Supporting Information

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Hayonim Cave

Hayonim Cave is situated on the right bank of Wadi Izhar, about 13 km from the Mediterranean coast and 50 m above the present Wadi channel, in the Western Galilee, Israel (1, 2).

The Faunal Assemblage. The faunal assemblage was first studied by Davis (3, 4) and later by Rabinovich, emphasizing the human mode of exploitation (5, 6). The distribution of species (NISP layer D4 = 1,479; D3 = 7,012; D1–2 = 5,077) is very similar in all occupation stages, with gazelle (*Gazella gazella*) being the most common species (more than 80% of NISP), followed by Persian fallow deer (*Dama mesopotamica*, 5–6%), while other species—red deer (*Cervus elaphus*), wild goat (*Capra aegagrus*), wild boar (*Sus scrofa*), aurochs (*Bos primigenius*), roe deer (*Capreolus capreolus*) and hartebeest (*Alcelaphus buselaphus*)—are represented by only several bones (5, 6).

Every bone was examined under the microscope, and every surface modification was noted (Figs. S1–S3 and Tables S1 and S2). Indeed, the fine preservation state of the bones and their relative density (more than 2,000 bones/m^3) permitted a detailed reconstruction of the butchery process at what seems to be a "consumption station" where animal resources were processed and shared among the group members, i.e., a "kitchen midden" (1). It appears that animal-carcass processing was a major activity in the cave during the Aurignacian occupation. Based on the location of the cut marks and their shape, the main activity that took place in situ was disarticulation, followed by some filleting and skinning (5, 6).

The Flint Assemblage. There is a great techno-typological similarity among the flint assemblages of the three sublayers of layer D. On the other hand, there is pronounced heterogeneity in the overall typological components of the whole lithic assemblage (1).

Flakes are dominant among the debitage items (including "core trimming elements" and "primary elements"). Within the tool categories the picture is different, and tools were modified on blade/bladelet and on flake blanks equally. The character of the debitage is quite irregular. The number of cores is relatively high. Still, judging from the frequencies and types of debitage items, it seems that a large number of tools were made elsewhere, while some of the items produced at Hayonim were taken away.

The typological aspect shows that the Aurignacian assemblage of Hayonim Cave is dominated by the end-scrapers category. The second large category is the burin group. Together, these two categories constitute more than half of the total number of tools in layer D. Borers and backed pieces are scarce, while denticulates and notches are relatively well represented. The el Wad points are quite scarce, and there is a moderate presence of bladelets and bladelet tools (Dufour bladelets).

Another interesting phenomenon is the high percentage of tools with double patina. It is more pronounced in certain tool-groups, i.e., the end-scrapers, the burins, and the denticulates and notches. Most of the double-patinated artifacts clearly derive from the preceding Mousterian levels exhibiting the Levallois technique characteristics including facetted striking platforms. Most probably these Mousterian items were available on the surface of the cave and the terrace due to the post-Mousterian erosion (see refs. 1 and 7 for more details on the flint assemblage and double patination).

The Bone and Antler Tools Assemblage. The bone and antler tool assemblage from Hayonim D is unique in its number of tools and their variety and is comparable only to the assemblages of Manot and Ksar Akil Caves (8–12). Such diversity calls for a detailed study incorporating new technological observations of the corpus. Indeed, a renewed study of the technology of the Hayonim D assemblage is currently under way. The majority of items are bone awls and antler projectile points. There are also several items, both bone and antler, which were most probably used in indirect percussion (namely as a chisel), as has been demonstrated through both technological and experimental studies (13–15).

The tools made of bone were modified in an expedient way using one simple technique, i.e., scraping. On the other hand, antler was exploited by a combination of techniques, namely a process defined by Averbouh as the "conjugation of several technical gestures, resulting in the use of various techniques with a precise purpose which is, concerning the osseous working, of transforming a raw material bloc into a particular object" (16, p. 55), implying a complex operational sequence.

This typological and technological dichotomy as regards bone and antler items is also observed in the Early Aurignacian of Europe (e.g., refs. 13 and 17–21) as well as in the Levantine Aurignacian assemblage of Manot Cave (12).

Whenever the base of the antler projectile point is preserved, it is a simple/massive point of the variety defined as "elongated objects with a pointed distal tip, a variable cross section (mostly elliptical) and a simple hafting system" (22). The projectile points that characterize the Evolved Aurignacian in Europe and the local Levantine Aurignacian are also known by various other names, including "pointed base points," "biconical," "massive base point," or simply "not split based points" (e.g., ref. 22). We prefer to use the terms "massive base point" or "simple base point," which relate better to the general morphology of these objects (23). Except for one split-based point from Kebara (24) [see also claims for a second specimen, from Hayonim Cave (25)], all projectile points from the Levantine Aurignacian (*ca*. 150 specimens so far) are simple/massive points (1, 9, 12, 26, 27). We attributed all broken specimens from Hayonim to this category according to the raw material, the cross-section extension of the worked surface of the object, and the morphometrics of the item. It seems that for all points are made from antler the cross-section is elliptical, the entire piece is worked, and they are fully compatible with the morphometrics of simple/massive points at other Aurignacian sites such as those from Manot Cave and Ksar Akil. The complete points measure 65–70 mm in length, 7–9 mm in width, and 6–8 mm in thickness.

Other Symbolic Items. In addition to the notched bones, some other items traditionally linked with the symbolic sphere of Paleolithic hunter-gatherer groups have been recovered from the Aurignacian layers in Hayonim Cave. Five are tooth pendants, one of which is unfinished. The pendants have already been described (1), but the preform (the unfinished piece) was identified only recently among the faunal remains.

The pendants were made from red deer vestigial canines (specimens HD157, HD179, and HD226, the unfinished item), a horse incisor (*Equus* sp.; specimen HD152), and a fox canine (*Vulpes vulpes*; specimen HD258). They were found in layers D1–2 (two items), layer D3, and D4 (one item in each layer) and in D sequence without exact provenience. No obvious spatial distribution in relation to other symbolic items was detected.

Two incised limestone slabs were uncovered in two different locations. The first item was found in D1–2 (square J21), while the second piece came from D4 (square I21) (1).

The incisions on the first object are clearer. One side depicts a linear figure that resembles the back of an ungulate, perhaps a horse, with some indication of a head. The other side of the slab has fewer incisions, hinting at some sort of a figure (an animal back?) in a diagonal direction and a series of descending lines (1).

The Notched Items of Hayonim D and Other Levantine Sites

Some of the notched gazelle scapulae (5) deriving from Hayonim D have already been published by Davis (28); however, during the revision of the bone and antler worked items from Hayonim D we observed four other notched specimens, i.e., three scapulae and one hyoid. The Levantine Aurignacian record so far comprises 14 items: nine from Hayonim Cave, four from Manot Cave, and one from Kebara. Although the one from Kebara was attributed by Davis to the Mousterian levels, the origin of this item is uncertain. In a recent revision of the archaeological material from Emireh Cave excavated by Turville-Petre and studied by D. Garrod (29), a notched bone was found (30). Emiran, Mousterian, Ahmarian, and Aurignacian occupation is suggested in the new revision of the lithic technology (30). However, the reassessment could not establish a clear stratigraphic sequence. We can assume that the notched piece originates from the Aurignacian occupation (Table S3).

Spatial Distribution of the Notched Items

The notched items are from the entire stratum of the Aurignacian occupation (D layers). Six pieces derive from layer D1–2, two from layer D3, and one from layer D (Fig. S4 and Table 1).

No particular spatial association is shown between the notched items and other nonlithic artifacts (pendants, ochre fragments, incised limestone slabs) or structures (namely hearths). Thus, of the five Aurignacian pendants made of teeth, only two (a horse incisor, HD152, and a fox canine, HD258) were found in the same square (I22a) at a similar depth with the notched hyoid (Fig. S4).

In D1–2, isolated patches of white ash suggested that, somewhere not far away, there was a fireplace (1). One of the scapulae comes from square H21, where there is clearly a hearth. Two notched specimens display marks of having been subjected to a combustion process. The surface of these specimens was burned, showing a homogenous color and patina (dark brown and soft brown, respectively). Since the pieces are broken and do not have a stratigraphic connection with combustion structures, it is not possible to speculate about the purpose (if any) of the thermic process. Alternatively, it could be merely incidental (e.g., broken pieces discarded into a fire).

It has been suggested that the archaeological occupations at Hayonim D could be reconstructed as a series of short but intensive sequences of occupations resulting in kitchen midden depositions. Therefore, the lack of precise association between the symbolic and other items might result from the continued tossing of debris at the same place during several occupation stages. Indeed, the repeated processing of meat and bone precludes the reconstruction of when and what was the role played by the symbolic items, but they clearly were part and parcel of the Aurignacian existence at the site.

Further Discussion of Notched Bone Significance in the Levantine Aurignacian

The emergence and diffusion of the Upper Paleolithic typo-technical traditions is among the most debated topics following the dispersal of AMH in Eurasia. It seems essential to examine and evaluate the variability among human groups when discussing the success and failure of this dispersal across new lands and the establishment of regional territories (31). Human groups differ (32, 33), not only because of different external environmental circumstances (34) but also because of intragroup social rules, customs, and relationships (35). Thus, the variability observed in ritual and symbolic behavior undoubtedly played an important role and is a crucial aspect when researching Pleistocene groups and/or cultures. Beyond the technological skills, the variability in social and spiritual dynamics lies at the core of human self-definition as a group, society, or culture (31).

A key feature of the use of symbols is that their meaning is assigned by arbitrary, socially constructed conventions, allowing the storage and visualization of information external to the human brain (e.g., refs. 36–38). The objects impregnated with a symbolic meaning reflect the use of the symbolic concepts to link the individual or population with their material culture and their environment (36).

As pointed out by Wobst (39), one aspect of symbolic material culture, and possibly the most significant benefit of symbolical behavior in general, is its ability to link the individual or group with other individuals and groups through the inter- and intragroup transmission of information. The use of artifacts to transmit messages is advantageous when used to communicate information to people who are in "the middle distance," that is, those people who are not so close to the sender that the messages are already known and not so distant that the meaning of the message cannot be deciphered (neighboring groups or other members of an alliance) (38–41). Such signals thus may include identification (class affinity, social group affiliation, rank, and so forth), authorship, and ownership. Temporal and spatial patterns of the symbolic material can be used to examine the volume and diversity of information flow within and between regions during the Paleolithic (Fig. S5) (38, 42–47).

In the absence of any functional purpose of the notched items, we suggest their use as distinctive personal objects attached to clothes or as pendants. Personal ornaments can be necklaces, pendants, or dress decorations (48). While the precise meaning of the message transmitted by such objects is lost to us, we can nevertheless assess its significance in a particular regional context. In this regard, it is interesting to note that, as in the Levantine Aurignacian, in other regions and material cultures a few specific types of raw materials with standardized shape were selected as personal ornaments. Examples are the selection of particular shell genus—*Nassarius*—to fabricate pendants from the African MSA to the beginning of the UP in both the Levant and Europe (48–51) and the particular shape of the so-called "basket beads" made mostly of ivory, characteristic of the Early Aurignacian in southwest France (45, 52, 53).

In the Levantine Aurignacian we witness the usage of a common available raw material but with a definite aim to create the desired shape. The technology applied, i.e., scraping bone surface and creating sawing-like marks, is not an innovation. The repetition is what suggests that the final use was the goal of the fabrication, and here we can only speculate. The regional variants of the graphic expressions of the Aurignacian could be rooted in the Paleolithic entities present in Eurasia before the arrival of the Aurignacian or could be linked with the dispersion of AMH groups across Eurasia (e.g., refs. 54–58). As pointed out by Bourrillon and colleagues (47), this pattern of regional variability matches the social geography models which focus on the material construction of identity at regional, group, and individual levels (38, 39, 43) that is expressed in personal ornaments and also in rock and mobile art, bone and antler industries, and lithic technology (e.g., refs. 12, 17, 42, 45, and 59–64). This could perhaps explain the differences in the graphic organization between the Levantine and the European Aurignacian varieties.

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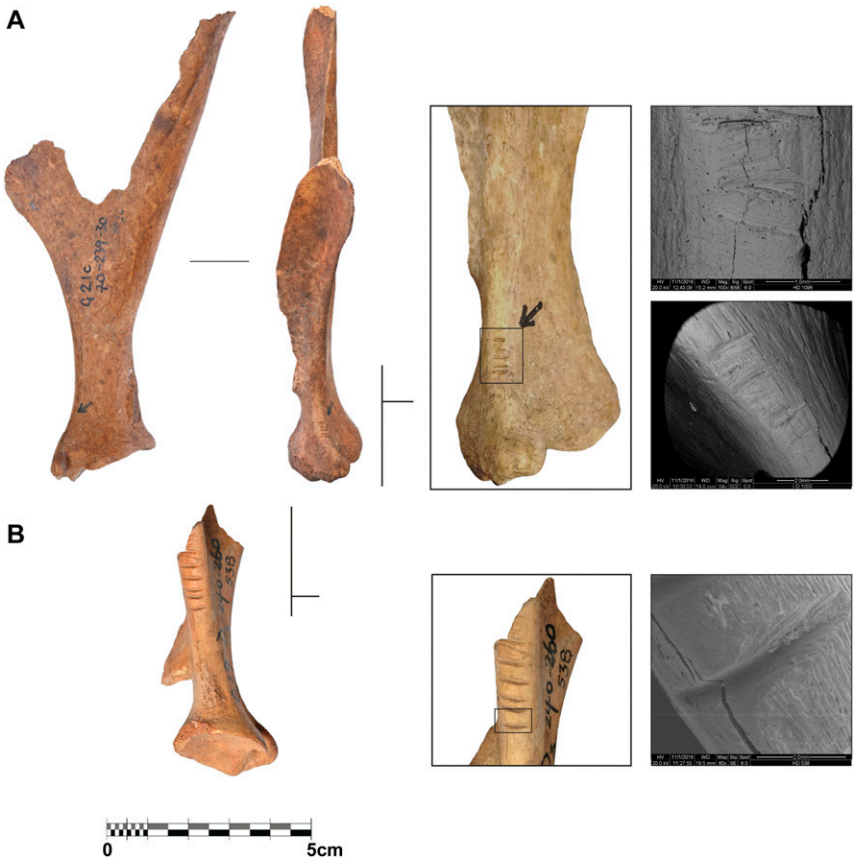

Fig. S1. (*A*) Scapula displaying cut marks (HD1096). (*B*) A notched scapula fragment (R538). Magnifications in scanning electron microscopy images: 100×, 34×, and 60×, respectively, from top to bottom. Image courtesy of Assaf Uzan (photographer).

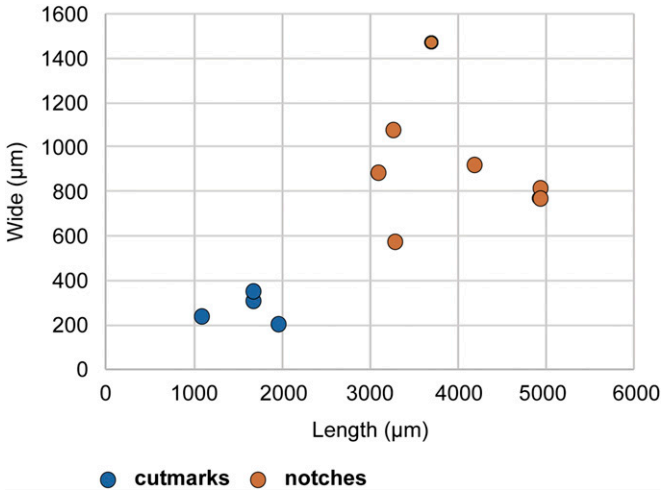

Fig. S2. Morphometrics (length vs. width in micrometers) of cut marks and notches.

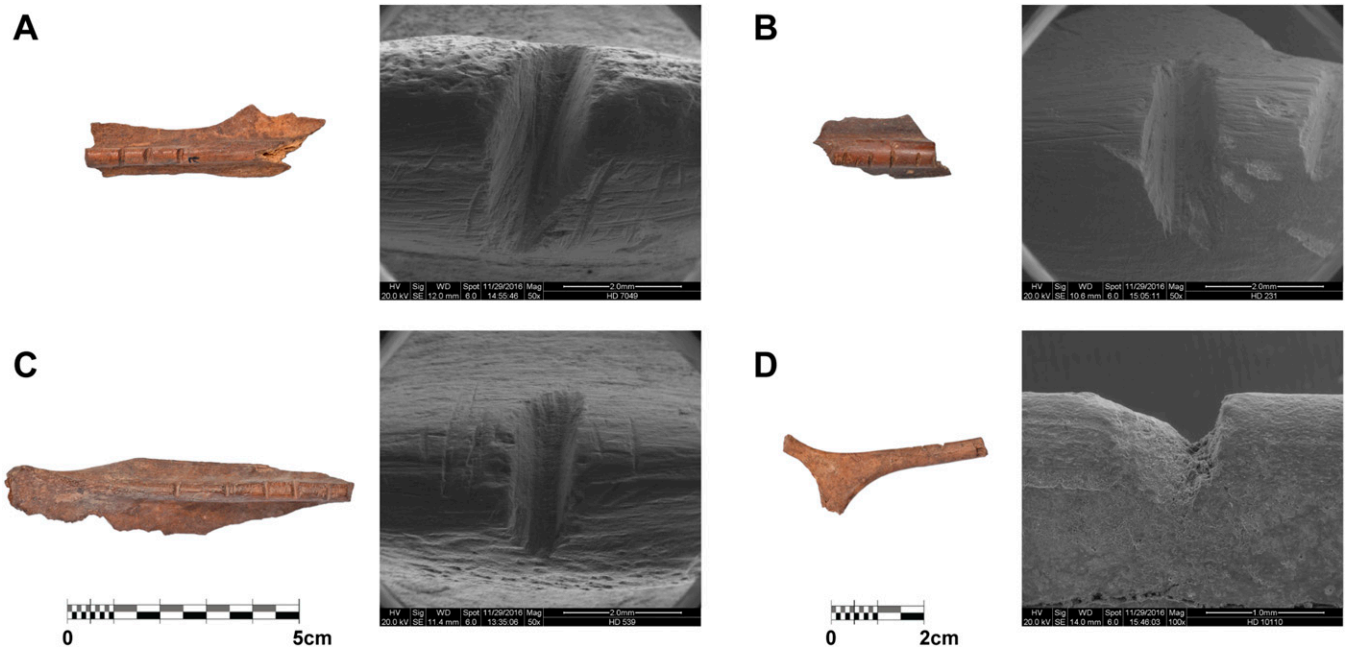

Fig. S3. Fragments of notched scapulae (*A*–*C*) and hyoid (*D*) from Hayonim D and detailed scanning electron microscopy images. Magnification of scanning electron microscope images: 50×–100×. Image courtesy of Assaf Uzan (photographer).

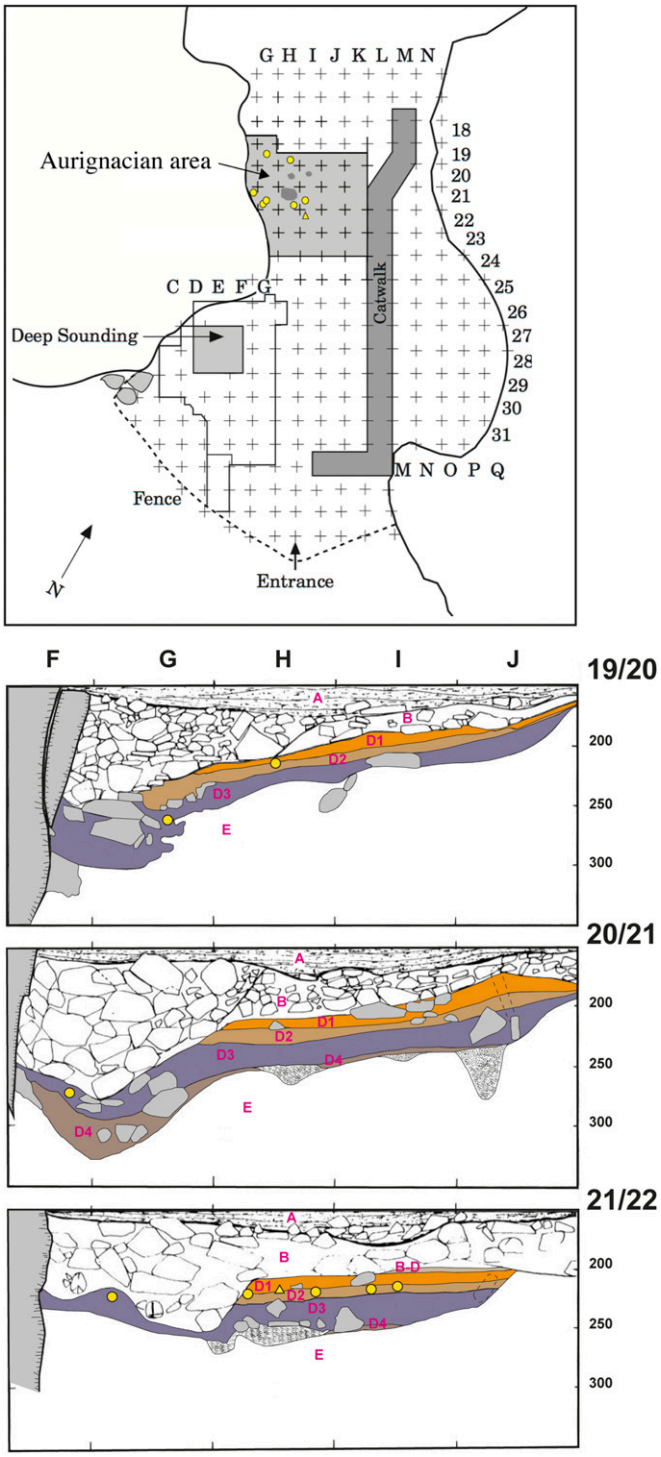

Fig. S4. Spatial distribution and stratigraphic location of Hayonim D notched bones (scapula: yellow circles; hyoid: yellow triangle) plotted over the West–East sections of stratum D. The Aurignacian area is shown in soft gray and hearths in dark gray in the cave plan. (Modified from refs. 1, 2.)

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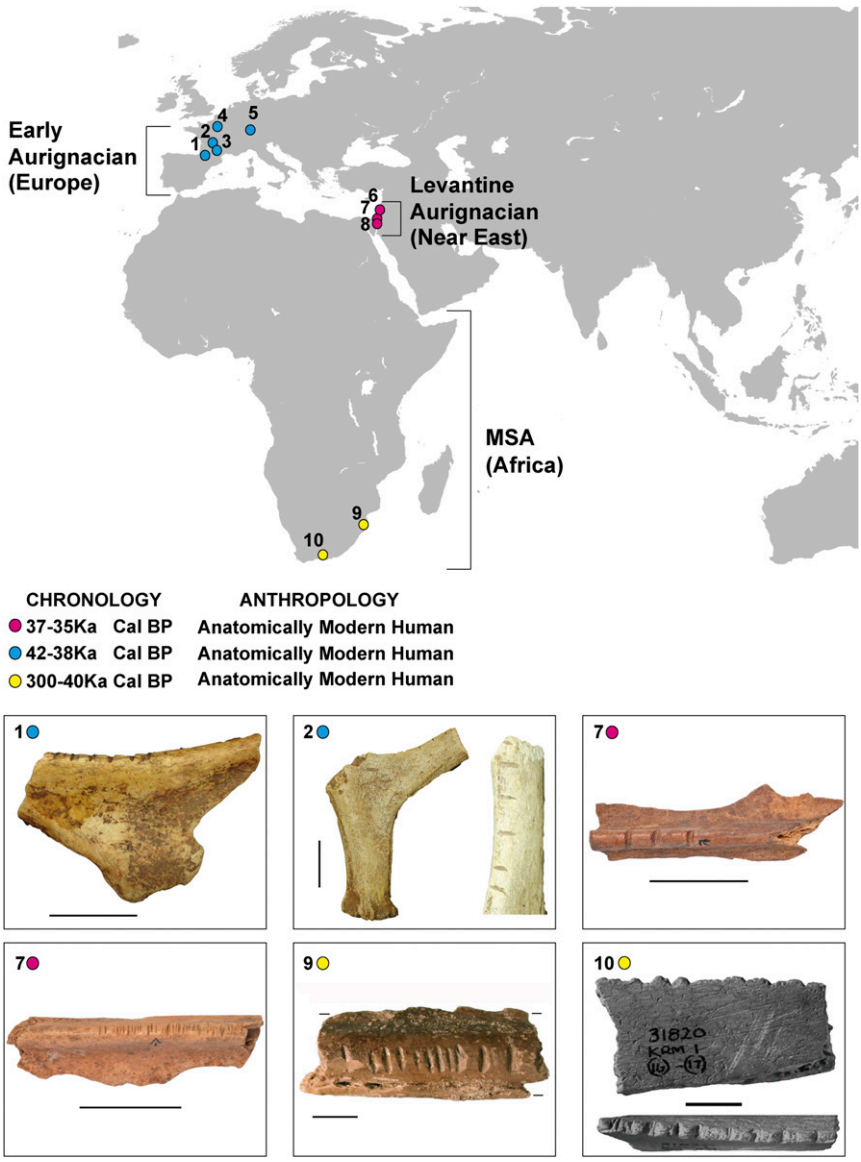

Fig. S5. Geographical distribution map and pictures of diverse notched flat bones referred to in the text and Table S2 from the Early Aurignacian of Europe, the Levantine Aurignacian, and the African MSA. (1) Isturitz (France) (courtesy of J.-M.T.); (2) La Quina-Aval (France) (reprinted with permission from ref. 1); (3) Castanet (France); (4) Princesse (Belgium); (5) Vogelherd (Germany); (6) Manot Cave (Israel); (7) Hayonim Cave (Israel) [image courtesy of Assaf Uzan (photographer)]; (8) Kebara Cave (Israel); (9) Border Cave (South Africa) (reproduced from ref. 2); and (10) Klasies River Mouth Cave (South Africa) (reprinted with permission from ref. 3).

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Table S1. Technological description of the Hayonim D notched bones

Specimen ID	Number of notches	Location of notches	Surface preparation technique	Area covered by scraping, mm	Notch technique	Area covered by notches, mm	Length of notches, mm	Distance between notches, mm	Notch cross-section
10,110	3*	Border	—		Sawing	12	0.5	1–2	V
HD231	7	Posterior border	Scraping	18	Sawing	18	3–4	1.5–3	V
HD537	16	Posterior border medial aspect	Scraping	44	Sawing	44	5	1.5–5	V
R538	6	Posterior border	Scraping	22	Sawing	18	5	1–2	V
R539	6	Posterior border costal end	Scraping	39	Sawing	52	3	2–7	V
HD540	6	Posterior border costal aspect	Scraping	11	Sawing	11	*ca*. 4	0.5–1.5	V
HD541	3	Posterior border	Scraping	16	Sawing	16	4–5	5	V
R7049	3	Posterior border near the posterior angle	Scraping	27	Sawing	13	3.5–4	3–6	V
R7053	32	Posterior border medial aspect	Scraping	32	sawing	32	2.5–3	0.5–1	V

*The third notch was not complete.

Table S2. Morphometrics of cut marks (specimen HD1096) and notched scapulae (R538, HD231, and R539)

Specimen ID	Marks	Length, μm	Width, μm
HD1096	Cut marks	1,977.3	203.57
		1,699.42	309.61
		1,695.4	347.75
		1,093.3	237.5
R538	Notches	4,193.18	554.5
		4,103.54	616.45
		4,957.45	814.1
		4,939.2	765.74
HD231	Notches	3,107.5	876.68
		4,208.52	921.44
		3,058.37	494.95
		4,037.28	747.68
R539	Notches	3,112.2	976.78
		3,309.1	568.66
		3,700.78	1,469.05
		3,289.7	1,068.87

Table S3. Notched items from Israel (Levantine Aurignacian), Africa (MSA), and Europe (Proto-Aurignacian and early Aurignacian) and an item from the Micoquian levels of Zaskalnaya (Crimea)

Type	Site	Chrono-cultural context	Chronology*	Dating reference	Raw material	Taxa	Anatomical part	Refs.
Notched bone	Hayonim	Levantine Aurignacian	28,980–29,900	Hv-2675/OxA- 2801/2802/2803/2804/2805/2806	Bone	*G. gazella*	Hyoid	1, 2 (C14 data), this paper
Notched bone	Hayonim	Levantine Aurignacian	Uncal BP		Bone	*G. gazella*	Scapulae	
Notched bone	Hayonim	Levantine Aurignacian			Bone	*G. gazella*	Scapulae	
Notched bone	Hayonim	Levantine Aurignacian			Bone	*G. gazella*	Scapulae	
Notched bone	Hayonim	Levantine Aurignacian			Bone	*G. gazella*	Scapulae	
Notched bone	Hayonim	Levantine Aurignacian			Bone	*G. gazella*	Scapulae	
Notched bone	Hayonim	Levantine Aurignacian			Bone	*G. gazella*	Scapulae	
Notched bone	Hayonim	Levantine Aurignacian			Bone	*G. gazella*	Scapulae	
Notched bone	Manot Cave	Levantine Aurignacian	38,000–34,000 Cal BP	RTD-7784-combine/RTD-7816/RTD-7194-combine/RTD-7195-combine/RTK-6305/6304/6624/6303/6307/6306/6308/RTD-7247/7246	Bone	*G. gazella?*	Scapulae?	3, 4–6 (C14 data)
Notched bone	Manot Cave	Levantine Aurignacian			Bone	*G. gazella*	Scapulae	
Notched bone	Manot Cave	Levantine Aurignacian			Bone	*G. gazella*	Scapulae	
Notched bone	Manot Cave	Levantine Aurignacian			Bone	*G. gazella*	Hyoid	
Notched bone	Kebara Cave	Levantine Aurignacian	No data	—	Bone	*G. gazella*	Scapulae	7
Notched bone	Emireh Cave	Levantine Aurignacian?	No data	—	Bone	*G. gazella?*	Scapulae?	8
Notched bone	Klasies River Mouth	MSA II	~60,000 BP†		Bone	Indeterminate	Rib or scapula	9
Notched bone	Klasies River Mouth	MSA II			Bone	Large bovid	Rib	
Notched bone	Border Cave 2WA	MSA (post Howiesons Poort)	57,490–55,250 Uncal BP	ANUA-17303/ANUA-18626/ANUA-19010	Bone	Indeterminate	indet	10
Notched bone	Zaskalnaya	Micoquian	43,000–38,000 Cal BP	OxA-4772/Ki-10894/Ki-10609	Bone	*Corvus corax*	Radius	11
Notched bone	Riparo Mochi	Proto-Aurignacian	44,000–41,000 Cal BP	OxA-2000	Bone	*Red deer*	Limb bone	12, 13 (C14), 14

Table S3. Cont.

Type	Site	Chrono-cultural context	Chronology*	Dating reference	Raw material	Taxa	Anatomical part	Refs.
Pendant	Princesse	Early Aurignacian	No data	—	Ivory	*Mammuthus primigenius*	Tusk	15, 16
Pendant	Princesse	Early Aurignacian		—	Antler	*Rangifer tarandus*	antler beam	
Notched bone	Isturitz	Early Aurignacian	~32/32,400 Uncal BP‡	No data	Bone	*C. elaphus*	Hyoid	17
Notched antler	La Quina	Early Aurignacian	38,892–34,998 Cal BP	OxA-6147 (Lyon-256)	Antler	*R. tarandus*	Antler tine	17, 18 (C14)
Notched bone	La Quina	Early Aurignacian			Bone	*R. tarandus*	Rib	
Grooved pendant	Castanet	Early Aurignacian	39,500–35,500 Cal BP	GifA-99166/99,180/97,313/97,312/99,	Ivory	*M. primigenius*	Tusk	19, 20 (C14), 21
Polisher	Castanet	Early Aurignacian		179/OxA-21559/21,560/21,564/21,563/21, 566/21,562/21,642/21,558/21,664/21,643/21,561/21,645/21,641	Bone	Horse or large bovid	Rib	
Polisher	Brassempouy	Early Aurignacian	38,600–37,100 Cal BP	GifA SM-11034	Bone	Horse or large bovid	Rib	19, 22 (C14)
Polisher	Brassempouy	Early Aurignacian			Bone	Horse or large bovid	Rib	19
Pendant	Cellier	Early Aurignacian	No data	—	Ivory	*M. primigenius*	Tusk	21
Pendant	Vogelherd	Early Aurignacian	38,274–36,384 Cal BP	KIA-8970	Ivory	*M. primigenius*	Tusk	23 (C14), 24

*C14 dates were obtained by recent methods (samples pretreatment) except for Hayonim D. New radiocarbon dating of Hayonim D is under process.
†U-TH and thermoluminescence.
‡Data from Szmidt (2005) (unpublished excavation report) cited in Soulier et al. (in press). p. 3, lacking laboratory code and type of sample. The data are cited as follow: "Deux (C4b1 et C 4b2) se rapportent à un Aurignacien ancien quelque peu différent de l'Aurignacien «typique» aquitain et ont livré plusieurs dates AMS aux alentours de 32,000/32,400 BP (Szmidt, 2005)", referred in Tejero 2014.

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