-51.
- Levy T.E. and Edwin C.M. van den Brink 2002.** Interaction Models, Egypt and the Levantine Periphery. In *Egypt and the Levant - Interrelations from the 4th Through the Early 3rd Millennium BCE*, eds. Edwin C.M. van den Brink and T. E. Levy. London and New York: Continuum, pp. 3 - 38.

- Lovell J. and Y.M. Rowan eds. 2011. Culture, Chronology and the Chalcolithic: Theory and Transition. Oxford; Oxbow Books.
- Manclossi F., Rosen S.A., and de Miroshadji P. 2016. The Canaanite Blades from Tel Yarmuth, Israel: A technological analysis. *Paleorient* 42-1: 49-74.
- Milevski I. 2011. Early Bronze Age goods exchange in the Southern Levant: a Marxist perspective. Equinox Pub. Oakville, CT.
- Milevski I. 2013. The transition from the Chalcolithic to the Early Bronze Age of the Southern Levant in socio-economic context. *Paleorient* 39(1): 193-208.
- Nativ A. and Gopher A. 2010. The Cemetery as symbol: A Reconsideration of Chalcolithic burial caves. *Cambridge Archaeological Journal* 21(2): 229-245.
- Perrot J. and Ladiray D. 1980. Les Tombes a ossuaires de la region cotierepalestinienne au IV^e millenaireavantl'Ere Chretienne. Paris: Cahiers du Centre de Recherche Francais de Jerusalem
- Popper K. 2002. Conjectures and Refutations: The Growth of Scientific knowledge. (2nd edition) London; Routledge.
- Porath Y. 1985. A Chalcolithic Building at Fasa'el. *Atiqot* 17: 1-19.
- Regev J., de Miroshadji P., Greenberg R., Braun E., Greenhut Z., and Boaretto E. 2012. Chronology of the Early Bronze Age in the Southern Levant: New Analysis for High chronology. *Radiocarbon* 54(3-4): 525-566.
- Rollefson G. and Kafafi Z. 2000. The 1998 Excavations at 'Ayn Ghazal: A Preliminary Report. *Annales of the Department of Antiquities Jordan* XLIV: 91-98.
- Rosen S.A. 1985. The Canaanite Blade and the Early Bronze Age. *Israel Exploration Journal* 33(1-2): 15-29.
- Rosen A.M. 2007. Civilizing Climate - Social Response to Climate Change in the Ancient Near East. Altamira Press, Lanham.
- Rosen A.M. and Rosen S.A. 2017. Environmental Change and Society in Holocene Prehistory. In *Quaternary of the Levant: Environments, Climate Change and Humans*, edited by Y. Enzel, and O. Bar-Yosef, pp. 1405-1422. Cambridge; Cambridge University Press.
- Rowan Y.M. and Golden J. 2009. The Chalcolithic Period in Southern Levant: A Synthetic Review. *Journal of World Prehistory* 22: 1-92.
- Rowan Y.M. and Levy T.E. 1994. Proto-Canaanite blades of the Chalcolithic Period. *Levant* 26: 167-174.

Schiffer M.B. 1987. Formation Processes of the Archaeological Record. Albuquerque: University of New Mexico Press.

Shalem D., Gal Z. and Smithline H. 2013. Peqi'in: A Late Chalcolithic Burial Site, Upper Galilee, Israel. Jerusalem; Ostrakon.

Tangri D., Cameron D.W., Zias J. 1994. A Reconsideration of "races" and their impact on the origins of the Chalcolithic in the Levant using available anthropological and archaeological data. *Human Evolution* 9(1): 53-61.

Wiener M.H. 2018. The Impact of Climate Change, Famine, Pandemics, and Warfare in the Collapse of Civilizations. Belfer Center for Science and International Affairs *Harvard Kennedy School Paper*: 1-22.

Zutovski K. and Bar S. 2017. Canaanite blade knapping waste pit from Zazael 4, Israel. *Lithic Technology* DOI: <https://doi.org/10.1080/01977261.2017.1347337>

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