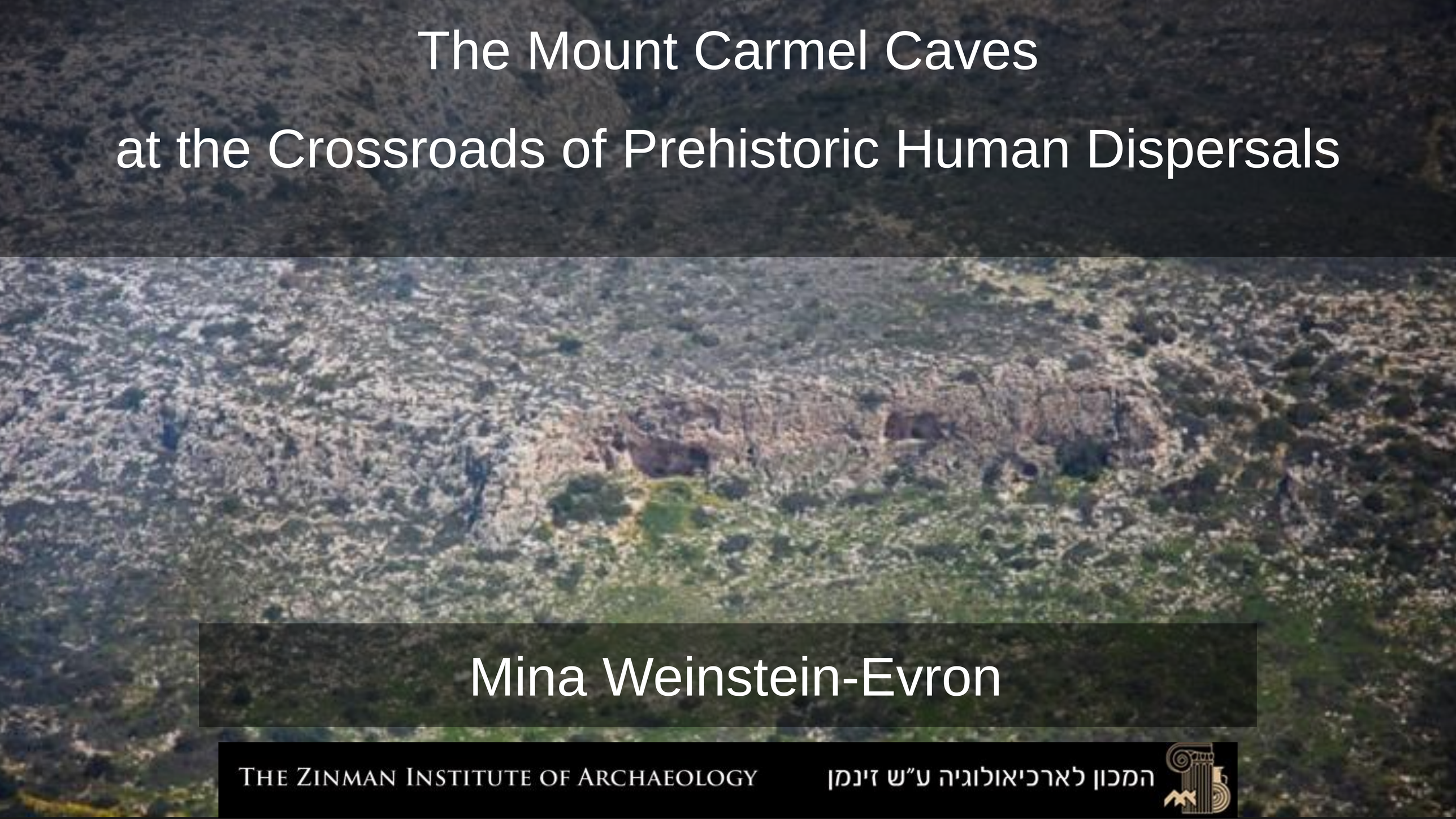
The Mount Carmel Caves

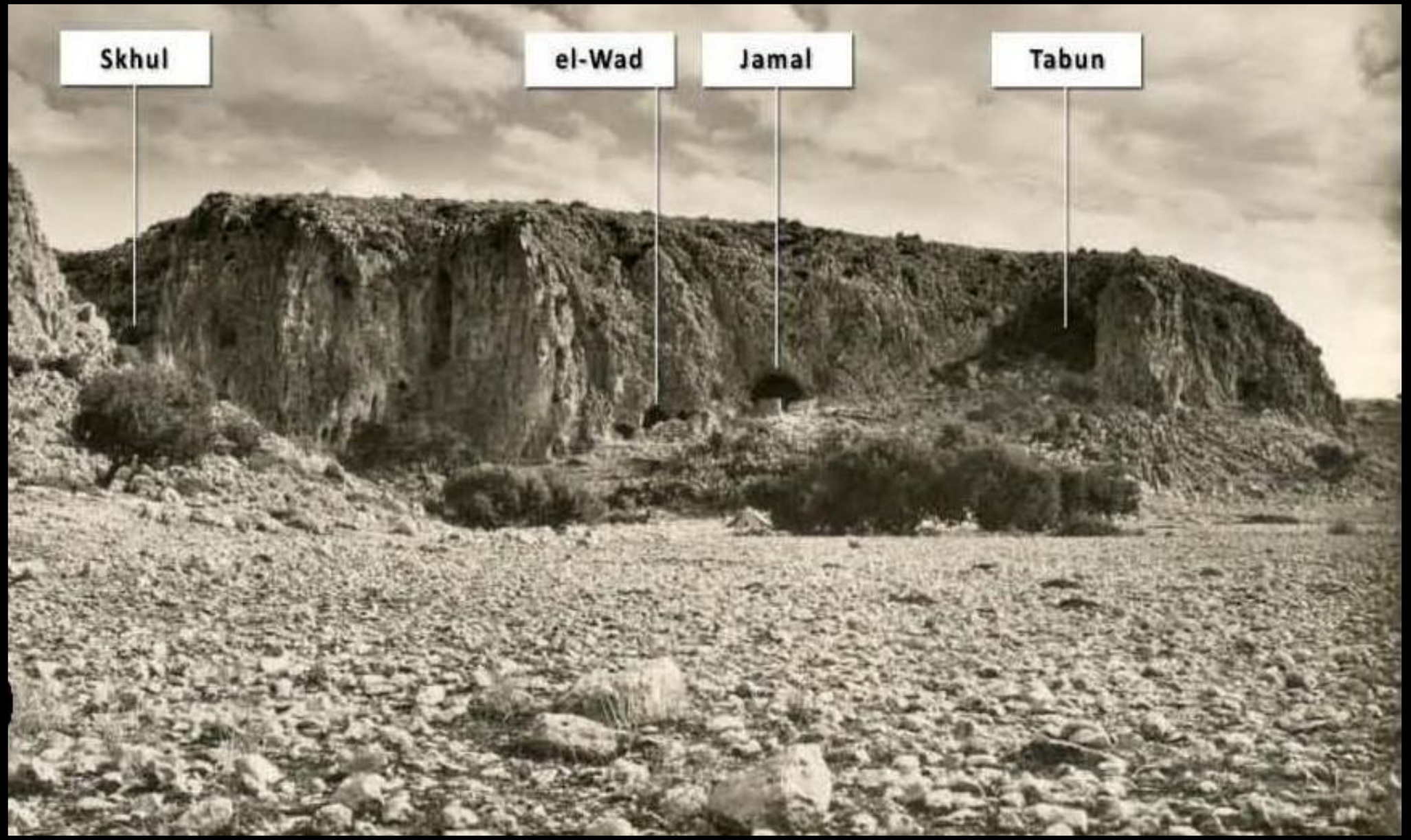
at the Crossroads of Prehistoric Human Dispersals



Mina Weinstein-Evron

THE ZINMAN INSTITUTE OF ARCHAEOLOGY

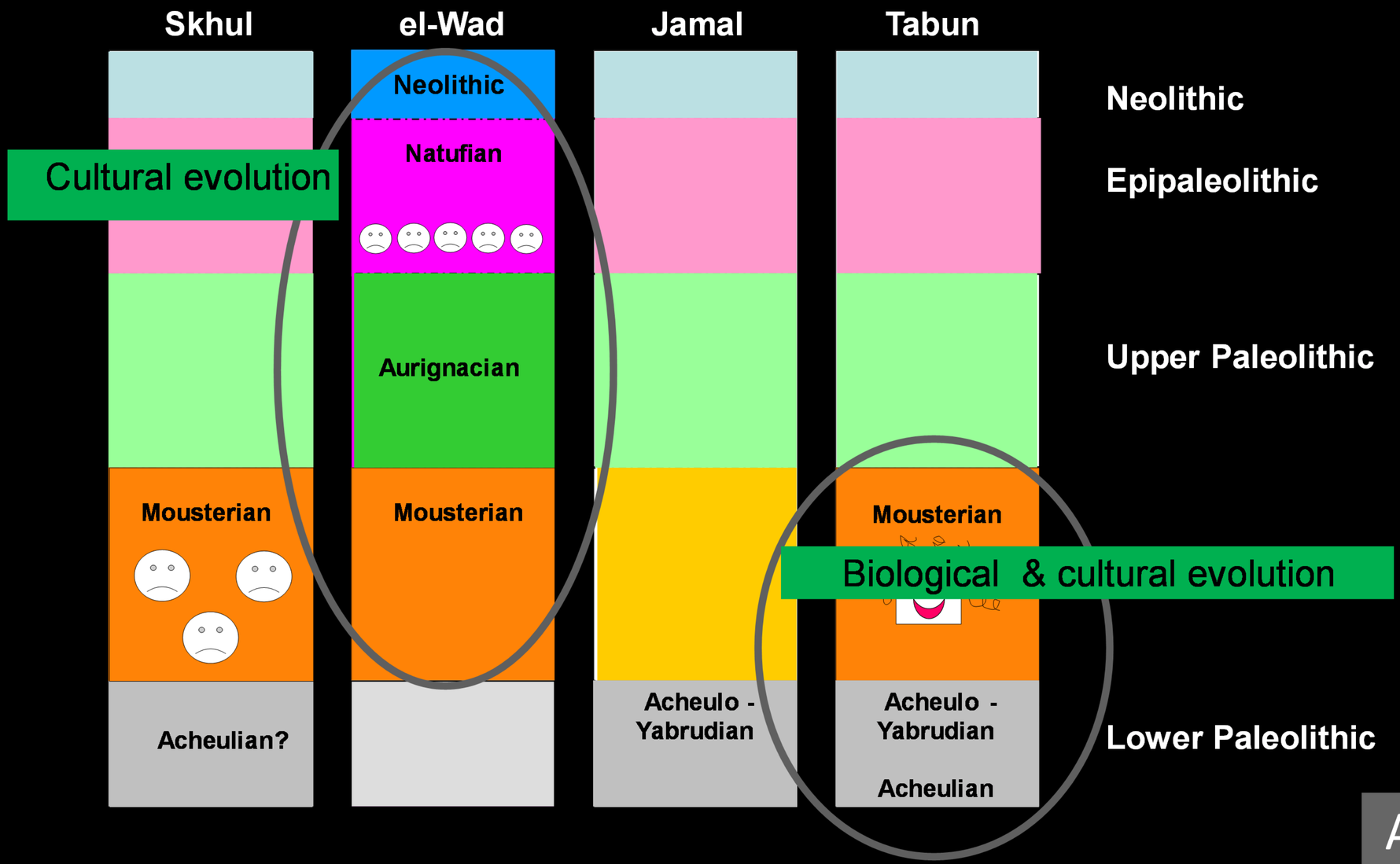
המכון לארכיאולוגיה ע"ש זינמן



A UNESCO World Heritage Site (2012)

Courtesy the Israel Antiquities Authority

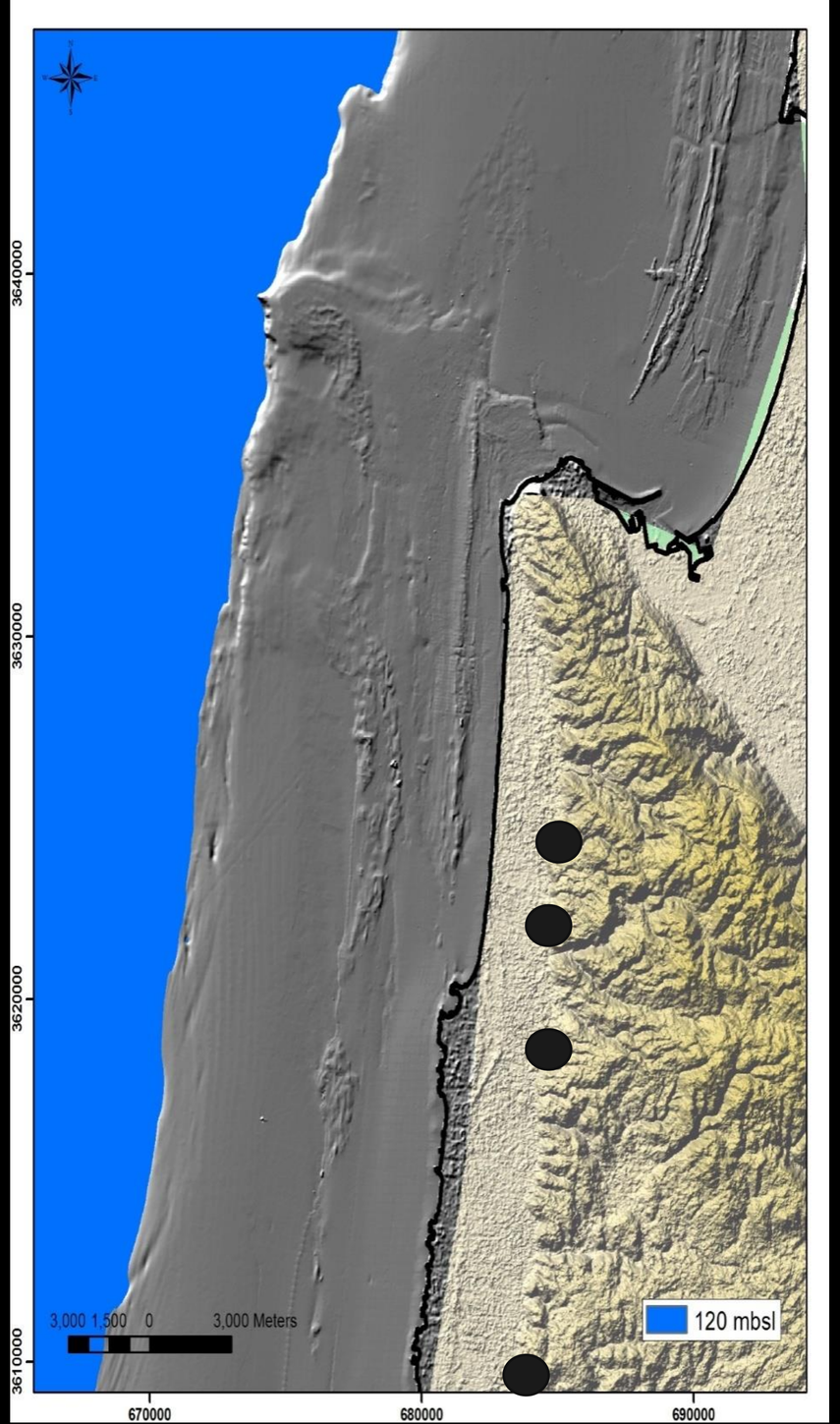
A long cultural sequence from the Lower Palaeolithic to the present



A single site

Outstanding Universal Values (OUV):

- Long cultural (and paleo-environmental) continuum and changes in life-ways
- Human evolution various MP human types (H. sapiens & Neanderthal); early burial site
- The Natufian culture – on the threshold of agriculture
- History of archaeological research


3640000
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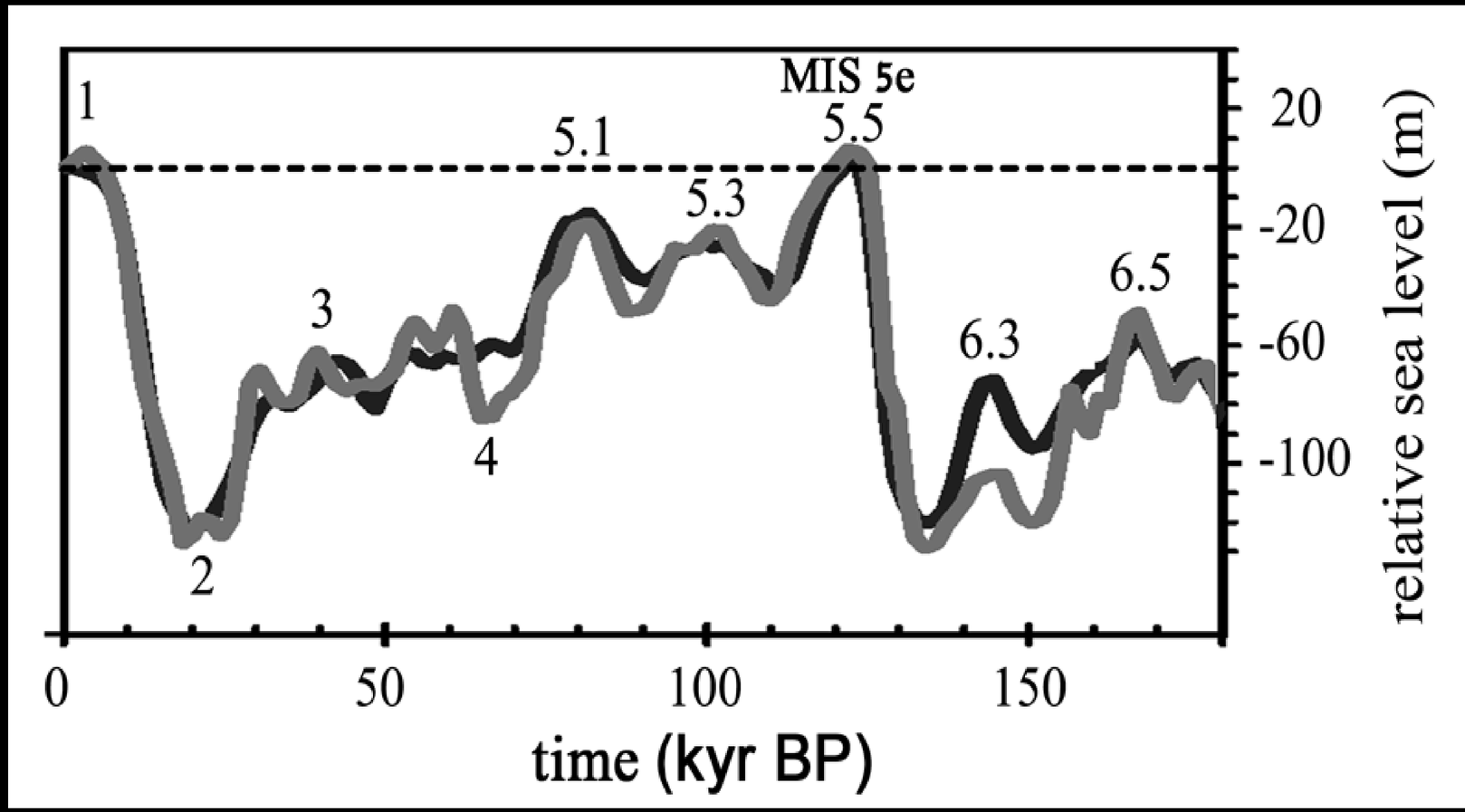
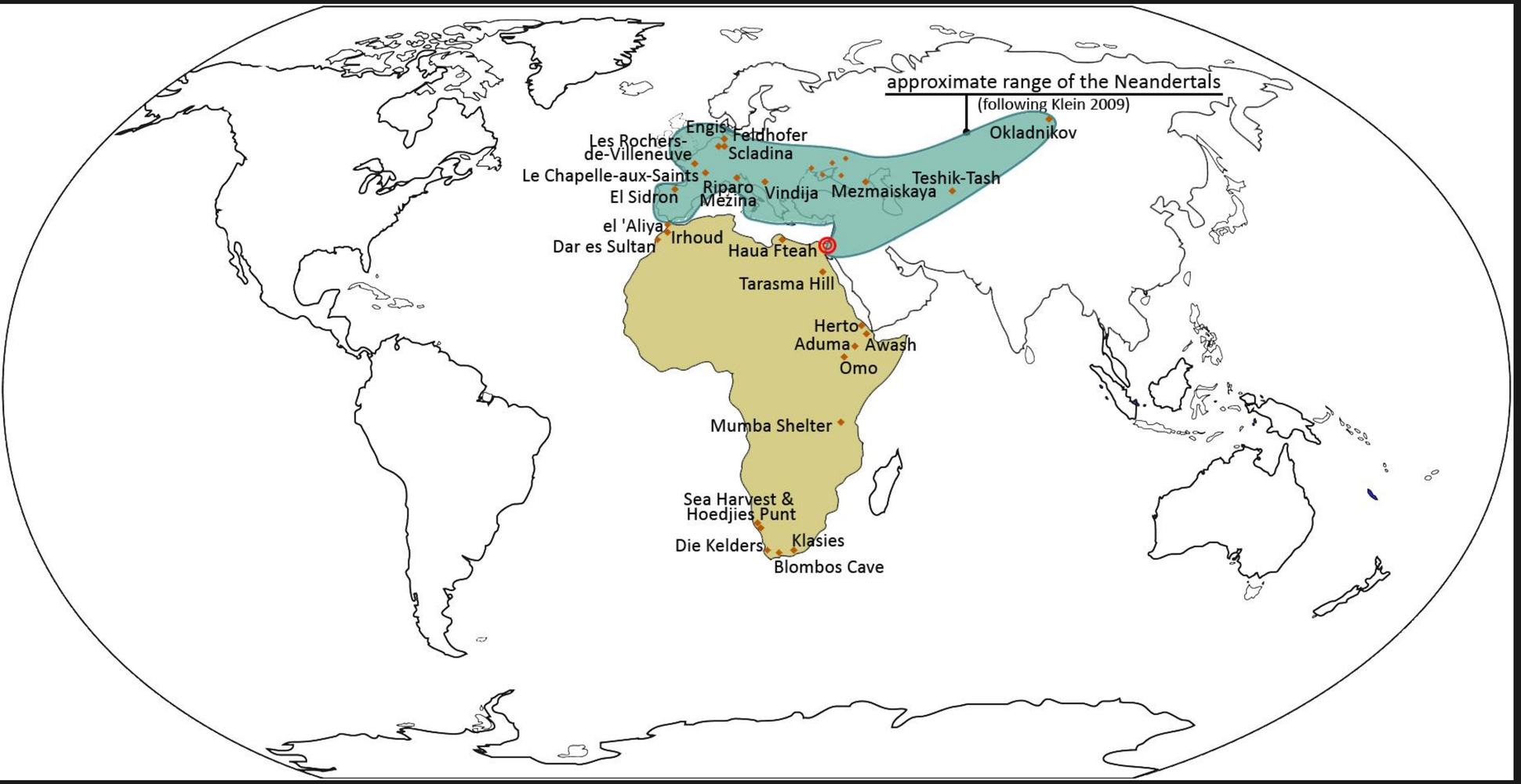
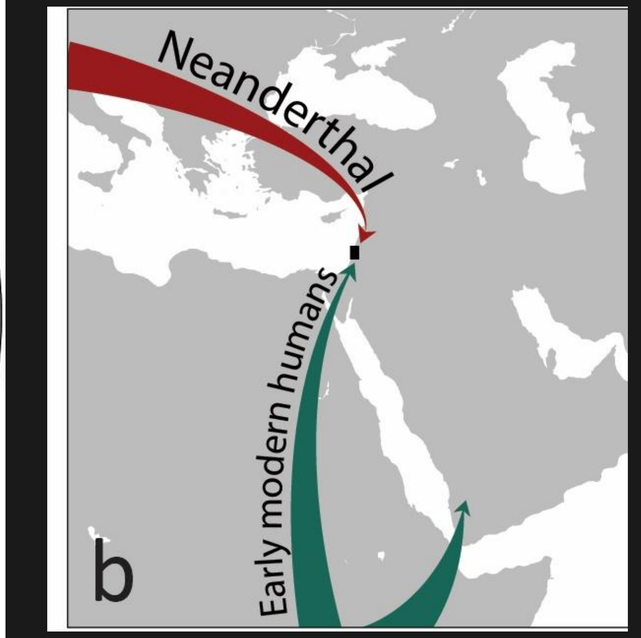
120 mbsl


MIS 5e
1
2
3
4
5.1
5.3
5.5
6.3
6.5
0
50
100
150
time (kyr BP)
20
-20
-60
-100
relative sea level (m)

Mount Carmel: a unique overlap of the Neanderthal and early modern humans ranges, within the same Middle Paleolithic cultural framework





Did they meet ? When? Who was there before? What was the results?

Levantine MP sites

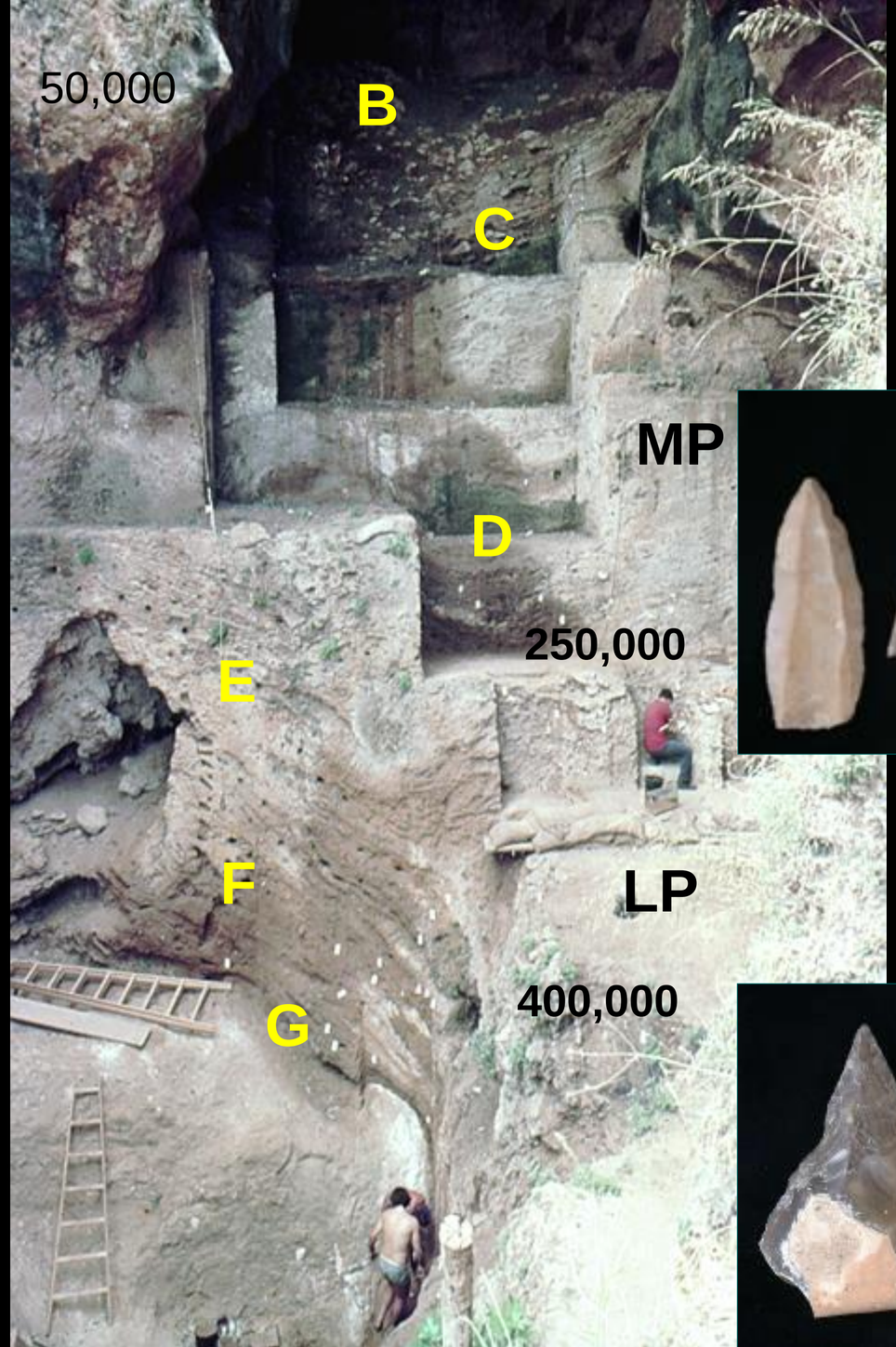
250,000-45,000 YBP

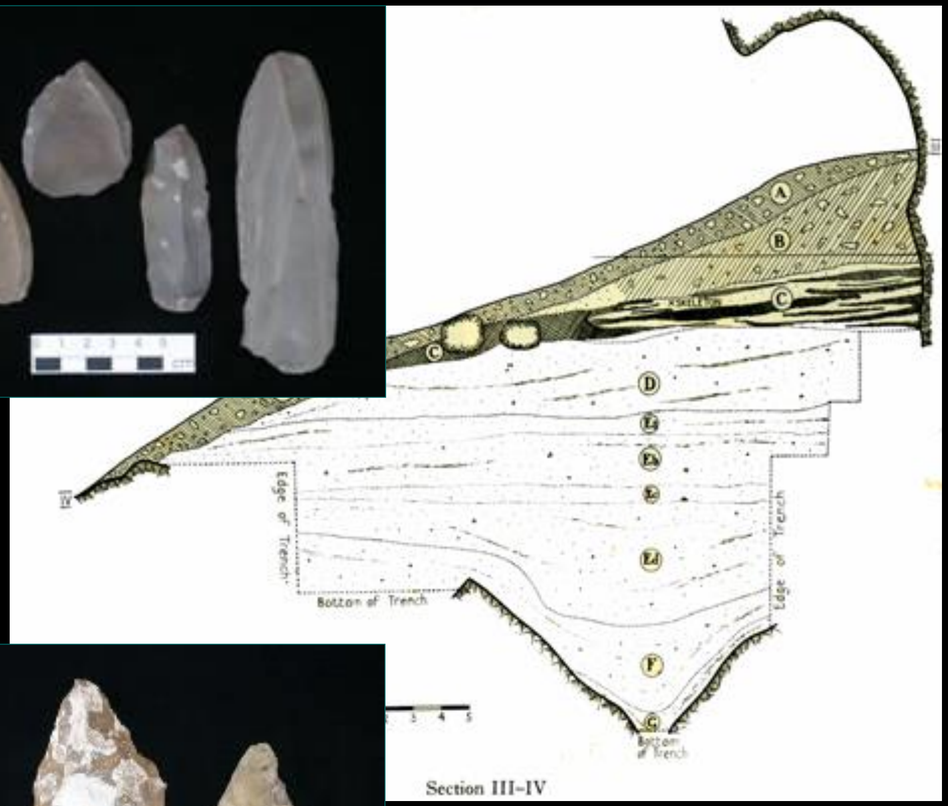
Human remains

140/120-50,000 YBP

***H. sapiens* – 120/90,000 YBP** **Neanderthals – 70/45,000 BP**

Tabun Cave: A long sequence with important Cultural Developments/ Revolutions

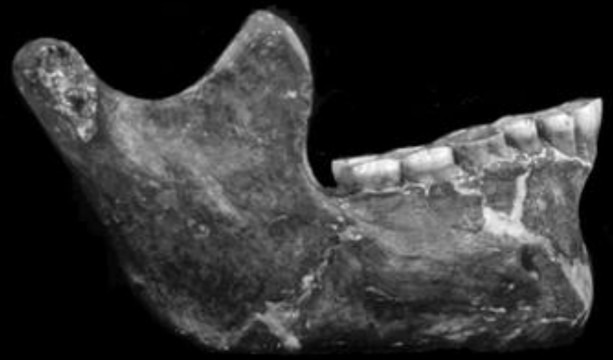




Tabun 1

Upper part of Layer C (or Layer B)

100/120 (150/160 ky)



Tabun 2

Lower part of Layer C

Harvati and Nickolson Lopez 2017

IV

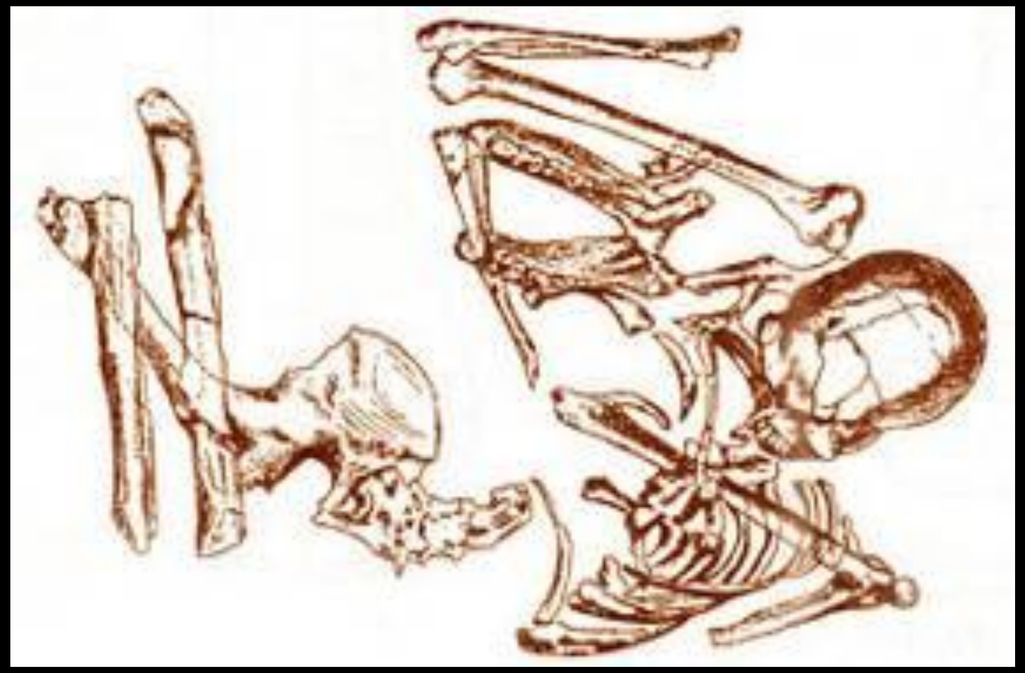
Skhul

Early modern humans

100-135,000 ky

V

Skhul early modern human burials



D’Ericco et al. 2010

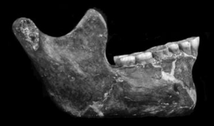
McCown 1937

Nassarius gibbosulus shell beads (Vanhaeren et al. 2006) from Skhul

V

Isotope stage	Ky BP	Entities	TL-based chronology	Hominides
3		Ahmarian	UP	Ksar Akil Qafzeh
4	50	Tabun B type	Amud, Kebara T. Faraj, Quneitra Dederiyeh	Dederiyeh Kebara, Amud Tabun 1 ?
5	100		Qafzeh Skhul Hayonim E	Qafzeh Skhul
6	150	Tabun C type		Tabun II (jaw)
7	200	Tabun D type	Negev sites Hayonim E Misliya	Misliya
8	250			
9	300		Zuttiyeh	Qesem
10	350			Tabun E

TABUN 1 ?



Tabun 1

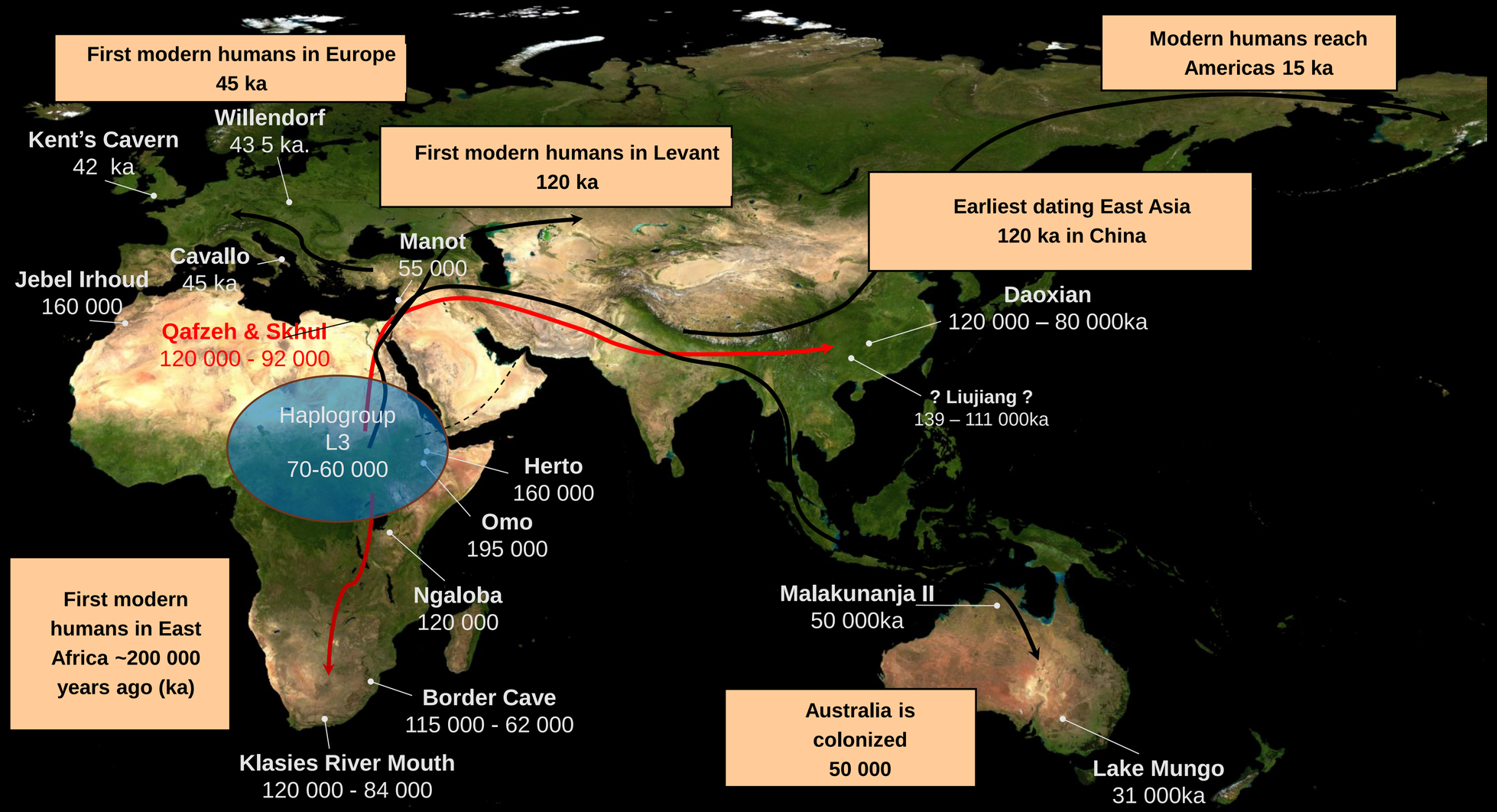
Skhul

Tabun 2

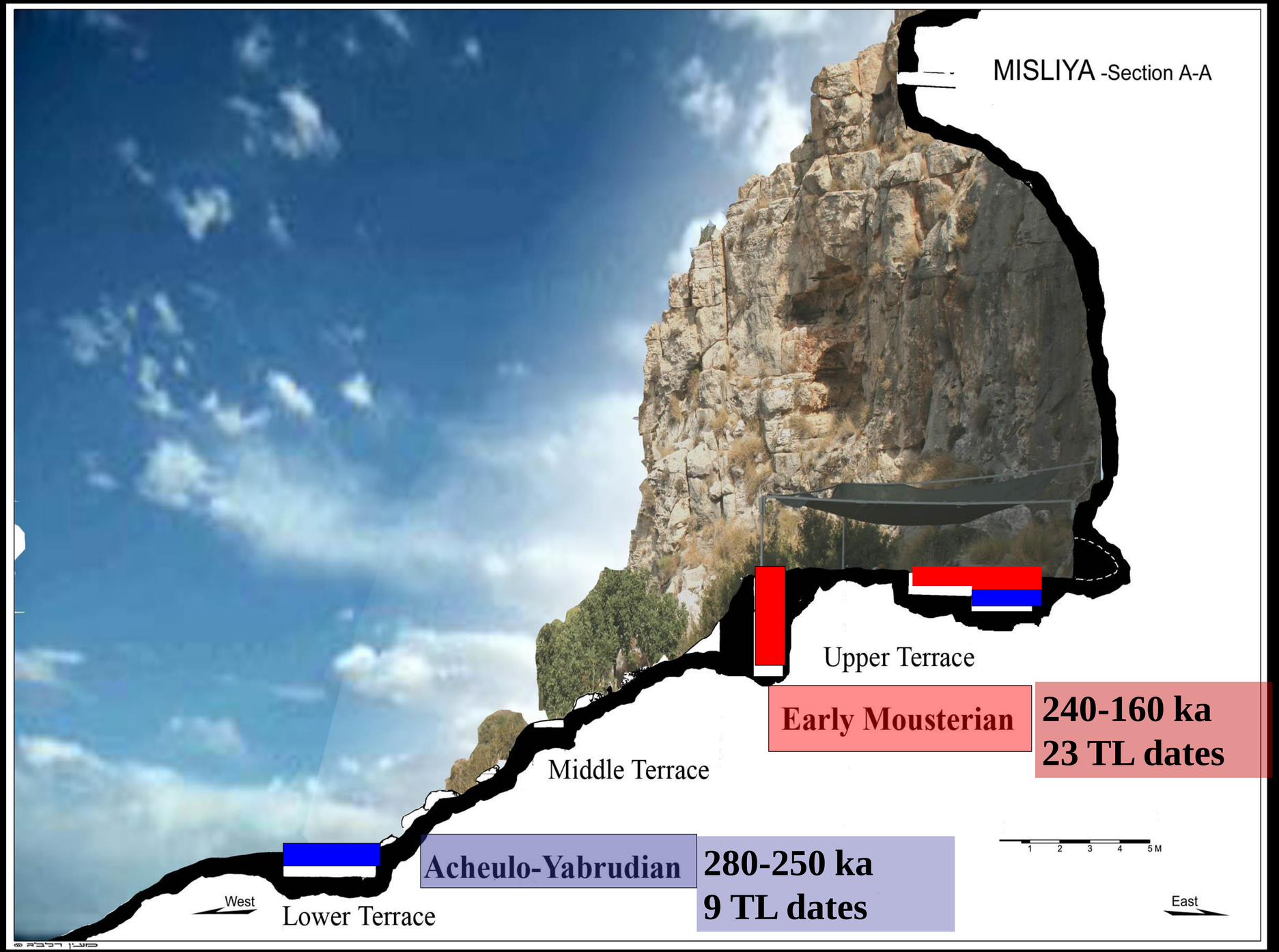
Important implications for understanding the origins of early modern humans and their relationships with the Neanderthals

Bar-Yosef 1998

Dispersal of modern humans 2016

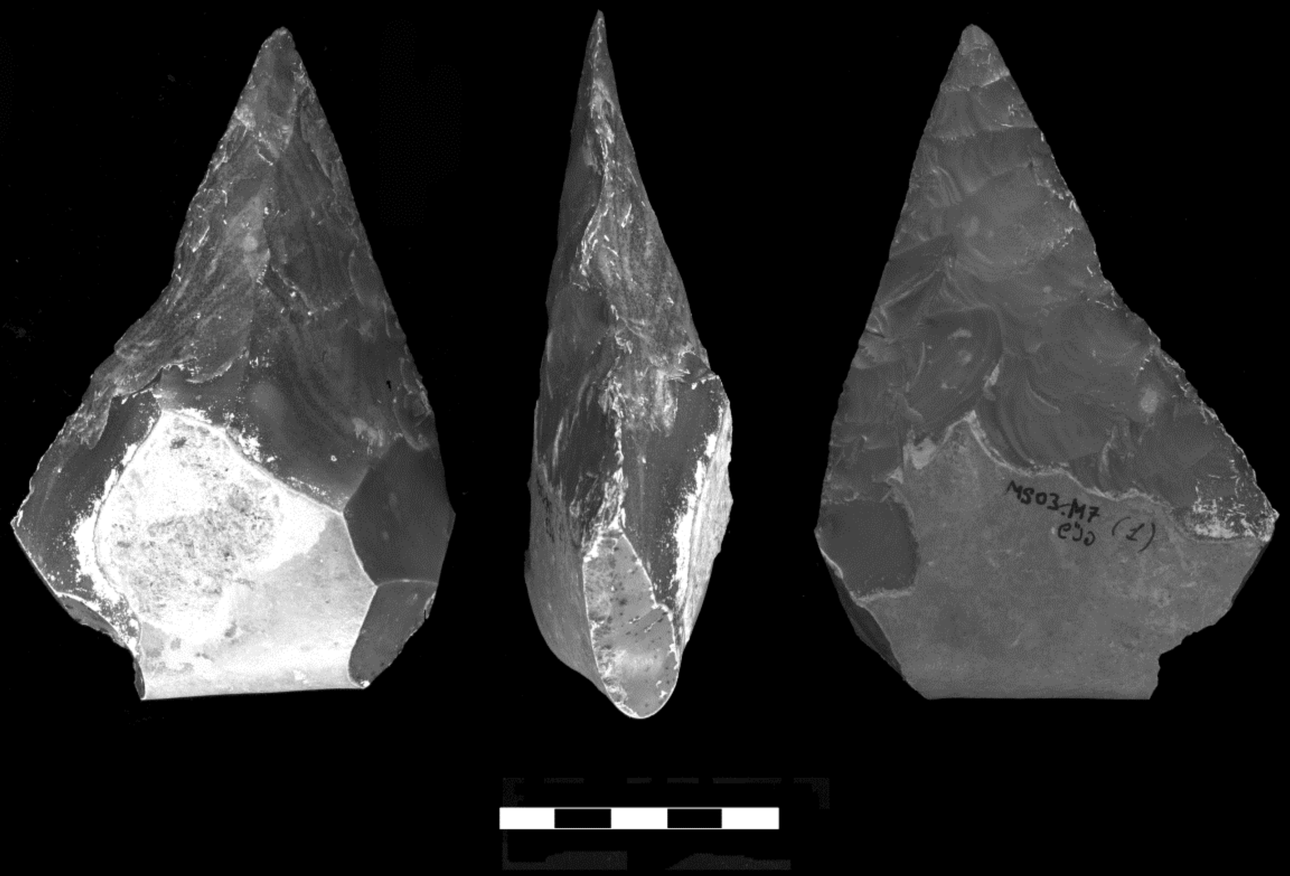


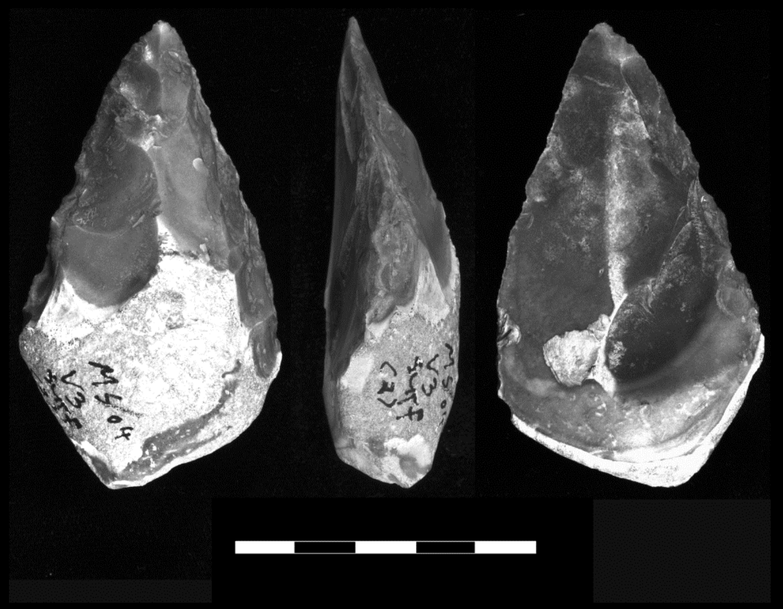

Upper Terrace
Lower Terrace

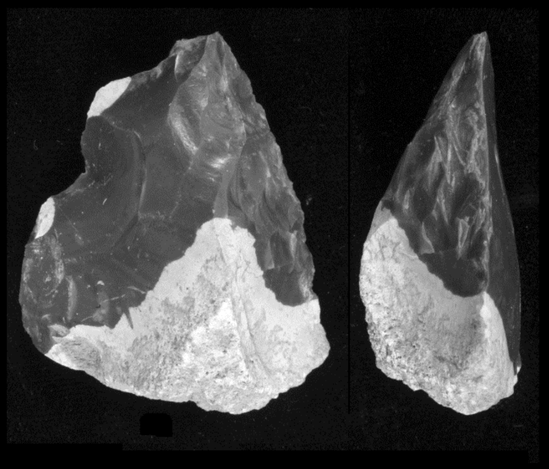

MISLIYA -Section A-A
Upper Terrace
Early Mousterian
240-160 ka
23 TL dates
Middle Terrace
Acheulo-Yabrudian
280-250 ka
9 TL dates
1 2 3 4 5 M
West
Lower Terrace
East

The Yabrudian assemblage

Handaxes and thick (Quina retouch) scrapers (abundant flakes)







UPPER TERRACE – MOUSTERIAN LAYERS

Deep Sounding (4 m)
EMP layers

Breccia

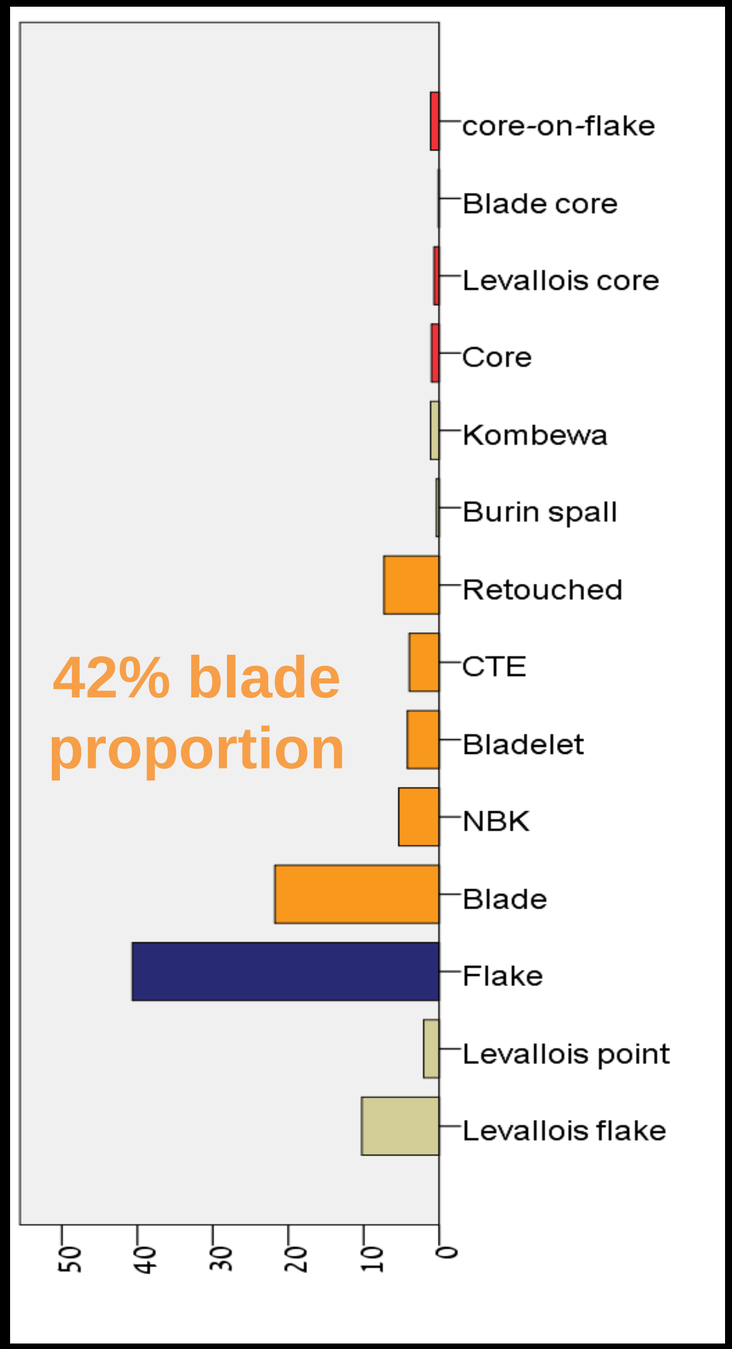
Soft sediments

rock fall

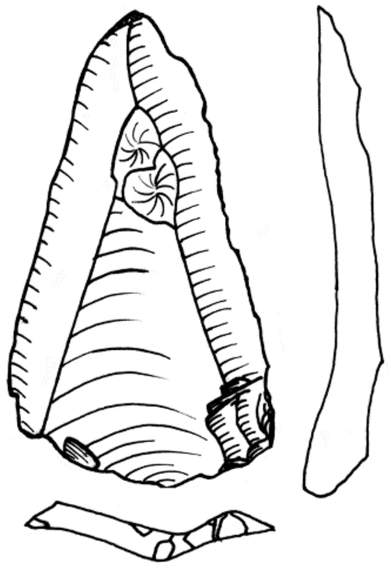

SURFACES
MS 13.8.07
K11 115

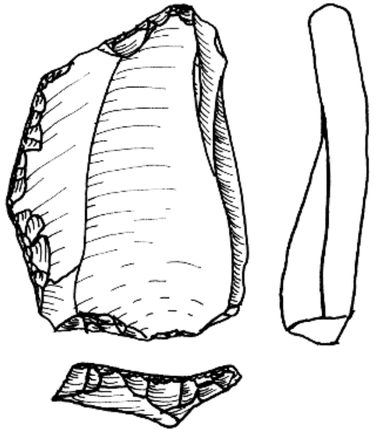
General breakdown

Flake	20315	47.4%
Blade	12620	29.4%
Levallois flake	4350	10.1%
Levallois point	1331	3.1%
CTE	665	1.6%
Burin Spall	121	0.3%
Core	680	1.6%
Retouched tool	2810	6.6%
Total	42892	
Debris	16201	
Chunk	2473	



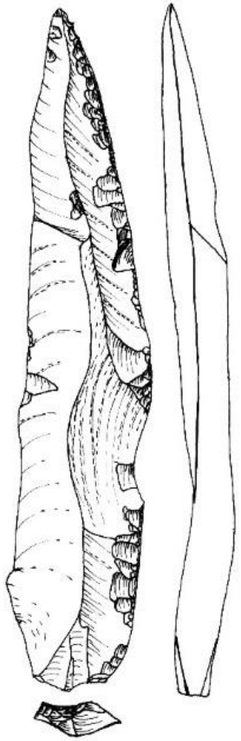
End products





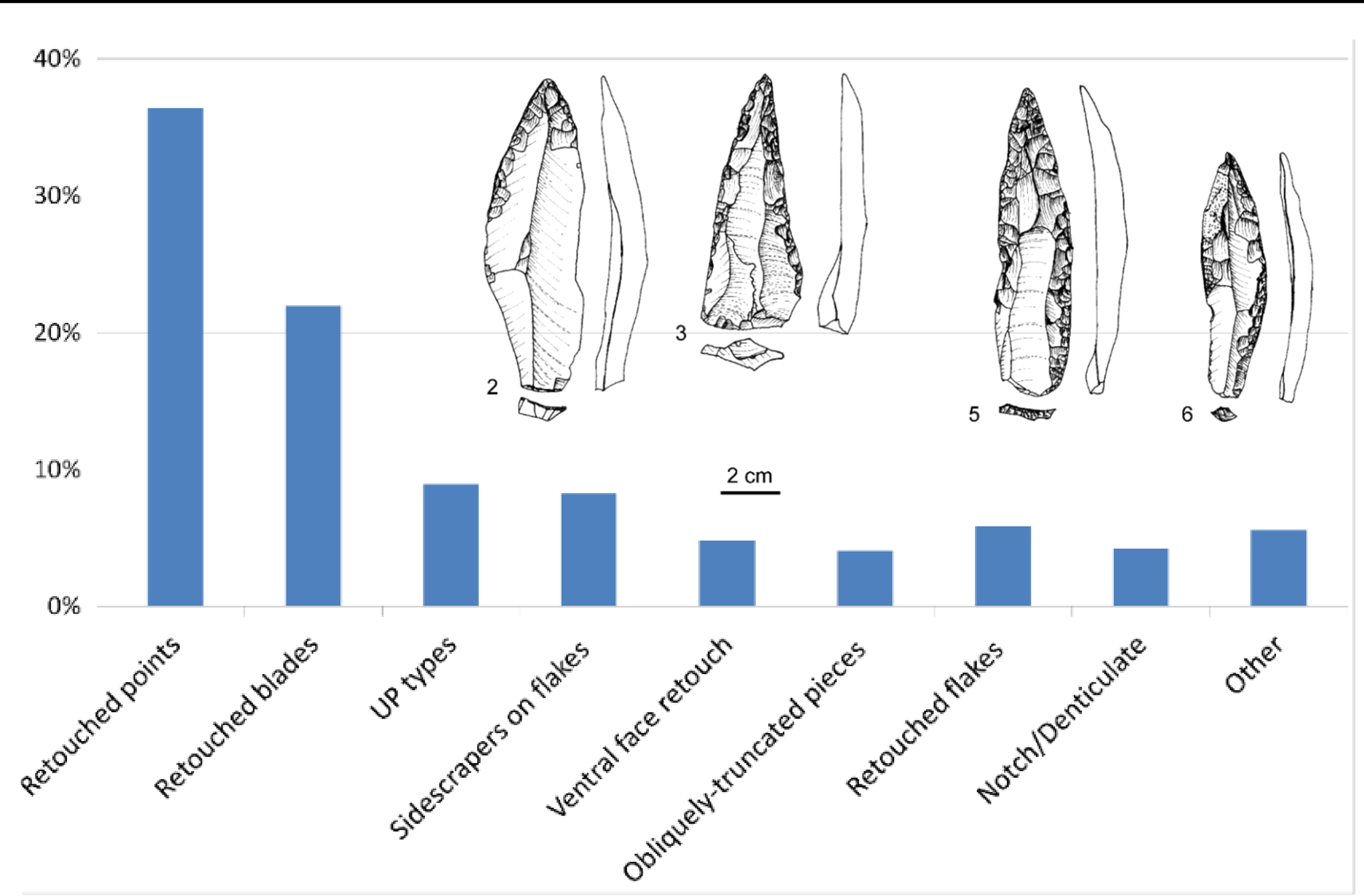
Levallois point

Levallois flake

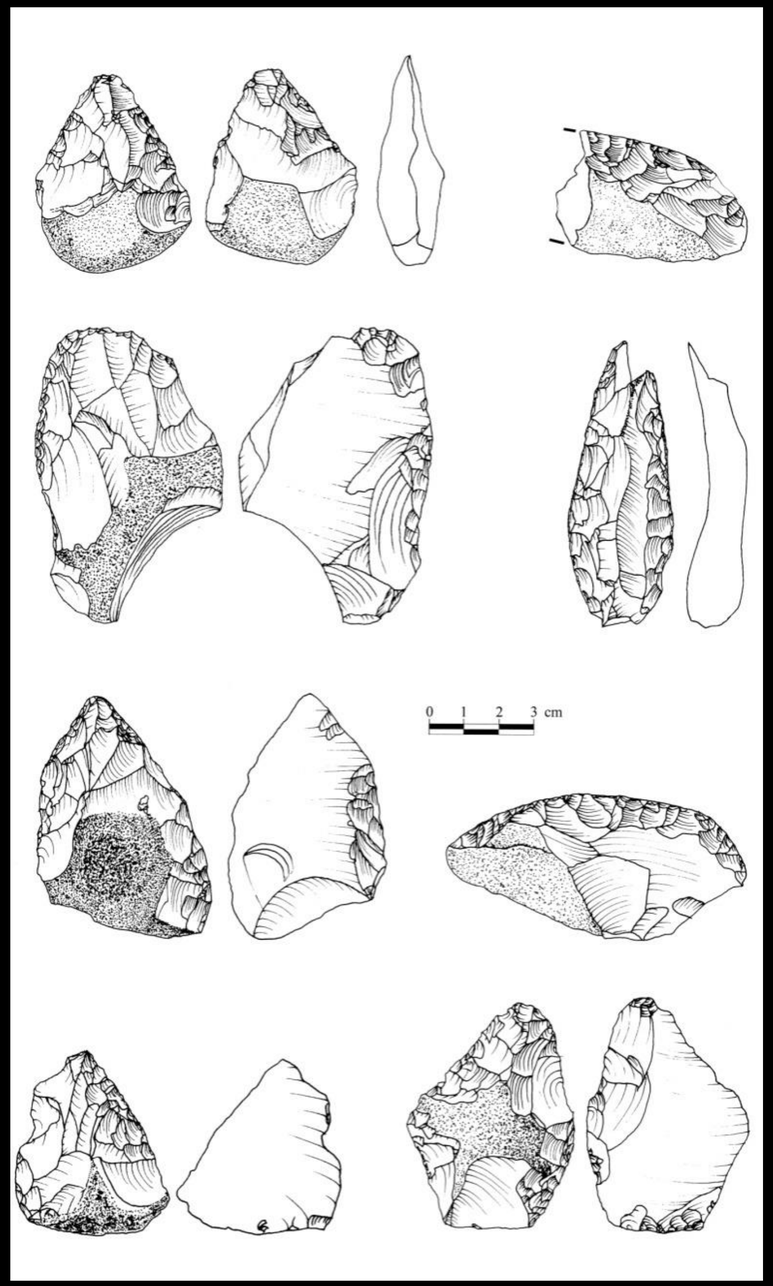


Blades

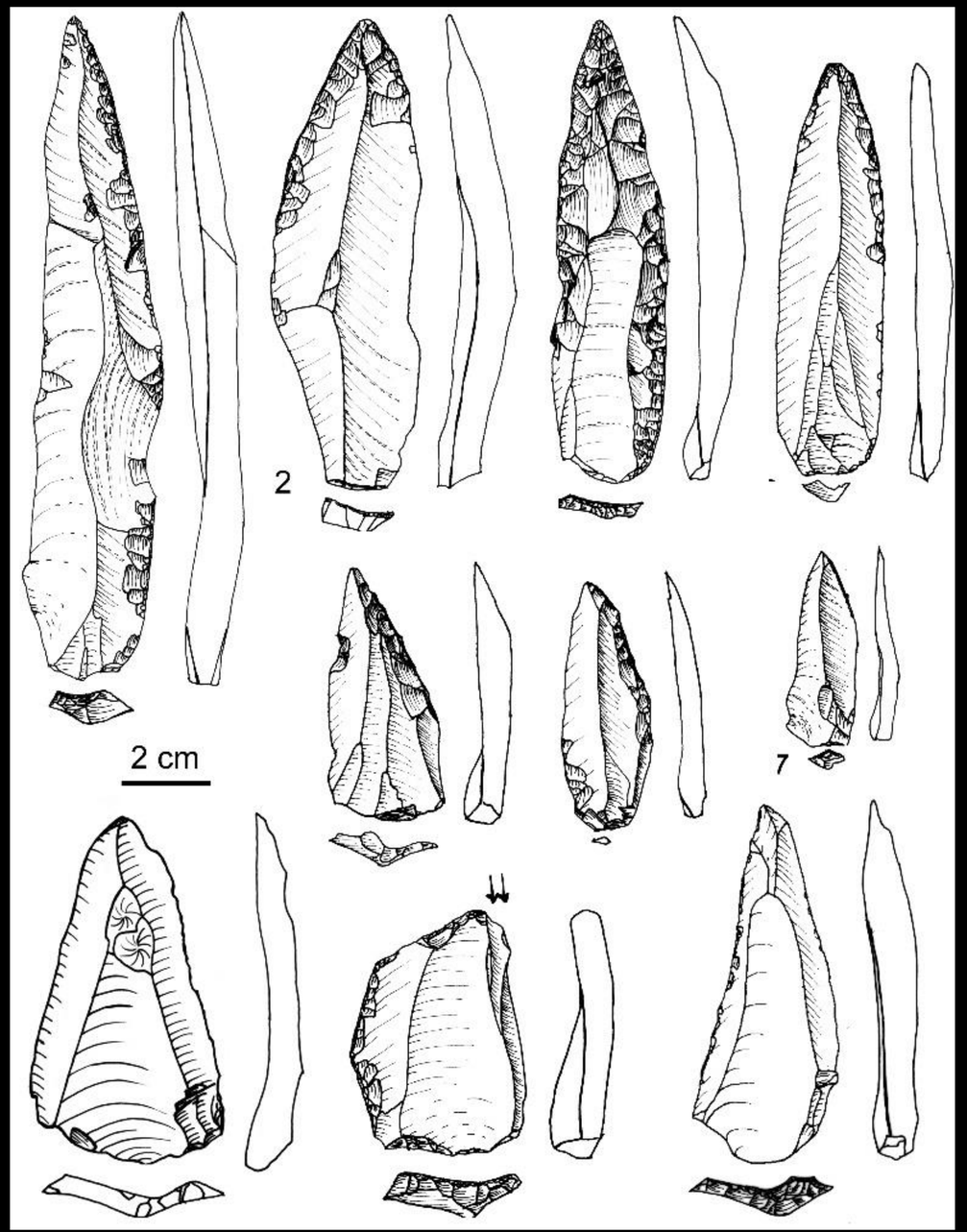
Retouched tools



Acheulo-Yabrudian



Early Levantine Mousterian

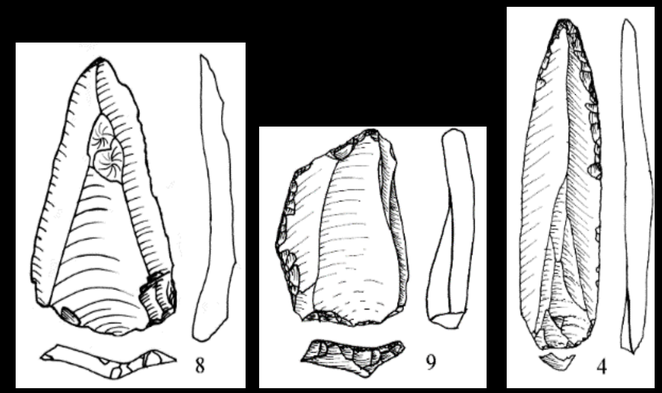


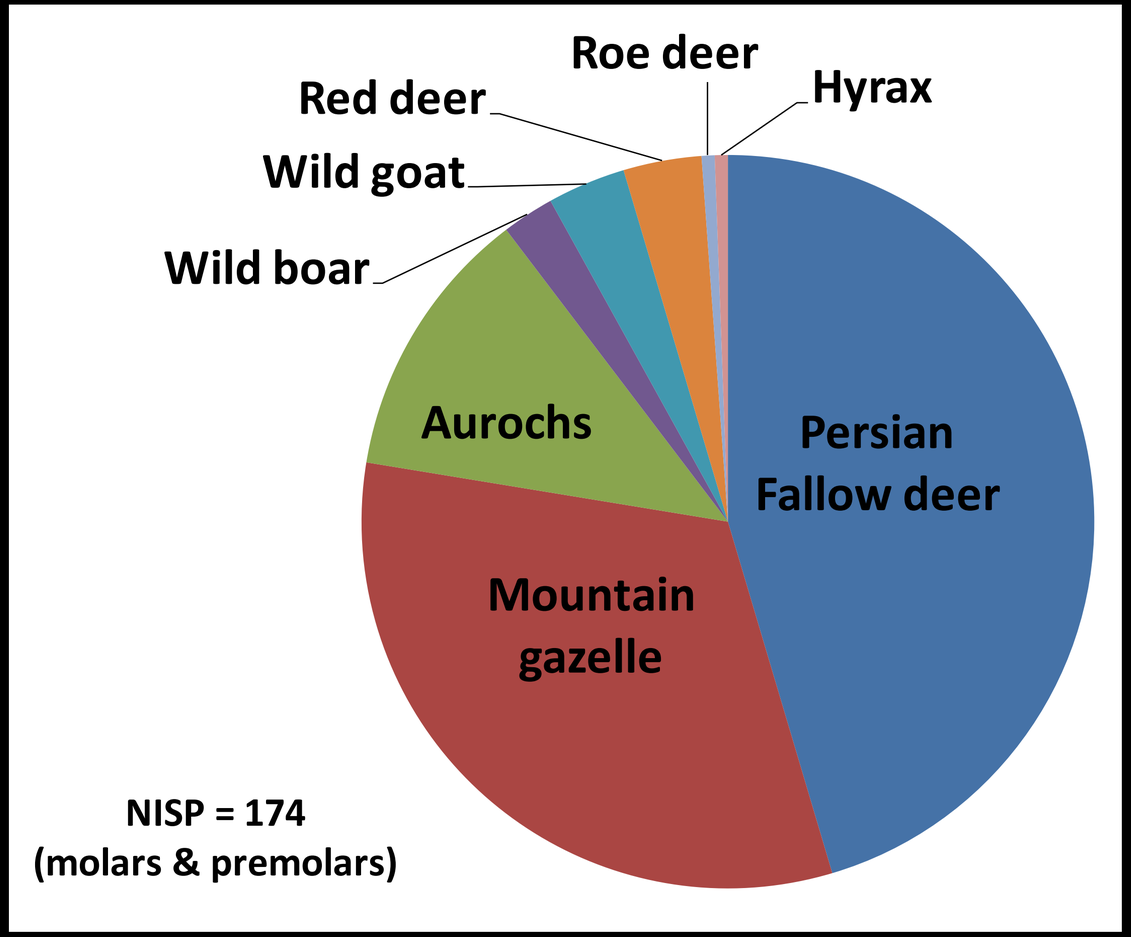
ELM arrived in the Levant as a well-developed technological package

Full-fledged Levallois technology
Laminar technology

- The **diversity in knapping methods** **and** **types of end-products** in the EMP of Misliya Cave is striking in comparison to the preceding Lower Paleolithic and the following Middle Paleolithic sites dated to late MIS 6 and MIS5.

- The production of Levallois points and convergent blades, and the level of core management involved in their production point to a **major conceptual and technological change** in comparison to the preceding Acheulo-Yabrudian and the Acheulian.



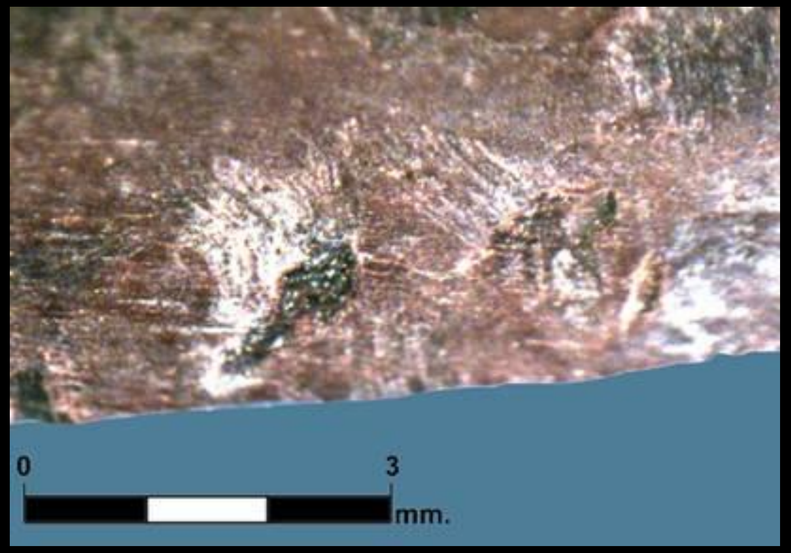


Humans acquired their ungulate prey by active and systematic hunting in various ecological settings in the vicinity of the cave

Yeshurun et al. JHE 2007

Human-inflicted bone surface modifications

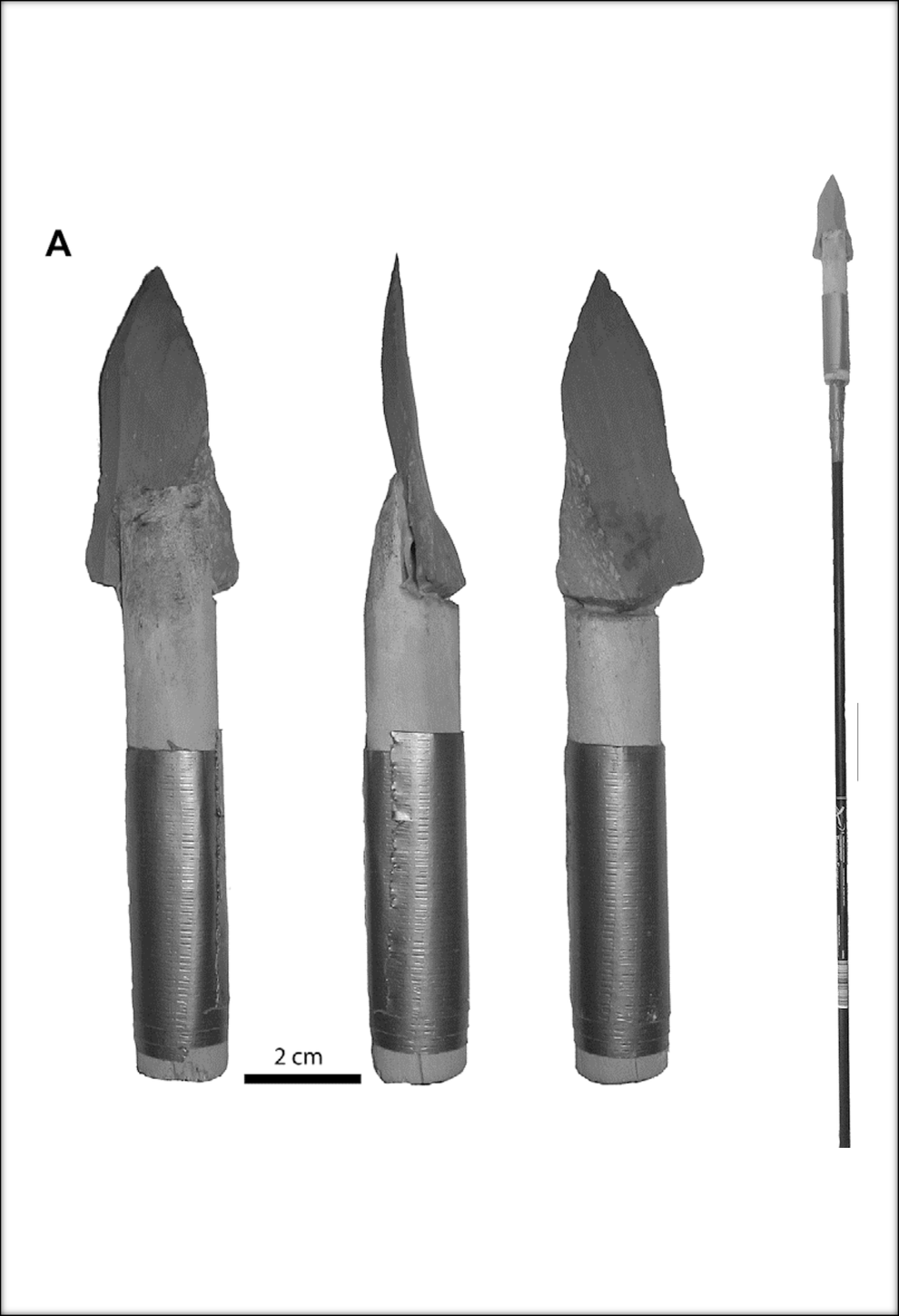
Cut marks



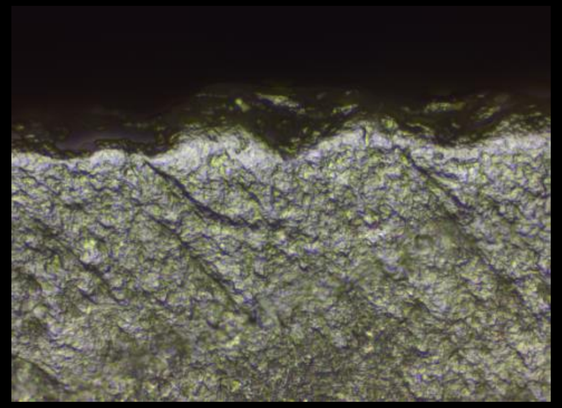
Use of hammer for bone marrow extraction

Dismembering, roasting & marrow extraction

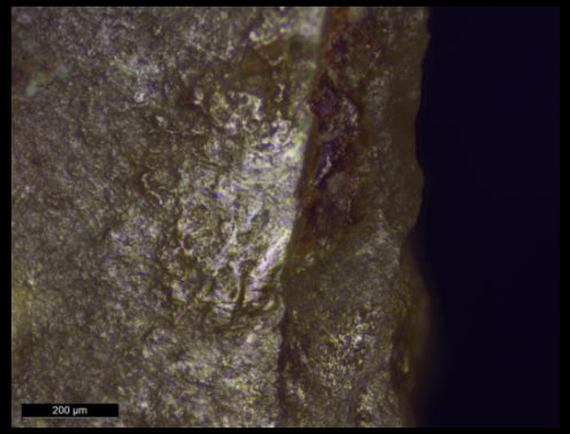
Yaroshevitz et al. 2016



Use-wear traces observed on EMP tools



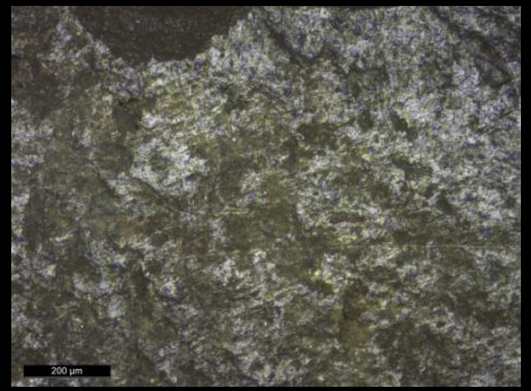
Hide-processing
(original magnification 100x)



Herbaceous plants working
(original magnification 100x)

Herbaceous plants cutting

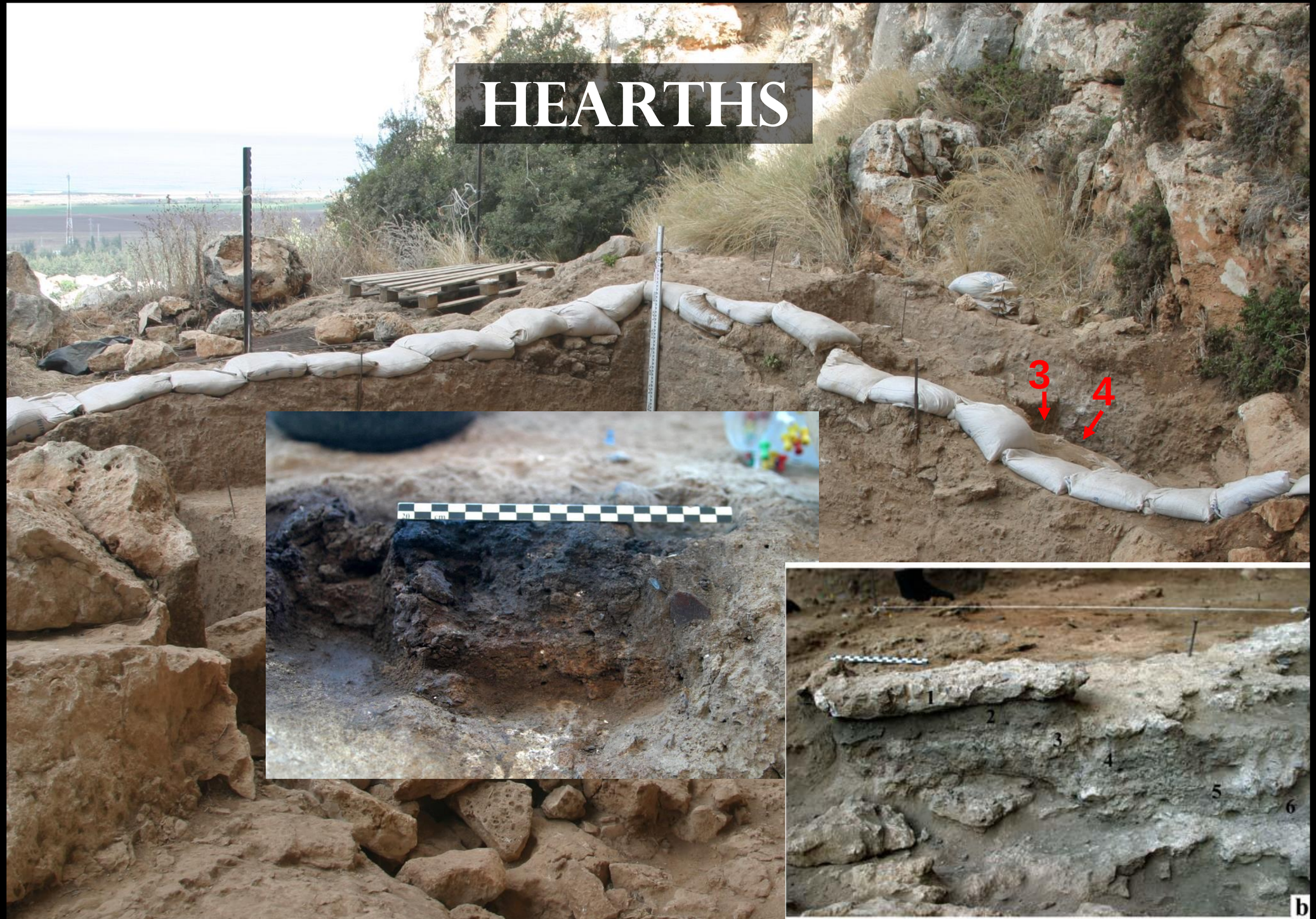
typical edge rounding
(original magnification 20x)

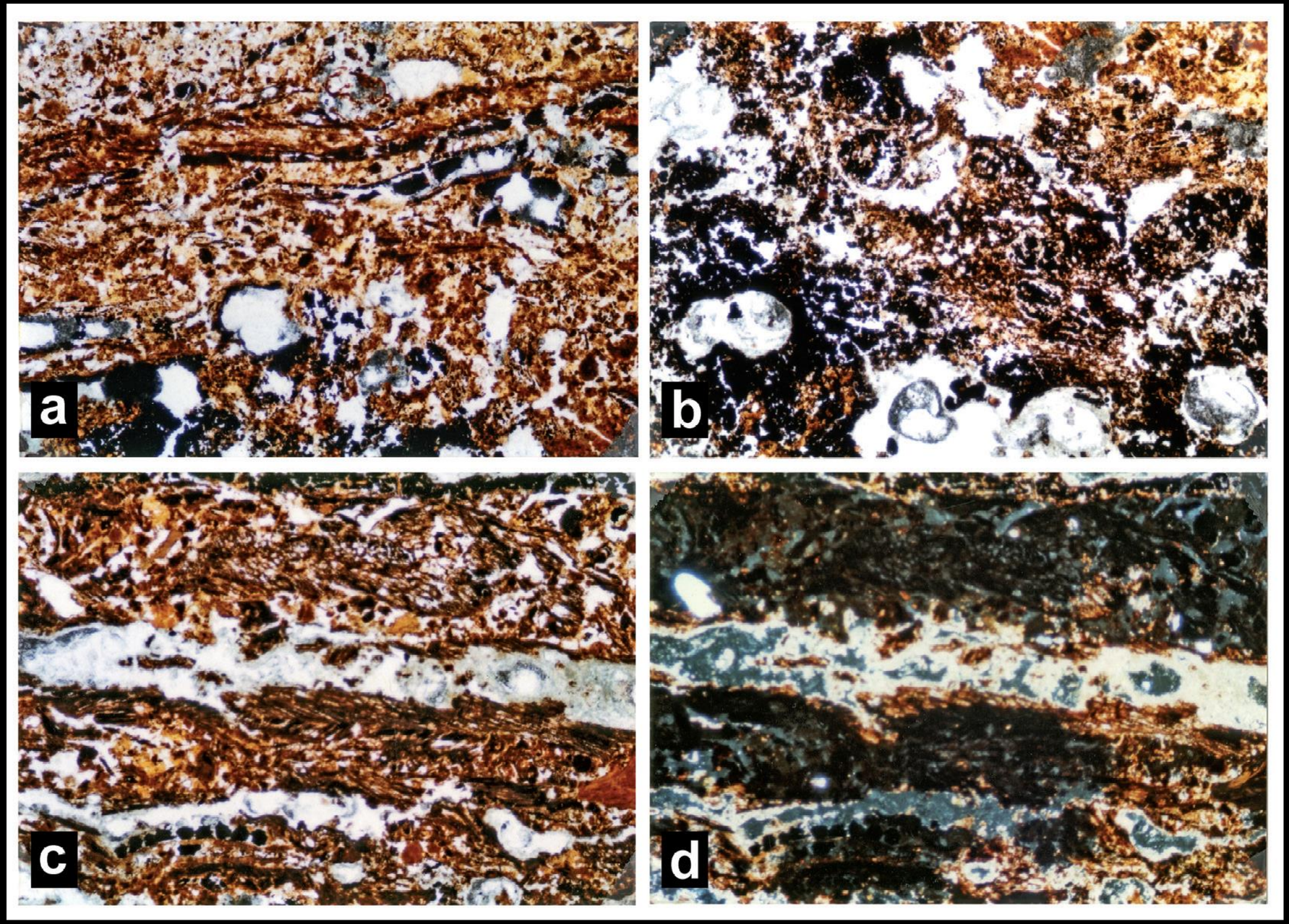


polish
associated
with striations

Groman-Yaroslavsky et al. 2016

HEARTHS





Charred tissues of grass materials (bedding?), Misliya Cave, Mount Carmel

Weinstein-Evron et al. PaleoAnthropoloy 2012

- Size of the lithic and faunal assemblages
- High intensity of occupation
- Repeated construction of hearths
- Distinct recurrent spatial differentiation
- Technological and typological innovation and variability

Repeated visits and low residential mobility already in the Early Levantine MP

- **Who are the people responsible for this wealth of cultural remains?**
- **How can the clear technological break between the LP and MP explained?**

PALEOANTHROPOLOGY

The earliest modern humans outside Africa

Israel Hershkovitz,[1,2]*† Gerhard W. Weber,[3]† Rolf Quam,[4,5,6]† Mathieu Duval,[7,8] Rainer Grün,[7,9] Leslie Kinsley,[9] Avner Ayalon,[10] Miryam Bar-Matthews,[10] Helene Valladas,[11] Norbert Mercier,[12] Juan Luis Arsuaga,[5,13] María Martinón-Torres,[8,14] José María Bermúdez de Castro,[8,14] Cinzia Fornai,[3,15] Laura Martín-Francés,[8,16] Rachel Sarig,[2,17] Hila May,[1,2] Viktoria A. Krenn,[3,15] Viviane Slon,[1] Laura Rodríguez,[5,18,19] Rebeca García,[5,18] Carlos Lorenzo,[20,21] Jose Miguel Carretero,[5,18] Amos Frumkin,[22] Ruth Shahack-Gross,[23] Daniella E. Bar-Yosef Mayer,[24,25] Yaming Cui,[26] Xinzhi Wu,[26] Natan Peled,[27] Iris Groman-Yaroslavski,[28] Lior Weissbrod,[28] Reuven Yeshurun,[28] Alexander Tsatskin,[28] Yossi Zaidner,[28,29] Mina Weinstein-Evron[28]

To date, the earliest modern human fossils found outside of Africa are dated to around 90,000 to 120,000 years ago at the Levantine sites of Skhul and Qafzeh. A maxilla and associated dentition recently discovered at Misliya Cave, Israel, was dated to 177,000 to 194,000 years ago, suggesting that members of the *Homo sapiens* clade left Africa earlier than previously thought. This finding changes our view on modern human dispersal and is consistent with recent genetic studies, which have posited the possibility of an earlier dispersal of *Homo sapiens* around 220,000 years ago. The Misliya maxilla is associated with full-fledged Levallois technology in the Levant, suggesting that the emergence of this technology is linked to the appearance of *Homo sapiens* in the region, as has been documented in Africa.

The timing and routes of modern human migration out of Africa are key issues for understanding the evolution of our own species. The fossil evidence suggests that the earliest members of the *Homo sapiens* clade (Jebel Irhoud, Omo, and Herto) appeared in Africa during the late Middle Pleistocene (*1*–*4*). Outside Africa, modern humans appeared much later, during the Late Pleistocene in the Levant (Qafzeh, Skhul) (*5*–*7*), and possibly in East Asia (Daoxian) (*8*). Misliya Cave, Israel, is part of a complex of prehistoric caves along the western slopes of Mount Carmel (Fig. 1 and fig. S1). Here we report on an adult hominin left hemimaxilla (Misliya-1) (Fig. 2A) found in Square N9 of the upper part of the Early Middle Palaeolithic (EMP) archaeological layer of the site (Stratigraphic Unit 6, Upper Terrace, Fig. 1 and fig. S1), associated with an Early Levantine Mousterian (Tabun D type) stone-tool assemblages (*9*, *10*). Misliya-1 preserves much of the alveolar and zygomatic processes, part of the palate and nasal floor, and the complete left dentition from the first incisor (represented by a broken root only) to the third molar (Fig. 2A).

Three independent numerical dating methods—U-series (U-Th), combined uranium series and electron spin resonance (US-ESR) series, and thermoluminescence (TL)—carried out in three different dating laboratories yielded consistent results (Fig. 2B, figs. S2 and S3, and tables S1 and S3). A series of nine TL dates on burnt flints from Square L10 and N12 in the vicinity of the human fossil (Fig. 1, A and B) provided a mean age of 179 ± 48 thousand years (ky) (2σ) (range = 212 to 140 ky) (*11*). U-Th analyses of the dentine of the I^2 from the maxilla and of the crust adhering directly to the maxilla yielded a minimum age of 70.2 ± 1.6 ky (2σ; table S1) and 185 ± 8.0 ky (2σ; Fig. 2B and table S2), respectively (*9*). The combined US-ESR dating of the enamel of the same tooth yielded a maximum age of 174 ± 20 ky (2σ)

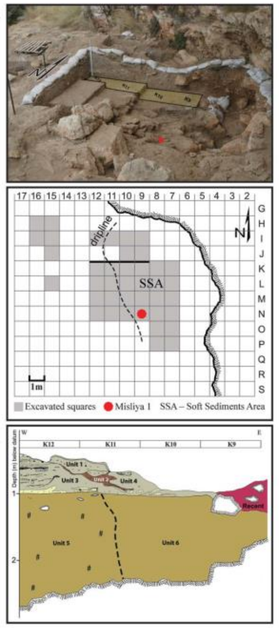


Fig. 1. The Misliya Cave excavation area at the Upper Terrace of the cave and the stratigraphy. (**A**) The excavation area and the location of the Misliya-1 maxilla (red dot). Squares K9 to K12 are indicated. (**B**) Map of the Misliya Cave Upper Terrace excavations (1 m^2 grid) with denoted excavated squares and showing the location of the human maxilla (Misliya-1). (**C**) Stratigraphic section of the Upper Terrace, squares K9 to K12. Apart from Unit 2, a Terra Rosa soil intrusion, all units contain EMP finds or assemblages. The present-day dripline roughly separates between highly cemented (Units 1,3,5) and more loosely cemented (Units 4 and 6) sediments. Misliya-1 was retrieved from the upper part of Unit 6.

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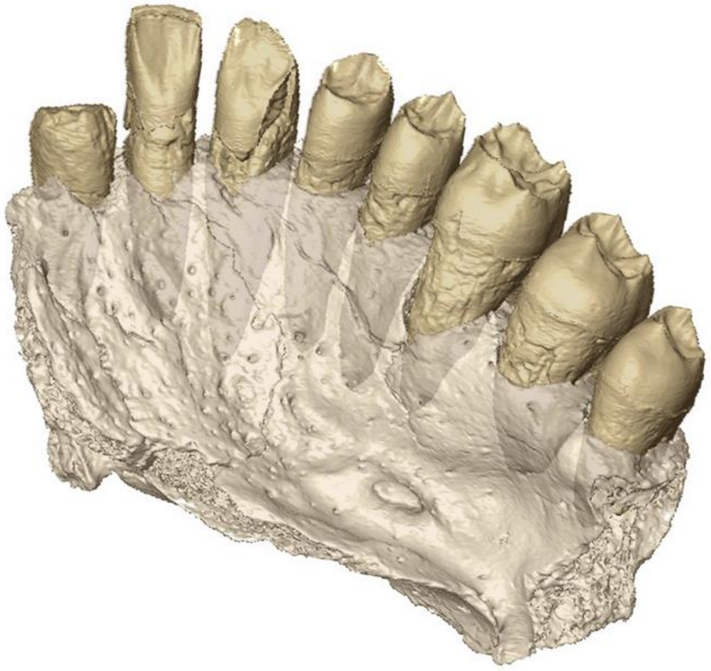
Misliya Cave, Israel

Virtual fossil
Matrix and
enamel
removed

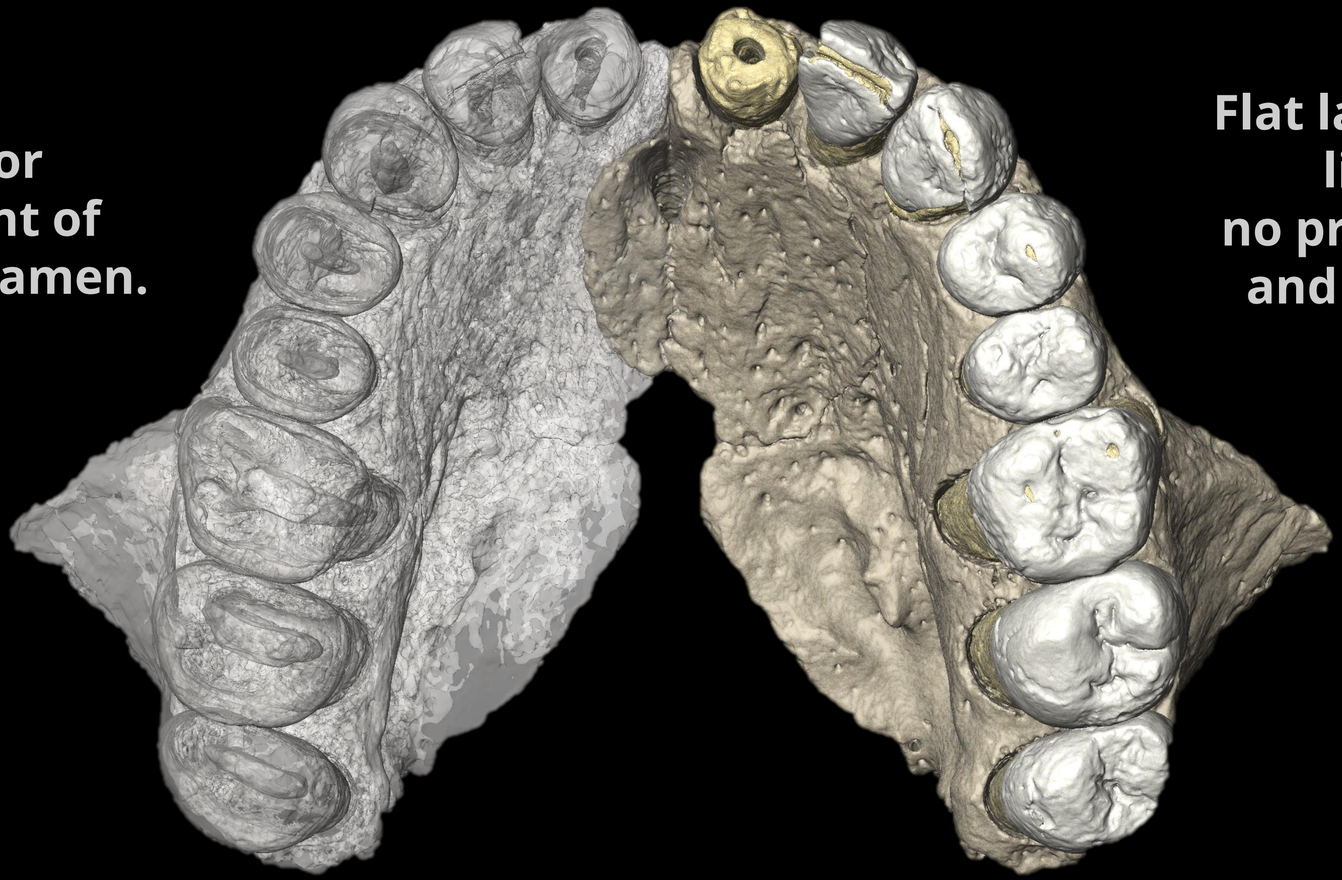


Original
specimen

Hershkovitz et al. 2018

1 cm

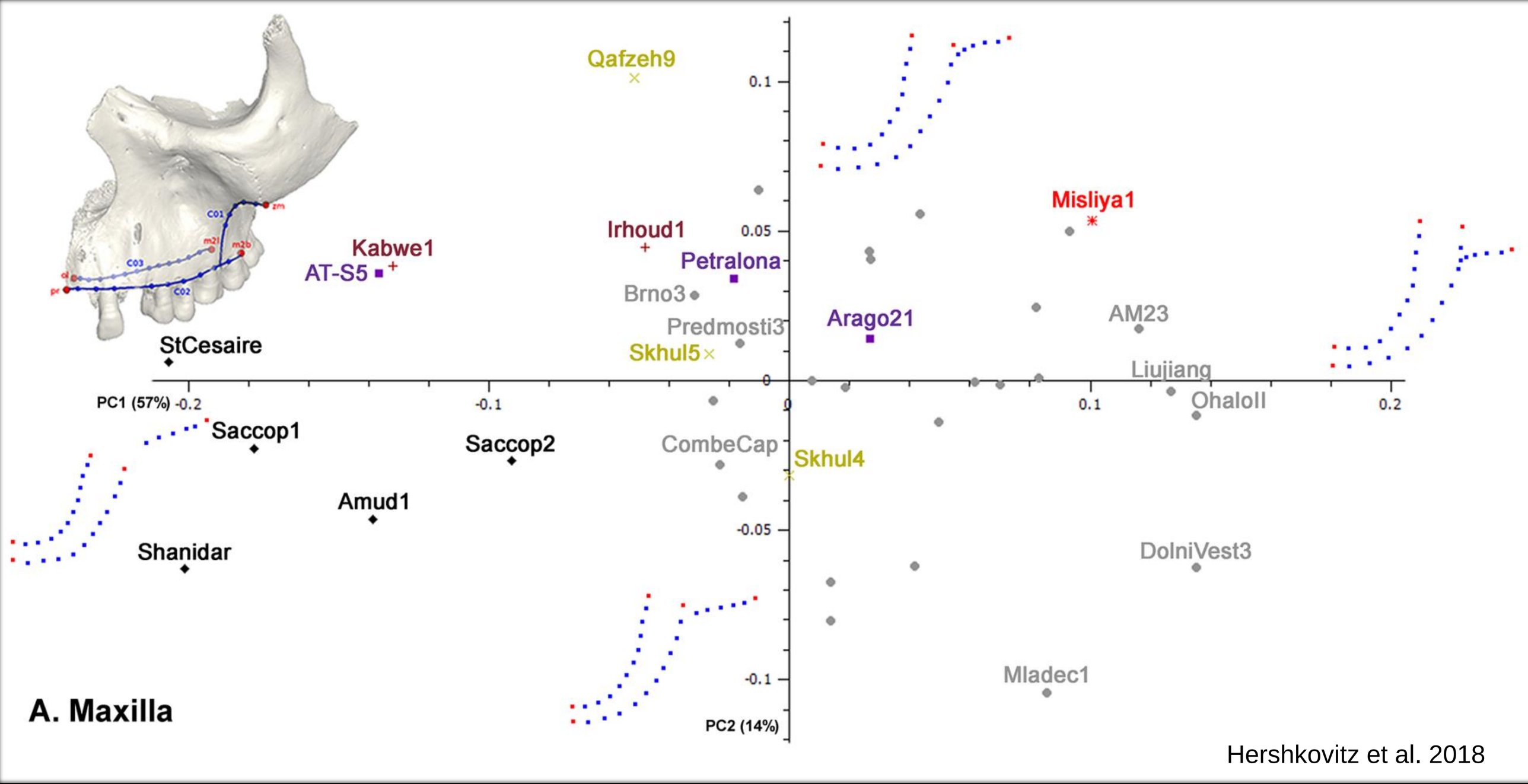
Anterior placement of incisive foramen.



Flat labial surface and lack of lingual tubercle of I^2
no pronounced shovel shape and no lingual tubercle for canine.

Parabolic dental arch, diverging posteriorly
even curvature of front teeth (not straight).

Hershkovitz et al. 2018

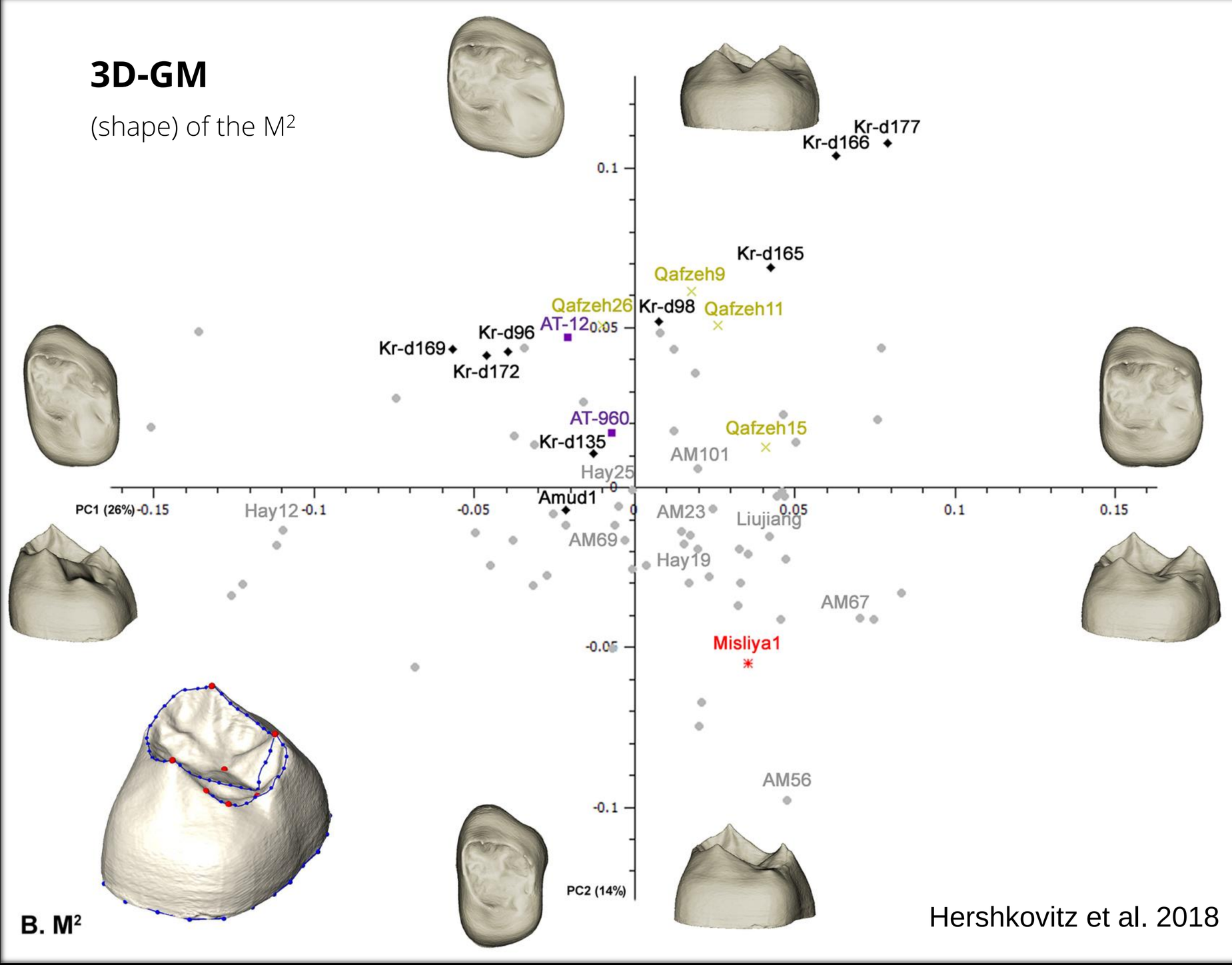


Hershkovitz et al. 2018

Root of the zygomatic arch anteriorly placed (M1), zygomatico-alveolar crest strongly curved, inserting low above dental arch.

3D-GM

(shape) of the M^2



B. M^2

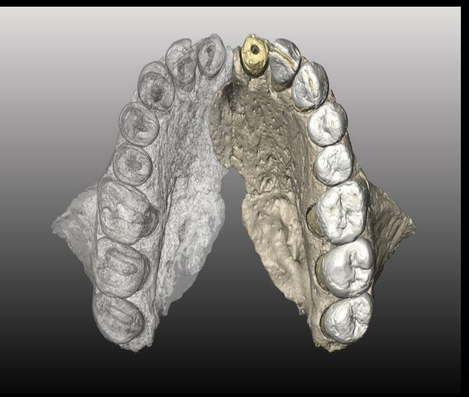
Reduction of the hypocone, rectangular crown base, buccolingually widened.

Hershkovitz et al. 2018

Misliya-1 represents a modern human and is distinct to Neanderthals and Middle Pleistocene specimens from Europe, Africa, and Asia.

Derived from the upper part of the EMP sequence.
EMP dated to 240-160 ky, similar to other EMP sites (Tabun, Hayonim).
Date more constrained with combined US-ESR of I2, altogether averaging around 185 ky.

Miss-Liya



Hershkovitz et al. 2018

Modern human in all anatomical criteria (teeth & maxilla)

Most probably originated from an African population whose exact identity/location still unknown

Corroborated by new aDNA data indicating an out-of-Africa event at least 220,000 ky (Posth et al. 2017)

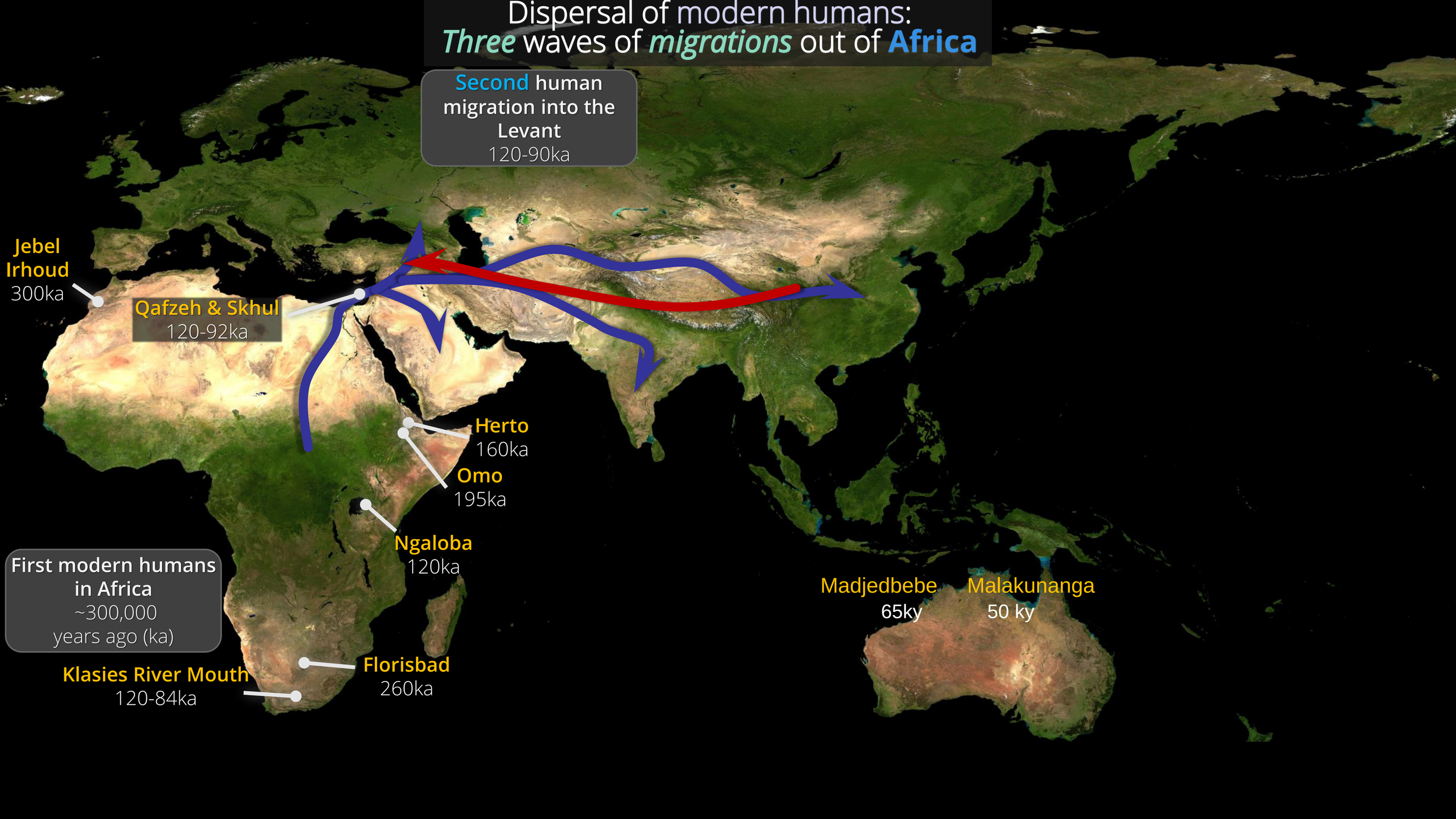
May explain the great variability in later Levantine populations

Its early date may explain modern humans in China 100-120 ky

Supports a northern route of expansion

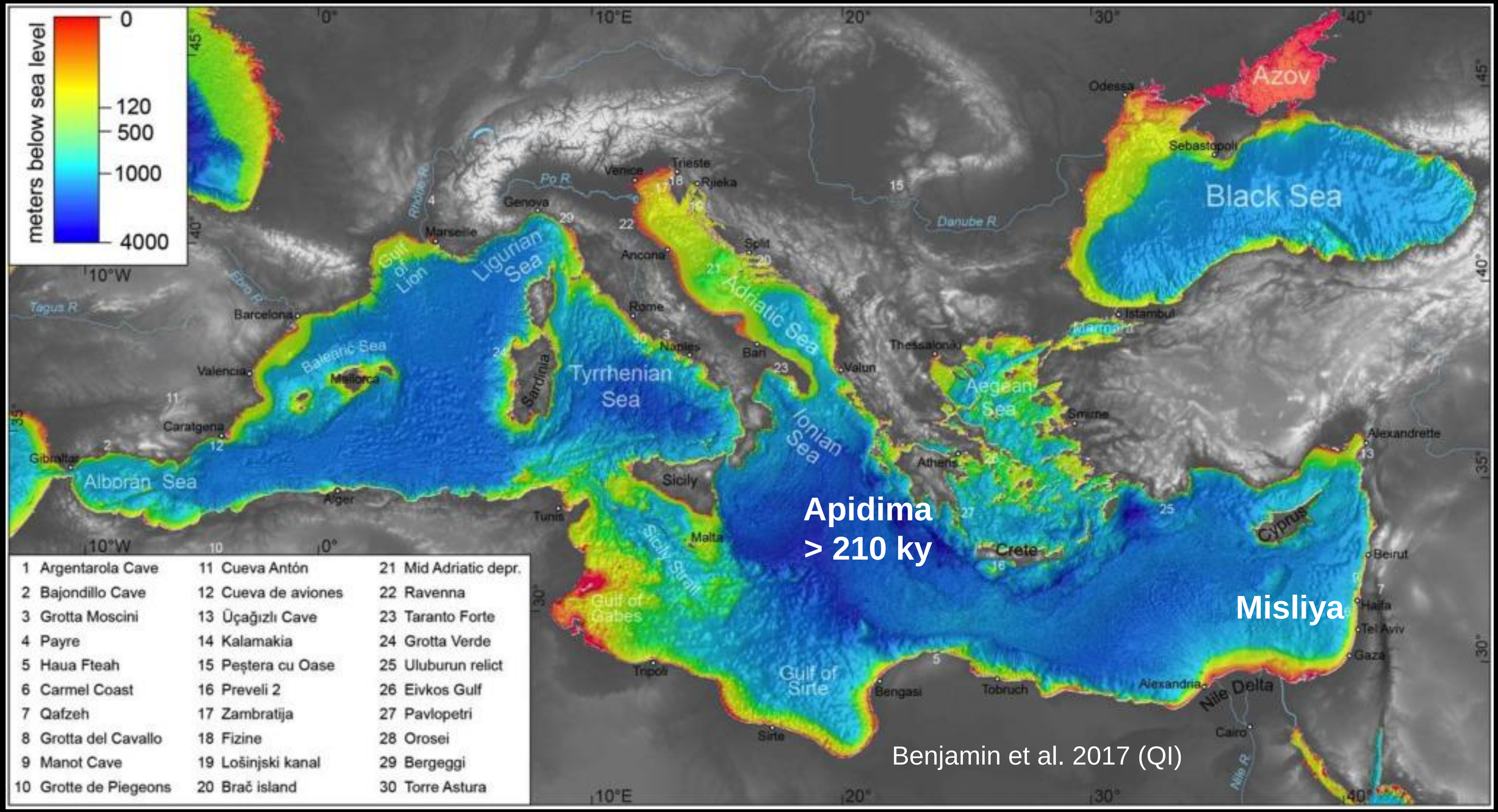
Aditional data
(Africa)

Dispersal of modern humans:
Three waves of *migrations* out of **Africa**


Dispersal of modern humans:
Three waves of migrations out of Africa
Second human migration into the Levant
120-90ka
Jebel Irhoud
300ka
Qafzeh & Skhul
120-92ka
Herto
160ka
Omo
195ka
Ngaloba
120ka
First modern humans in Africa
~300,000 years ago (ka)
Florisbad
260ka
Klasies River Mouth
120-84ka
Madjedbebe
65ky
Malakunanga
50 ky


Dispersal of modern humans:
Three waves of migrations out of Africa
First modern humans in Europe
45ka
Willendorf
43.5ka
Third human migration into the Levant
90-70k
Ust-Ishim
45ka
Kent's Cavern
42ka
Cavallo
45ka
Jebel Irhoud
300ka
Manot
55ka
Aduma
90-70ka
Herto
160ka
Omo
195ka
Ngaloba
120ka
First modern humans in Africa
~300,000 years ago (ka)
Madjedbebe
65ka
Australia is colonized
65ka
Florisbad
260ka
Klasies River Mouth
120-84ka

Apidima Cave - a wider eastern Mediterranean phenomenon



Benjamin et al. 2017 (QI)

Human timeline in the Levant

Alternating occupations of the Levant on the part of Neanderthals and *H. sapiens*.

First Replacement

Second Replacement

Third Replacement

Fourth Replacement

Fifth Replacement

300 — 240 — Apidima **1** & **2** — 170 — 120 — 80 — 55 ka

Qesem

Zuttiyeh

Pre-Neanderthals

Misliya

Tabun

Skhul

Qafzeh

Amud

Kebara

E. Neanderthals

Manot

Jebel Irhoud

Florisbad

Eliye Springs

Omo

Herto

Ngaloba

Klasies River

Daoxian

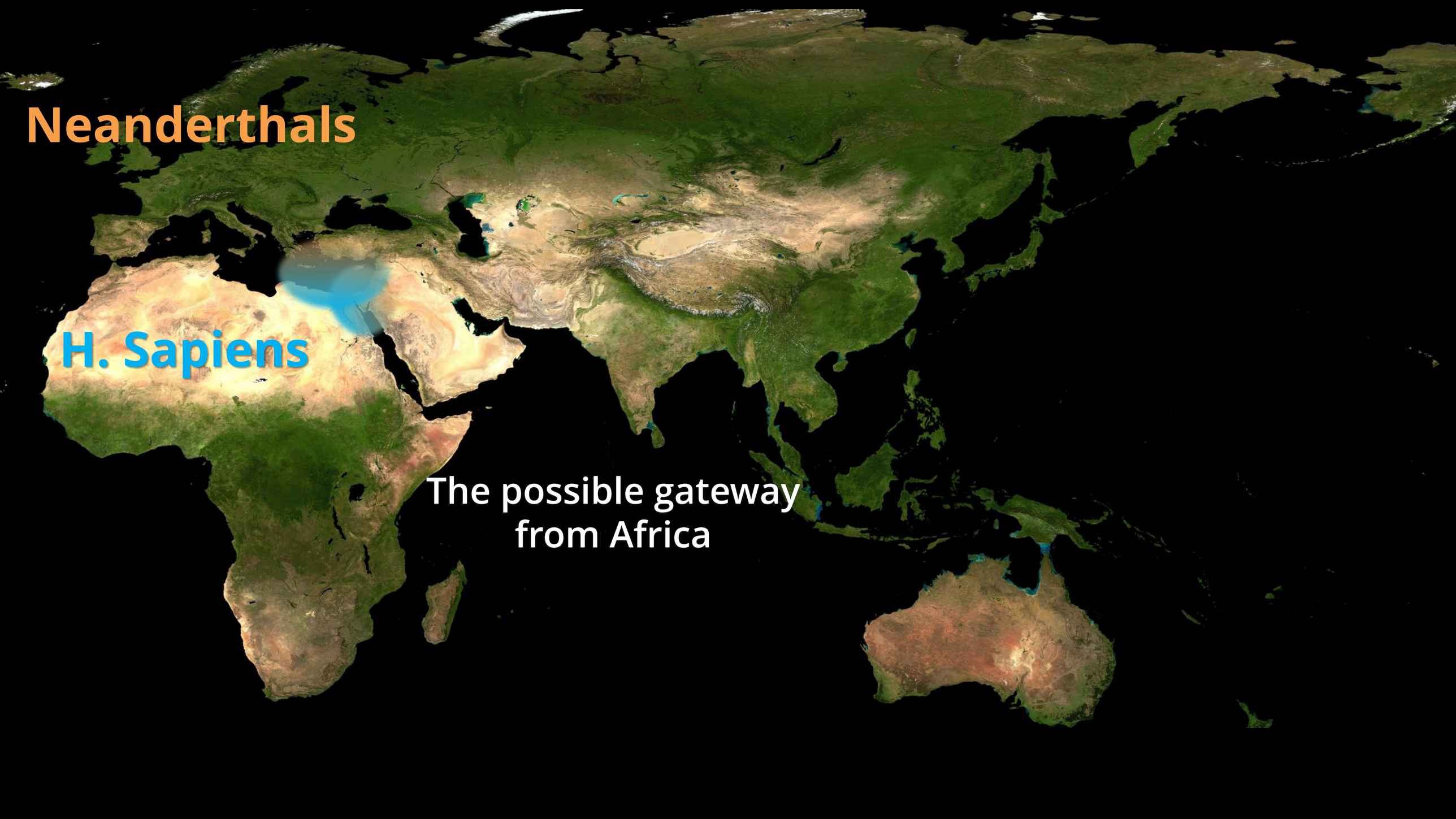
Liujiang ?

Ust-Ishim

Cavallo

Kent's Cavern

Willendorf


Neanderthals
H. Sapiens
The possible gateway
from Africa

After Misliya? A new look at Tabun 2 (160 ky)

“Our results do not indicate a clear affinity of Tabun C2 with either Neanderthals or early modern humans, and therefore do not support assignment to either taxon. Rather, our findings point to similarity of Tabun C2 with geologically older specimens, and suggest that the large size of the specimen may be a contributing factor to its archaic morphology … Tabun C2 may retain a primitive overall mandibular shape … consistent with its proposed great geological age. Our findings also suggest a possible presence of a third taxon in this region during the later part of the middle Pleistocene”.

Harvati and Nicholson Lopez 2017 (Tilier 2005; Belfer-Cohen and Arensburg 1998; Garrod)

What happens after Misliya?

The Qafzeh and Skhul hominins: who they are?

135-90 ka

Qafzeh 9

Qafzeh 6

Skhul V

Large variation among Qafzeh individuals alsin the teeth (Q9 vs. Q11)

The Amud Cave hominins: who they are?

70-50 ka

Missing Neanderthal traits:

- Suprainiac fossa
- "En bombe" highly convex cranial shape
- Occipital bun

Amud 1 individual presents mosaic pattern of both modern humans and Neanderthal traits.

Mixing of Misliya with former populations and new dispersals

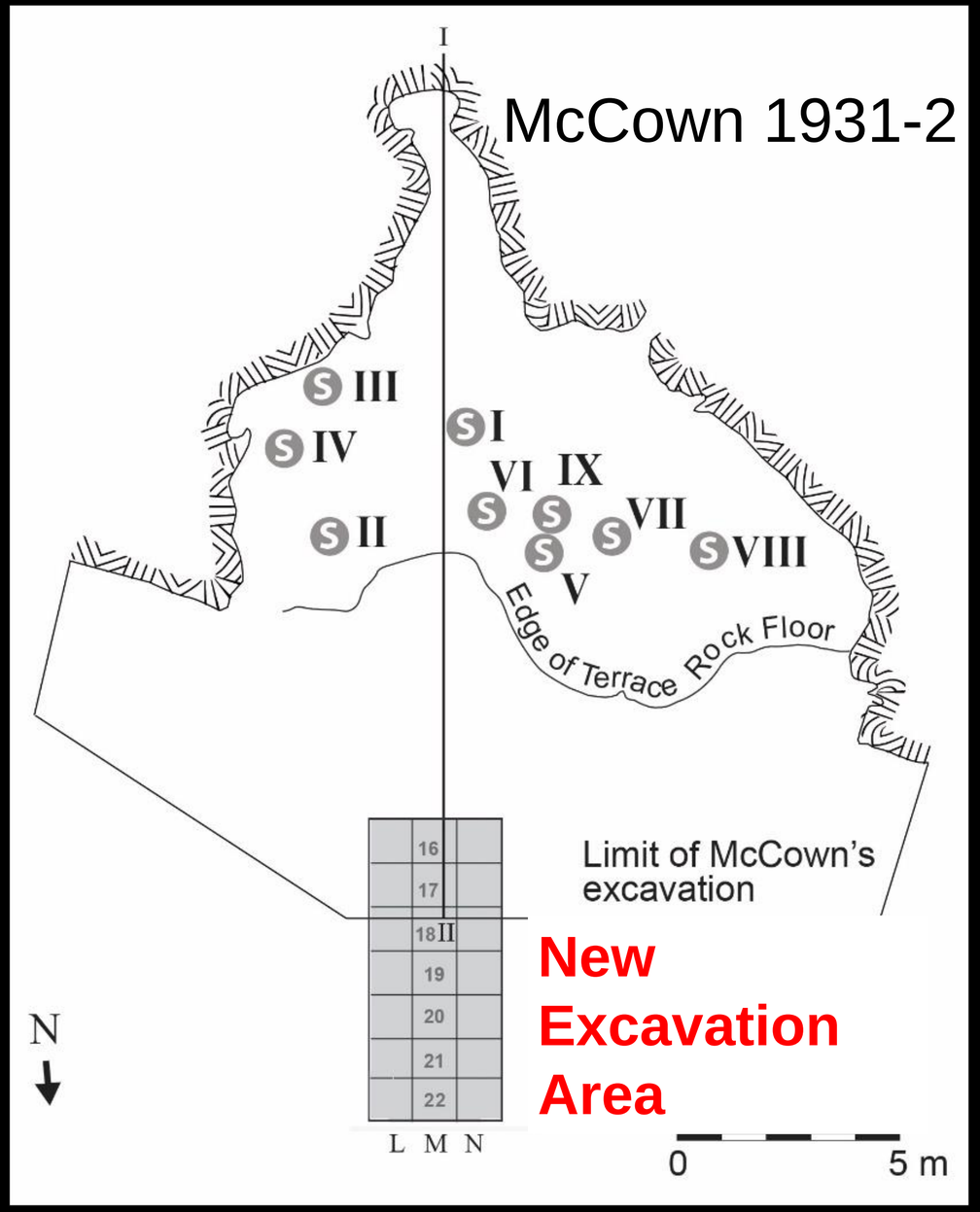

B
C
D
E
F
G

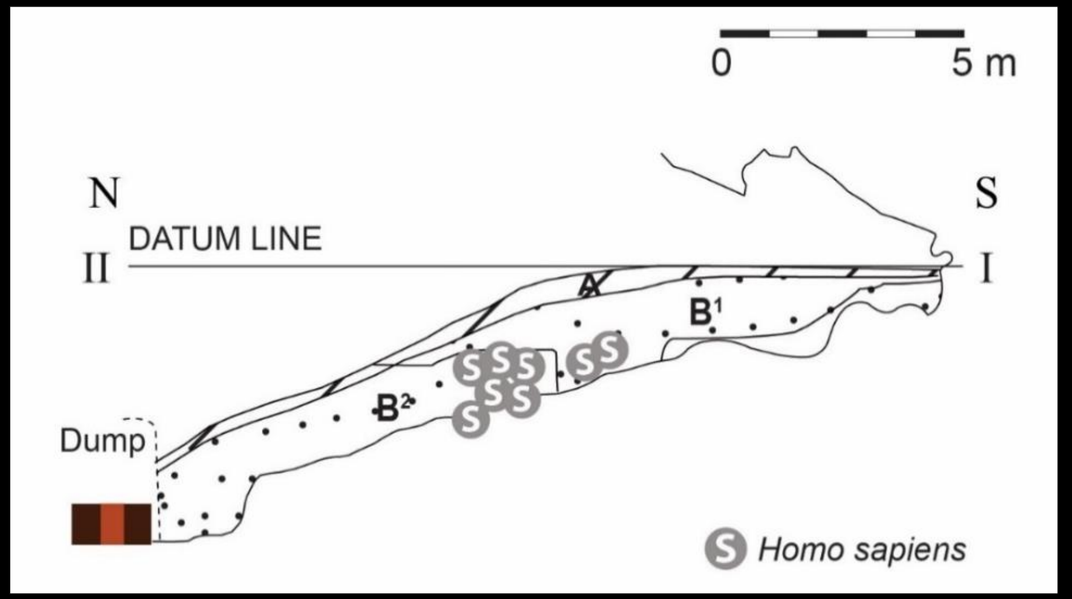

מוסטרית
MOUSTERIAN
B
C

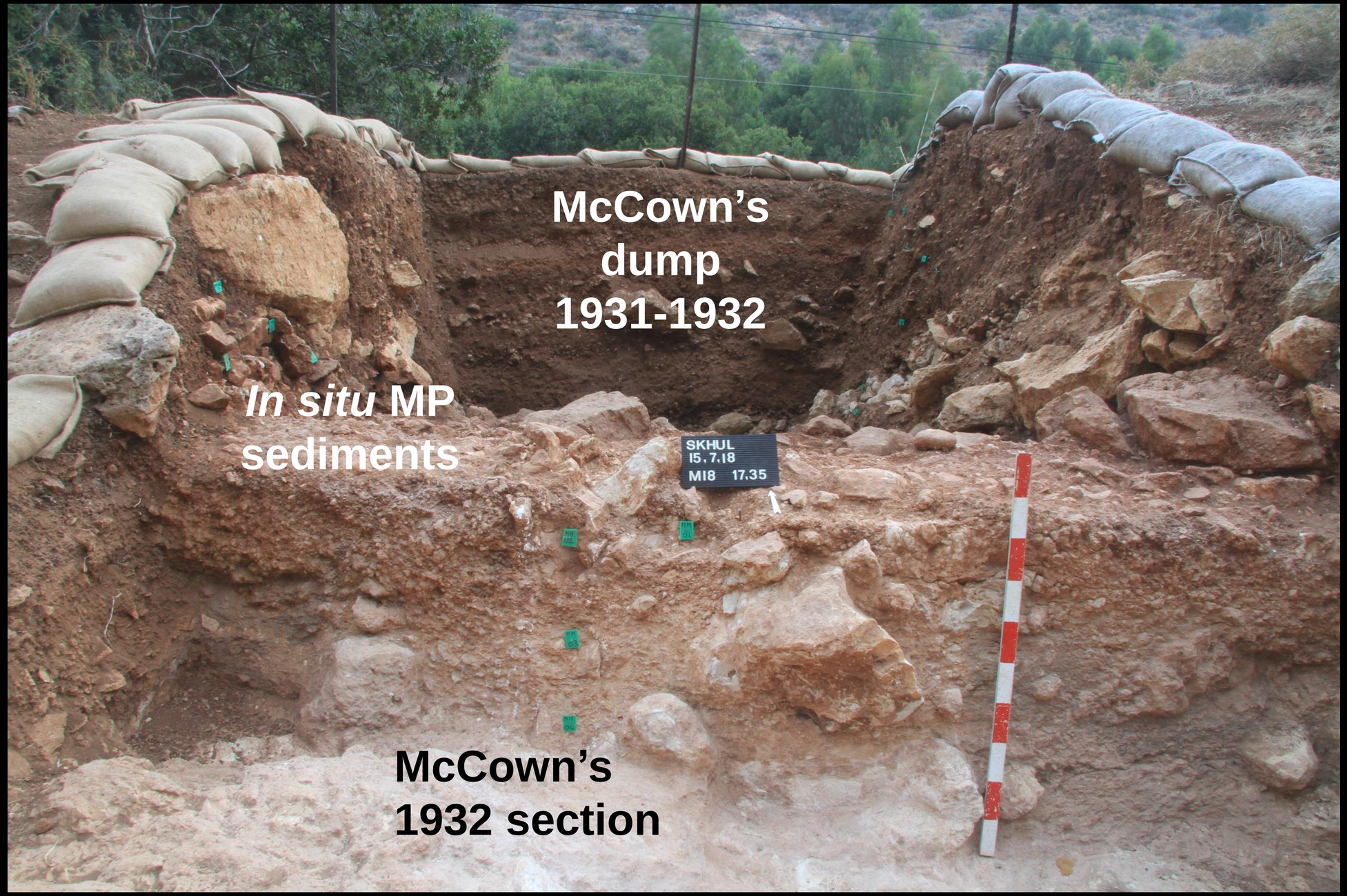

TAB 16-13
TAB 16-12
TAB 16-11
TAB 16-10
TAB 16-9
TAB 16-8
TAB 16-7

Tabun Layer B

Skhul Cave


McCown 1931-2
I
III
IV
II
I
VI
IX
VII
VIII
V
Edge of Terrace
Rock Floor
16
17
18
II
19
20
21
22
L M N
N
Limit of McCown's excavation
New Excavation Area
0
5 m


0
5 m
N
S
II
DATUM LINE
I
A
B¹
B²
Dump
Homo sapiens


McCown's
dump
1931-1932
In situ MP
sediments
SKHUL
I5,7,18
MI8 17.35
McCown's
1932 section


5
cm


5
cm

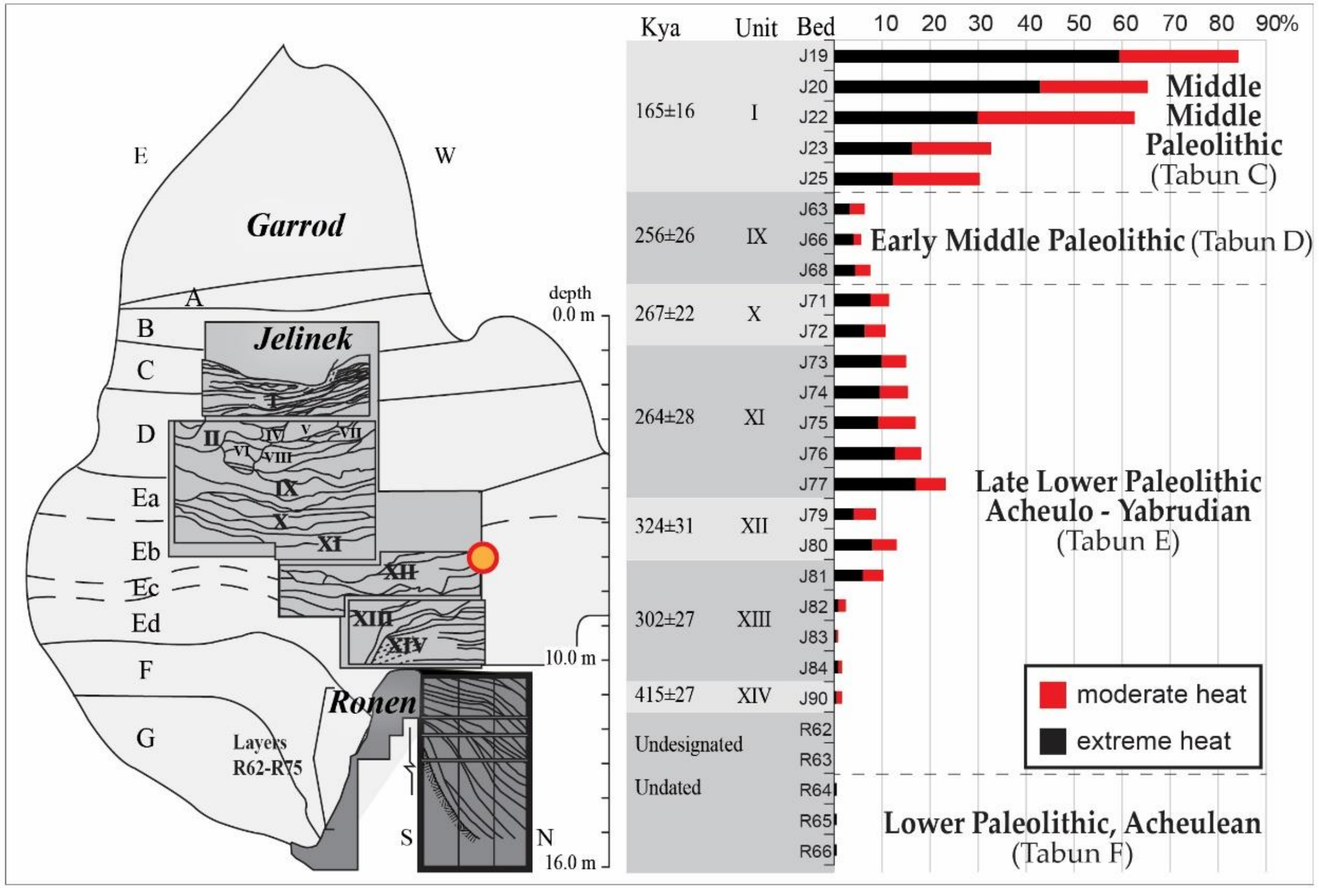

5
cm


5
cm


5
cm

‘Fire at will’: The emergence of habitual fire use 350,000 years ago

Ron Shimelmitz [a,*], Steven L. Kuhn [b], Arthur J. Jelinek [b], Avraham Ronen [a], Amy E. Clark [b], Mina Weinstein-Evron [a]



- The different scales of data

“If the Skhul burials took place within a relatively short time span, then the best age estimate lies between 100 and 135 ka” (ESR and U-series of four human fossils; Grun et al. JHE 2005)

Human remains themselves represent very short instances within the long cultural Mount Carmel (Levantine) sequence (11 Skhul remains 275 years)

- The value of long cultural sequences
  - The crucial role of dating
- The notion of migrations/dispersals

Thank you …

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