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Supplemental information

A worked bone assemblage from 120,000–90,000 year old deposits at Contrebandiers Cave, Atlantic Coast, Morocco

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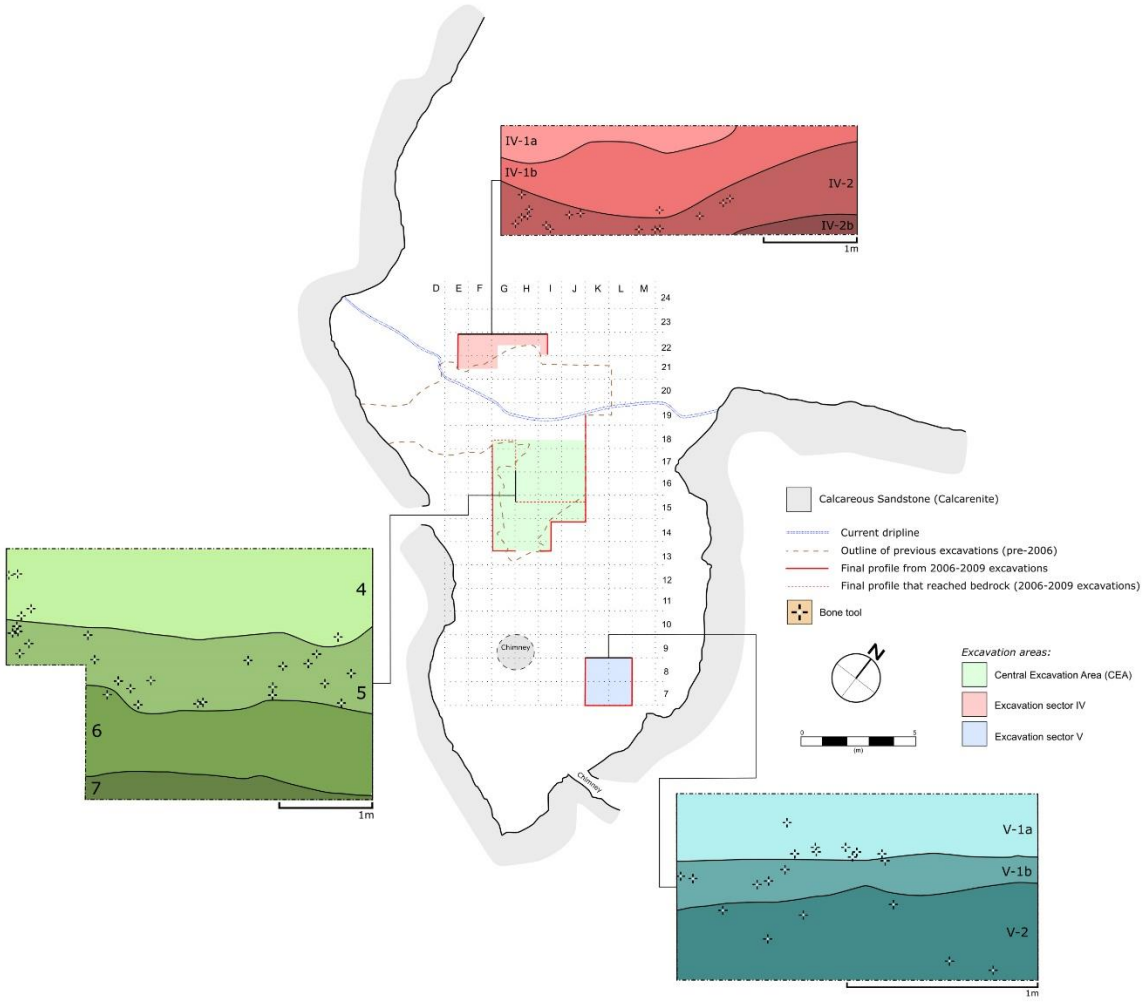

Figure S1. Map of Contrebandiers Cave showing excavation grid with the location of the central excavation area (CEA), sector IV and sector V, related to main Figure 1 and STAR Methods. Stratigraphic profiles with total station plotted locations of bone tools and their stratigraphic level associations.

Table S1. Ages and their 1σ uncertainties reported in Jacobs et al. (2011) and Dibble et al. (Dibble et al., 2012, Dibble et al., 2013) for MSA layers from which bone tools were recovered, related to STAR Methods.

Sample	Method	Sector	Layer	Age (ka)
		ATERIAN		
CONT-33	TL	IV	IV-2	87 ± 11
CONT-34	TL	IV	IV-2	87 ± 10
CONT-36	TL	IV	IV-2	115 ± 11
CONT-37	TL	IV	IV-2	80 ± 11
CONT-39	TL	IV	IV-2	85 ± 11
CONT-53	TL	IV	IV-2	179 ± 14
SC39	OSL	IV	IV-2	96 ± 8
SC37	OSL	IV	IV-2	101 ± 9
SC31	OSL	RT	4	92 ± 6
SC32	OSL	RT	4	97 ± 7
SC20	OSL	CEA	4D	104 ± 7
SC8	OSL	CEA	4D	108 ± 9
SC7	OSL	CEA	4D	117 ± 9
AT1	ESR (LU ESR (RU)	V	V-1A	109 ± 7 132 ± 9
PT45	ESR (LU ESR (RU)	V	V-1A	105 ± 11 121 ± 14
FT94	ESR (LU ESR (RU)	V	V-1A	86 ± 2 108 ± 3
FT95	ESR (LU ESR (RU)	V	V-1A	94 ± 3 108 ± 4
SC23	OSL	V	V-1B	113 ± 7
SC34	OSL	V	V-2	107 ± 9
		MAGHREBIAN MOUSTERIAN		
FT93	ESR (RU)	CEA	5A	117 ± 18
FT83	ESR (RU)	CEA	5A	123 ± 10
PT44	ESR (RU)	CEA	5A	90 ± 2
CONT-5	TL	CEA	5A	89 ± 16
CONT-28	TL	CEA	5A	92 ± 14
SC16	OSL	CEA	5A	118 ± 9
FT84	ESR (RU)	CEA	5B	115 ± 7
CONT-52	TL	CEA	5B	89 ± 14
SC15	OSL	CEA	5B	116 ± 8
CONT-50	TL	CEA	5C	116 ± 13
SC19	OSL	CEA	5C	124 ± 9
SC14	OSL	CEA	5C	113 ± 7
SC6	OSL	CEA	5C	114 ± 8
SC13	OSL	CEA	5C	112 ± 7
SC1	OSL	CEA	5C	115 ± 8
SC28	OSL	CEA	5C	115 ± 8
SC12	OSL	CEA	5C	119 ± 8

Figure S2. Additional examples of Contrebandiers Cave spatulate tools made on rib bones, related to main Figure 2 and main Figure 3. A, **B**, and **C** on specimens CB G22-304 and CB E22-552 are microscope photographs showing manufacture marks on the edges and body of the piece, with 1 cm scale.

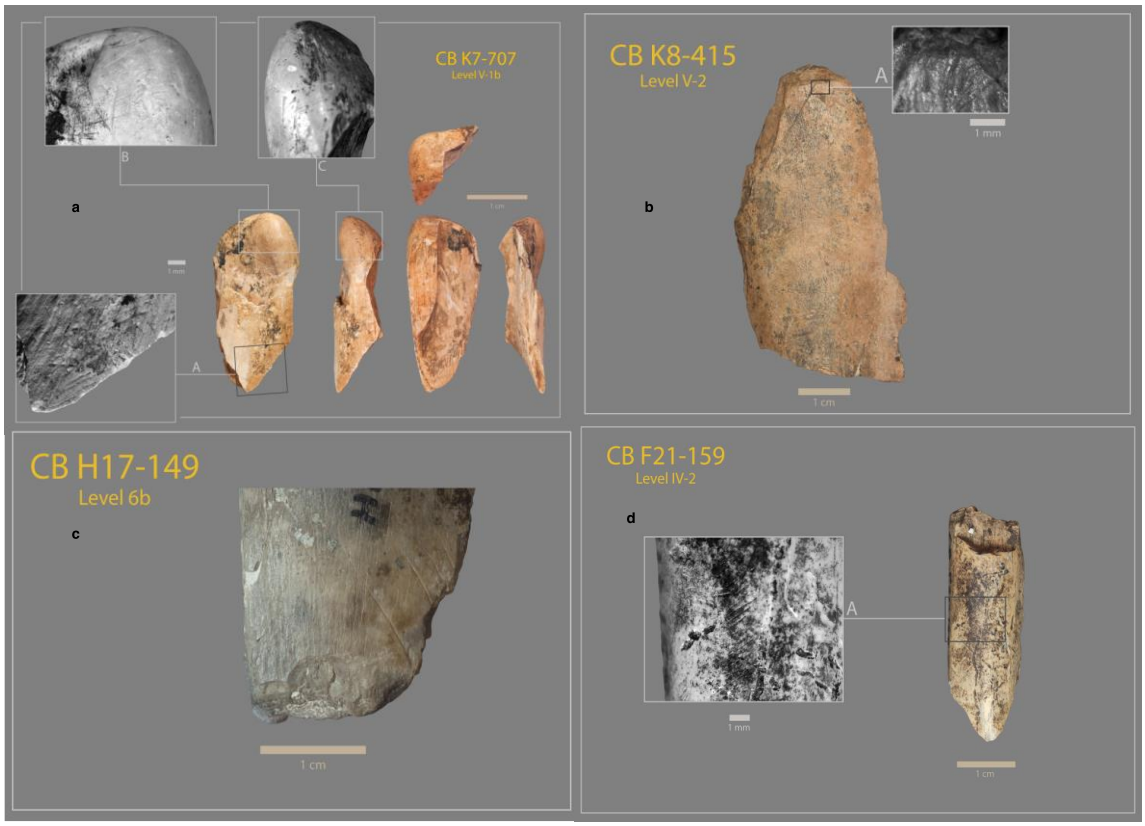

Figure S3. Examples of other bone tool types, related to STAR Methods. (**A**) K7-707, a formal piece of unknown function with polish restricted to one end. (**B**) Example of polish restricted to limited areas of an informal bone tool interpreted as resulting from use on K8-415. (**C**) H17-149 is an example of a possible pressure flaker with flake removals at tip interpreted as resulting from use. (**D**) F21-159 is an example of a possible “snapped-tipped” piece.

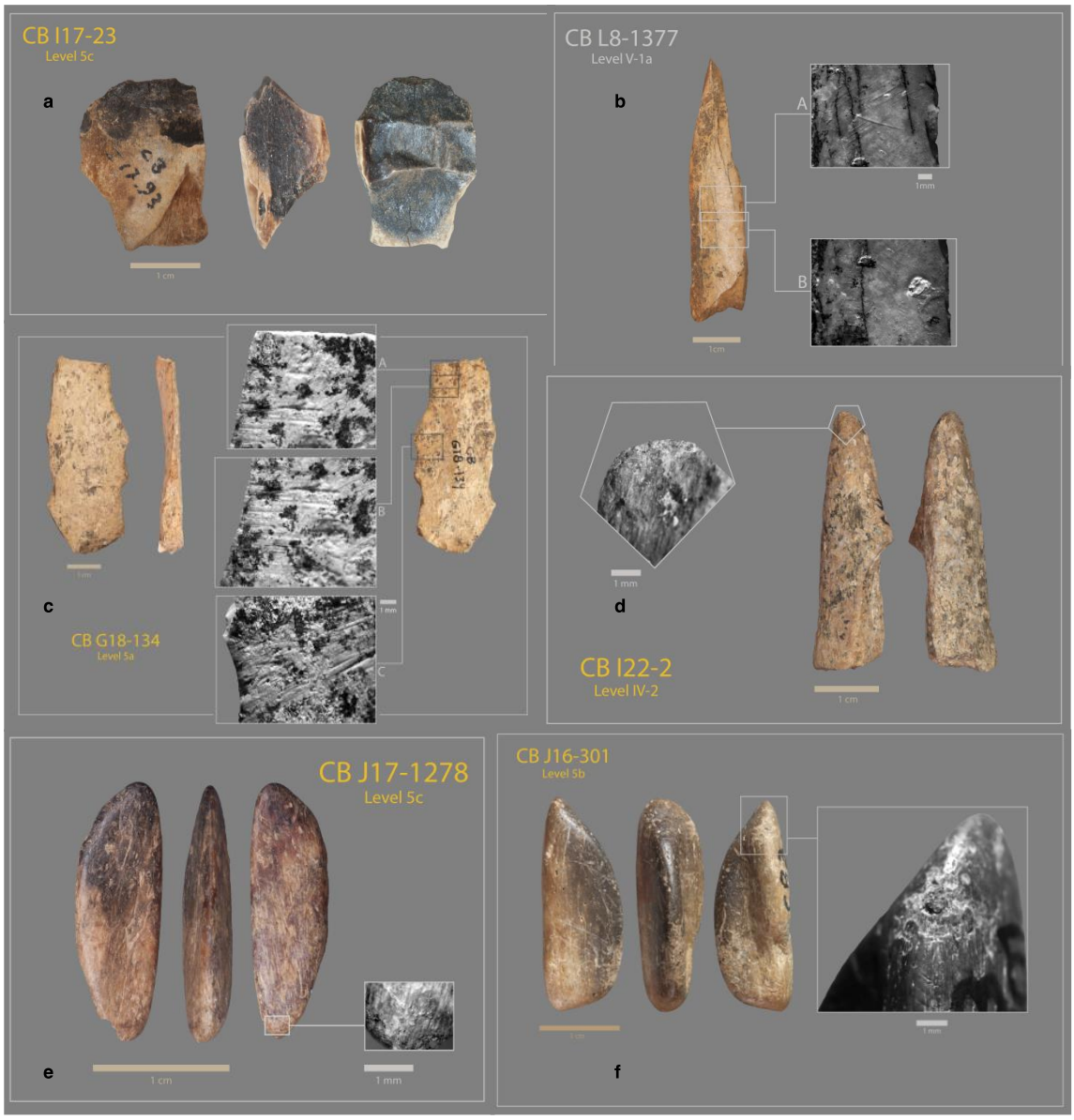

Figure S4. Examples of other formal and informal tool types, related to STAR Methods. (**A**) I17-23 is an example of a scaled piece shaped by flake removal using percussion. (**B**) L8-1377 is a formal tool that does not conform to a known type but resembles an awl. (**C**) G18-134 is an example of a formal bone tool that does not conform to a known type. (**D**) I22-2 is an example of a formal bone tool that does not conform to a known type. (**E**) J17-1278 is an example of a likely informal bone tool with smoothing and polish that does not conform to a known type. (**F**) J17-301 is an example of a likely informal bone tool with smoothing and polish that does not conform to a known type.

Table S2. Bone tool unique specimen identification numbers (Square IDs) showing bone tool type, burning extent, length (mm), width (mm), thickness (mm), archaeological layer, and xyz provenience (meters), related to STAR Methods.

Square ID	Tool Type	Burning	Length	Width	Thickness	Layer	X	Y	Z
E21-105	spatulate	tip only	91.08	33.58	9.04	IV-2	5.524	21.818	-1.812
E21-81	unknown	none	67.39	18.43	9.38	IV-2	5.626	21.986	-1.74
E22-143	unknown	none	67.08	20.04	9.92	IV-2	5.694	22.249	-1.643
E22-182	unknown	none	51.72	20.45	7.89	IV-2	5.662	22.034	-1.729
E22-552	spatulate	none	38.52	27.19	2.97	IV-2	5.89	22.457	-1.848
E22-561	spatulate	none	30.15	19.18	2.74	IV-2	5.914	22.45	-1.858
E22-717	unknown	partial	31.4	20.47	6.75	IV-2	5.618	22.835	-1.481
F21-194	unknown	none	19.85	10.64	5.83	IV-2	6.135	21.967	-1.707
F21-48	unknown	none	41.4	17.65	12.23	IV-2	6.253	21.933	-1.698
G13-165	retoucher	complete	38.81	25.47	10.63	4	7.251	13.897	-1.952
G14-1201	unknown	none	21.85	8.7	4.23	4	7.272	14.663	-1.559
G14-19	unknown	partial	101.45	26.9	16.94	4	7.017	14.847	-1.179
G15-60	unshaped split rib	none	75	30.06	6.78	4	7.168	15.598	-1.636
G17-217	unknown	none	38.19	18.4	7.91	5C	7.145	17.658	-2.071
G17-264	unknown	tip only	23.46	7.63	5.4	5A	7.117	17.41	-1.814
G17-70	unknown	none	27.91	11.57	6.53	5A	7.121	17.326	-1.766
G17-88	retoucher	none	73.69	38.42	16.35	5A	7.08	17.348	-1.834
G18-134	unknown	none	57.44	23.84	6.27	5A	7.898	18.473	-1.86
G22-303	spatulate	none	70.39	23.39	4.56	IV-2	7.079	22.627	-1.881
G22-304	spatulate	none	52.48	15.6	2.87	IV-2	7.548	22.535	-1.725
G22-312	spatulate	none	63.94	24.64	4.05	IV-2	7.099	22.624	-1.873
G22-582	spatulate	none	108.57	23.85	7.53	IV-2	7.809	22.949	-1.572
H17-123	unknown	complete	23.91	8.7	5.4	5C	8.369	17.914	-2.461
H17-149	pressure flaker	partial	41.17	22.34	8	6B	8.134	17.968	-2.518
H17-470	unknown	partial	20.6	18.05	11.58	5C	7.974	17.841	-2.14
H17-474	unknown	none	99.99	44.69	20.71	5D	8.453	17.741	-2.652
H17-573	unknown	partial	26.29	16.53	4.86	5C	8.232	17.849	-2.377
H17-65	unknown	none	29.3	12.62	8.04	4	8.07	17.784	-1.697
H18-144	unknown	partial	21.21	14.95	4.66	5C	8.59	18.123	-2.378
I16-22	unknown	none	38.44	19.32	6.09	5B	9.663	16.603	-2.141
I16-247	retoucher	partial	21.45	20.08	4.75	5C	9.931	16.387	-2.45

I16-531	unknown	tip only	63.53	22.82	5.86	5C	9.125	16.237	-2.634
I17-23	scaled piece	partial	24.24	17.78	12.76	5C	9.928	17.22	-2.542
I22-2	unknown	none	39.13	13.57	8.95	IV-2	9.138	22.671	-1.138
J16-301	smooth unknown	tip only	25.46	9.63	7.52	5B	10.41	16.346	-2.07
J16-441	retoucher	complete	34.25	18.1	5.97	5C	10.791	16.644	-2.302
J16-476	smooth unknown	complete	29.13	10.69	4.76	5C	10.044	16.182	-2.219
J16-52	unknown	none	55.05	24.05	10.71	4	10.66	16.862	-1.907
J17-1278	smooth unknown	tip only	18.5	5.94	3.61	5C	10.5	17.961	-2.408
J17-398	retoucher	none	95	15.61	8.84	5A	10.886	17.93	-2.104
J19-10	unknown	complete	24.77	11.12	9.39	5C	10.685	19.051	-2.67
K7-108	unknown	none	49.61	11	4.66	V-1B	11.846	7.078	-1.381
K7-215	retoucher	none	58.23	17.8	9.41	V-1B	11.542	7.356	-1.575
K7-246	unknown	none	38.71	11.78	10.93	V-1B	11.054	7.352	-1.418
K7-317	retoucher	none	37.01	13.6	5.62	V-2	11.361	7.836	-1.712
K7-707	unknown	none	29.31	14.11	7.75	V-1B	11.595	7.315	-1.556
K8-132	retoucher	none	46.41	14.63	4.82	V-1A	11.847	8.836	-1.394
K8-133	retoucher	none	38.65	30.63	12.46	V-1A	11.734	8.886	-1.416
K8-148	unknown	none	81.47	14.97	5.13	V-1A	11.996	8.852	-1.373
K8-1641	pressure flaker	none	42.16	19.04	17.94	V-1B	11.684	8.717	-1.497
K8-246	retoucher	none	43.45	22.5	6.76	V-1B	11.203	8.655	-1.538
K8-249	unknown	none	57.84	12.78	9.77	V-1B	11.14	8.69	-1.529
K8-415	pressure flaker	none	59.59	30.92	8.33	V-2	11.781	8.353	-1.734
K8-43	unknown	none	53.46	18.4	8.34	V-1A	11.693	8.799	-1.244
K8-565	retoucher	none	38.25	16.36	6.95	V-2	11.593	8.421	-1.864
L7-226	unknown	none	64.31	19.6	7.75	V-1B	12.036	7.129	-1.426
L7-519	unknown	tip only	58.37	15.15	8.17	V-2	12.894	7.944	-2.086
L7-983	unknown	none	52.99	29.05	11.04	V-2	12.247	7.18	-1.679
L8-1203	retoucher	none	49.75	17	7.2	V-1B	12.176	8.734	-1.588
L8-1377	unknown	none	55.01	12.07	4.41	V-1A	12.206	8.419	-1.49
L8-704	retoucher	complete	18.21	15.48	61.53	V-2	12.537	8.186	-1.985
L8-754	unshaped split rib	none	60.44	28.38	4.81	V-2	12.13	8.708	-2.275

Table S3. The provenience of carnivore bones bearing skinning marks, related to main Figure 5 and STAR Methods. Unique specimen identification numbers (Square IDs) showing skeletal element, skeletal element description, taxonomic Class, taxonomic Order, taxonomic Family, Genus and species, skeletal element side, archaeological layer, and xyz provenience (meters). Where U= unidentifiable, L= left, and R=right.

Square ID	Skeletal element	Description	Class	Order	Family	Genus species	Side	Layer	X	Y	Z
G22-101	mandible	body	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	L	IV-2	7.211	22.161	-1.764
J19-251*	tibia	shaft	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	L	7	10.767	19.538	-3.777
J19-377*	tibia	shaft	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	L	7	10.799	19.594	-3.784
K7-382	mandible	body	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	L	V-1B	11.351	7.25	-1.731
K8-337	mandible	other	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	R	V-2	11.944	8.461	-1.697
L7-503	mandible	body	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	R	V-2	12.792	7.876	-1.877
L7-659	mandible	body	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	U	V-2	12.634	7.359	-1.532
L7-923	mandible	other	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	U	V-1B	12.577	7.3	-1.439
G14-918	proximal phalanx	proximal epiphysis	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	U	4	7.774	14.054	-1.81
K7-892	radius	shaft	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	U	V-2	11.647	7.911	-1.94
G13-193	proximal phalanx	complete	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	U	4	7.189	13.984	-1.082
K8-425	mandible	shaft	Mammalia	Carnivora	Canidae	*Vulpes rueppellii*	R	V-2	11.794	8.403	-1.795
K8-910	ulna	distal epiphysis	Mammalia	Carnivora	Canidae	*Canis aureus*	R	V-2	11.504	8.563	-1.835
K7-705	metapodial	proximal epiphysis	Mammalia	Carnivora	Canidae	*Canis aureus*	U	V-1B	11.595	7.315	-1.556
K8-215	mandible	body	Mammalia	Carnivora	Felidae	*Felis silvestris*	R	V-1B	11.303	8.585	-1.455
L7-833	proximal phalanx	complete	Mammalia	Carnivora	Felidae	*Felis silvestris*	U	V-1A	12.52	7.74	-1.268

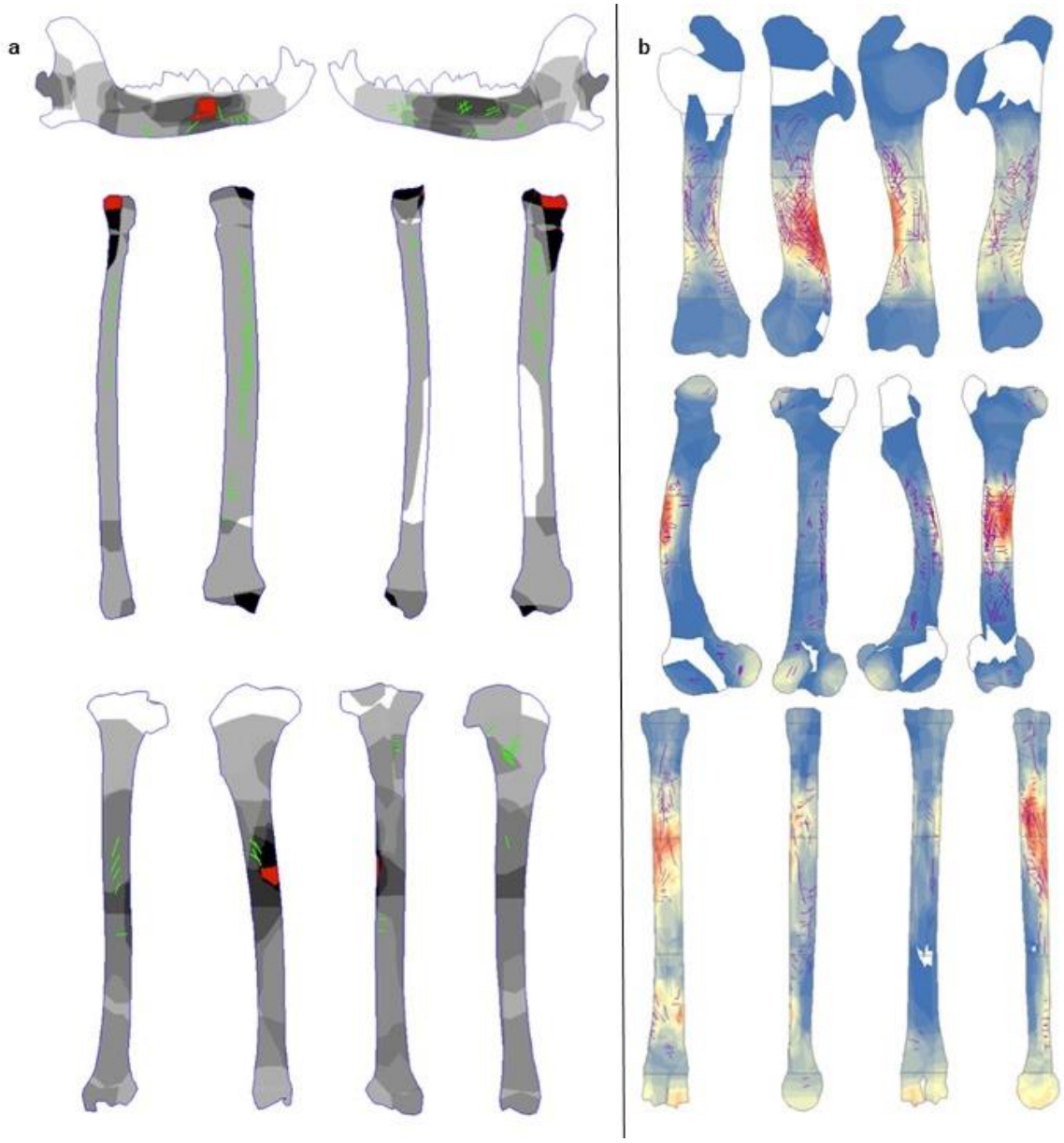

Figure S5. Distributions of cut marks on (A) carnivore (green lines represent cut marks) and (B) bovid (purple lines represent cut marks) bones, related to main Figure 5 and STAR Methods.

Figure S6. Shaped bone tools that do not conform to a yet-known type, related to STAR Methods. **A**, **B**, and **C** on specimens CB G14-1201 and CB K7-707 are microscope photographs with 1 cm scale.

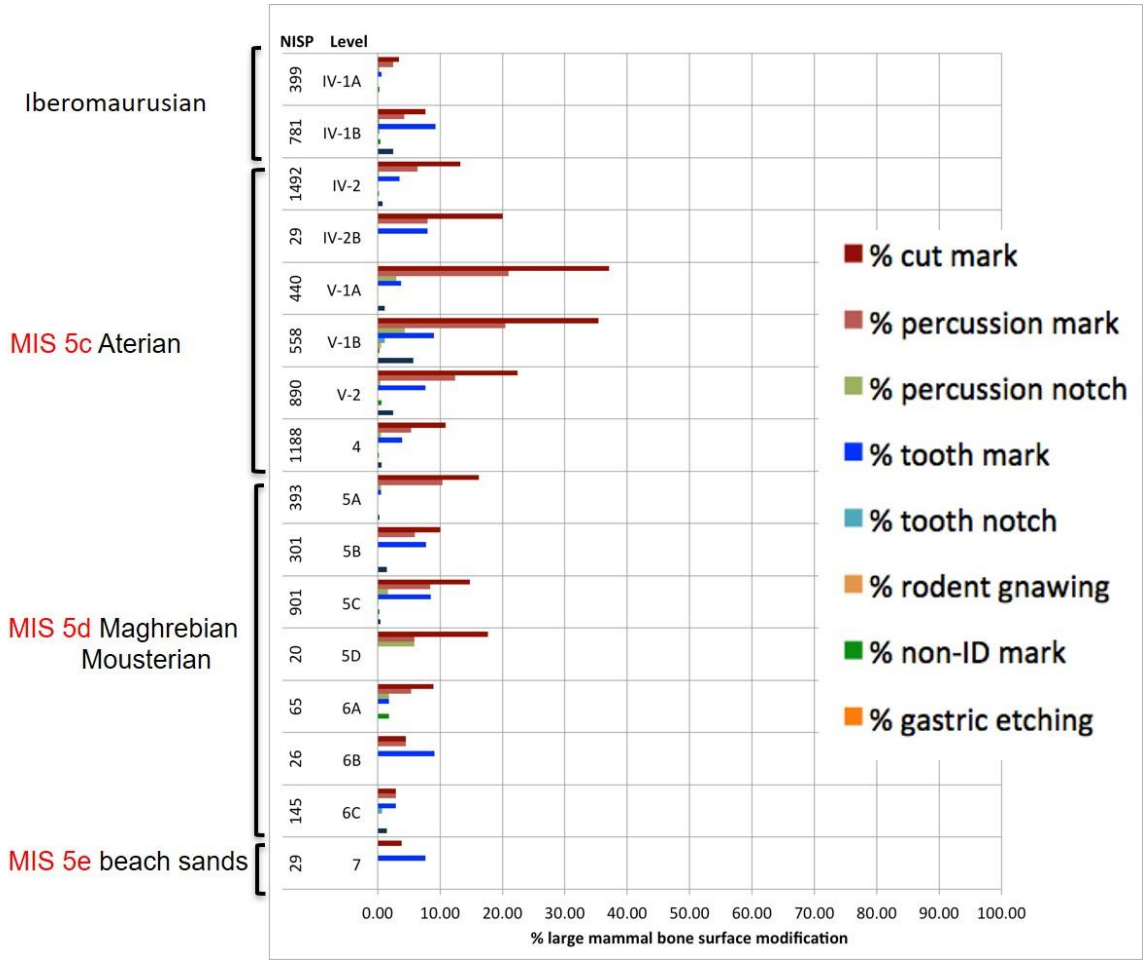

Figure S7. Surface modification of large mammal bones (N = 6,603) in CEA, sector IV and sector V, related to STAR Methods.

Table S4. Bone tool unique specimen identification numbers (Square IDs) showing skeletal element, skeletal element description, taxonomic Class, taxonomic Order, taxonomic Family, Genus and species, skeletal element side, and body size class, related to STAR Methods. Where U= unidentifiable, L= left, and R=right.

Square ID	Skeletal Element	Description	Class	Order	Family	Genus species	Side	Body size
E21-105	long bone	shaft	Mammalia	U	U	U	U	U
E21-81	tibia	shaft	Mammalia	U	U	U	U	2b/3a
E22-143	radius	shaft	Mammalia	Artiodactyla	Bovidae	U	L	3
E22-182	femur	shaft	Mammalia	Artiodactyla	Bovidae	U	U	1b/2a
E22-552	U	other	Mammalia	U	U	U	U	U
E22-561	U	other	Mammalia	U	U	U	U	U
E22-717	femur	shaft	Mammalia	Artiodactyla	Bovidae	U	U	2
F21-194	U	other	Mammalia	U	U	U	U	U
F21-48	long bone	shaft	Mammalia	U	U	U	U	U
G13-165	long bone	shaft	Mammalia	Artiodactyla	Bovidae	U	U	3
G14-1201	U	other	Mammalia	U	U	U	U	U
G14-19	metapodial	shaft	Mammalia	Artiodactyla	Bovidae	U	U	3b/4a
G15-60	rib	shaft	Mammalia	U	U	U	U	3b/4a
G17-217	radius	shaft	Mammalia	Artiodactyla	U	U	U	2
G17-264	U	other	Mammalia	U	U	U	U	U
G17-70	U	other	Mammalia	U	U	U	U	U
G17-88	femur	shaft	Mammalia	Artiodactyla	Bovidae	U	U	4
G18-134	U	other	Mammalia	U	U	U	U	U
G22-303	rib	shaft	Mammalia	U	U	U	U	U
G22-304	rib	shaft	Mammalia	U	U	U	U	U
G22-312	U	other	Mammalia	U	U	U	U	U
G22-582	rib	shaft	Mammalia	U	U	U	U	U
H17-123	U	other	Mammalia	U	U	U	U	U
H17-149	femur	shaft	Mammalia	U	U	U	U	3
H17-470	long bone	epiphysis	Mammalia	U	U	U	U	2
H17-474	radius	shaft	Mammalia	U	U	U	U	5
H17-573	long bone	shaft	Mammalia	U	U	U	U	2
H17-65	long bone	shaft	Mammalia	U	U	U	U	U
H18-144	U	other	Mammalia	U	U	U	U	U

I16-22	radius	shaft	Mammalia	Artiodactyla	Bovidae	U	U	3
I16-247	long bone	shaft	Mammalia	U	U	U	U	2b/3a
I16-531	femur	shaft	Mammalia	Artiodactyla	U	U	U	3
I17-23	long bone	shaft	Mammalia	Artiodactyla	Bovidae	U	U	2
I22-2	long bone	shaft	Mammalia	U	U	U	U	2
J16-301	long bone	shaft	Mammalia	U	U	U	U	1b/2a
J16-441	long bone	shaft	Mammalia	Artiodactyla	Bovidae	U	U	2b/3a
J16-476	long bone	shaft	Mammalia	U	U	U	U	1b/2a
J16-52	long bone	shaft	Mammalia	U	U	U	U	3
J17-1278	U	other	Mammalia	U	U	U	U	1
J17-398	radius	shaft	Mammalia	Artiodactyla	Bovidae	*Gazella* sp.	U	2a
J19-10	U	other	Mammalia	U	U	U	U	U
K7-108	metapodial	shaft	Mammalia	Artiodactyla	Bovidae	*Gazella* sp.	U	1b/2a
K7-215	radius	shaft	Mammalia	Artiodactyla	Bovidae	U	R	3a
K7-246	long bone	shaft	Mammalia	U	U	U	U	U
K7-317	tibia	shaft	Mammalia	Artiodactyla	Bovidae	U	R	1b/2a
K7-707	long bone	shaft	Mammalia	U	U	U	U	1b/2a
K8-132	metapodial	shaft	Mammalia	Artiodactyla	Bovidae	U	U	2b
K8-133	humerus	shaft	Mammalia	Artiodactyla	Bovidae	U	U	4a
K8-148	metapodial	shaft	Mammalia	Artiodactyla	Bovidae	U	U	2b
K8-1641	mandible	tooth	Mammalia	Cetacea	Physeteridae(?)	*Physeter macrocephalus(?)*	U	6
K8-246	humerus	shaft	Mammalia	Artiodactyla	U	U	U	3b
K8-249	metapodial	shaft	Mammalia	Artiodactyla	Bovidae	*Gazella* sp.	U	2b
K8-415	femur	shaft	Mammalia	Artiodactyla	Bovidae	U	U	4b
K8-43	femur	shaft	Mammalia	Artiodactyla	U	U	U	2b
K8-565	humerus	shaft	Mammalia	Artiodactyla	U	U	U	1b
L7-226	tibia	shaft	Mammalia	Artiodactyla	Bovidae	*Gazella* sp.	L	2b
L7-519	femur	shaft	Mammalia	Artiodactyla	Bovidae	*Gazella* sp.	U	2a
L7-983	humerus	shaft	Mammalia	Artiodactyla	Bovidae	*Bos primigenius*	U	5
L8-1203	humerus	shaft	Mammalia	Artiodactyla	Bovidae	U	U	3
L8-1377	humerus	shaft	Mammalia	Artiodactyla	Bovidae	*Gazella* sp.	L	2a
L8-704	mandible	tooth	Mammalia	Artiodactyla	Suidae	U	L	3
L8-754	rib	shaft	Mammalia	Artiodactyla	Bovidae	*Bos primigenius*	U	5

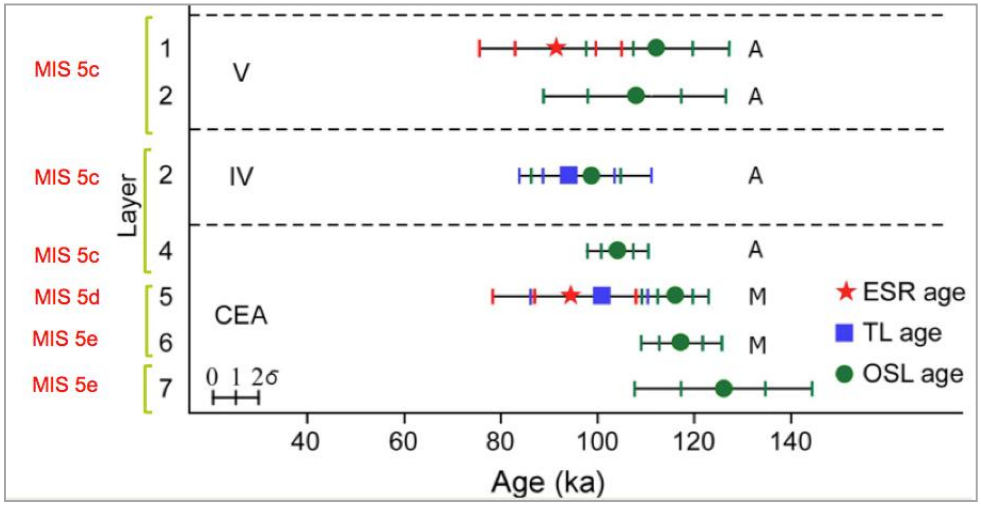

Figure S8. Weighted mean ages for MSA layers at Contrebandiers Cave derived from three independent dating techniques, related to STAR Methods. 'A' represents the so-called Aterian and 'M' represents the so-called Maghrebian Mousterian stone tool industries. Figure modified from Dibble et al. (2012).

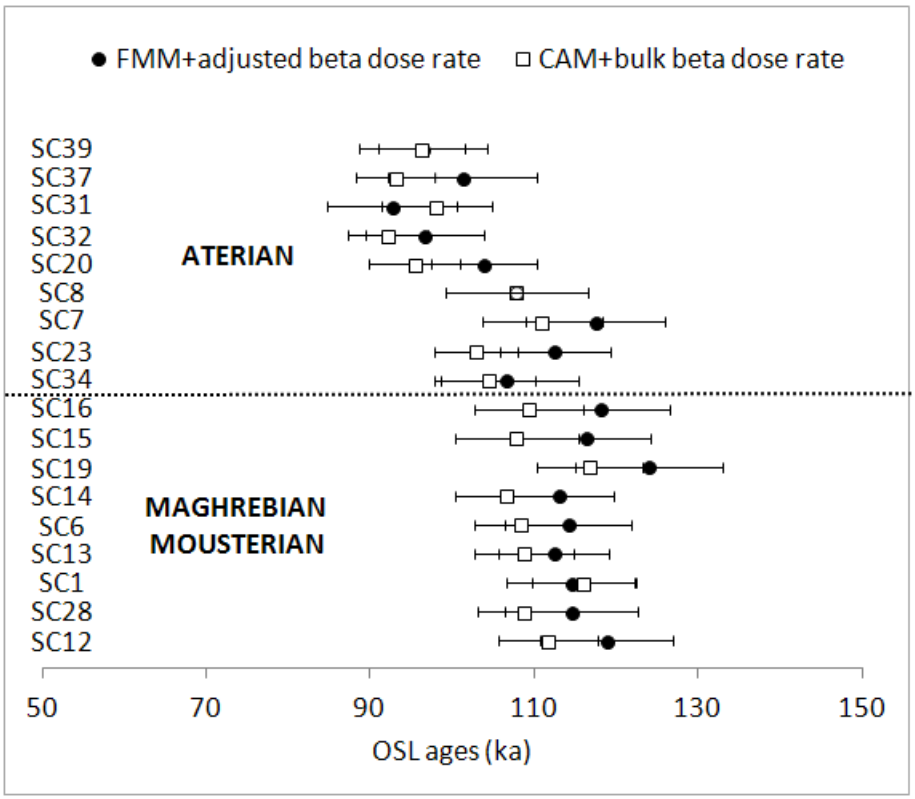

Figure S9. Comparison of ages for the samples collected from layers in which bone tools were found with (filled circles) and without (open squares) the beta dose correction method of Jacobs et al. (2011), related to STAR Methods.