The Neandertals

Part IV:
The Debate over Neandertal Abilities

by
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July, 2020

H. What's wrong with wood…?

One of the Schoningen Throwing Spears

300-400 Ka

Irony: Wood not stone

- A fundamental irony of Paleolithic (or “Old Stone” Age) archaeology is that it concerns a period of human history when most artifacts probably were made from wood.
  - Suggested by the heavy use of wood as raw material among recent or ethnographic hunter-gatherers and
  - repeated discovery of microscopic traces of wood-working on the edges of Paleolithic stone tools.
  - Lower and Middle Paleolithic: limited evidence of use of bone, antler, and ivory (relative to the Upper Paleolithic and recent hunter-gatherers).

Schöningen excavation:

Schöningen mine in Lower Saxony, northern Germany.

'Outstanding' preservation of wooden artefacts in the water saturated lakeside sediments in Schöningen

Oldest Wooden Spears: Schöningen, Germany; 400 Ka


Wooden thrusting spear, Schöningen, Germany, about 400,000 years old.

- 8 wooden spears like this one were found at Schöningen, Germany, along with stone tools and the butchered remains of more than 10 horses.
- These spears are currently the oldest known wooden artifacts in the world.
- Along with some still embedded in horses.
- Schöningen spears had ballistic qualities indicating that they were thrown as javelins
- created by using stone tools to sharpen both ends of 2-meter long spruce shafts that had been scraped smooth.

Wooden thrusting spear, Schöningen, Germany, ~400 Ka.
Image Credit: Chip Clark, Smithsonian Institution

Date of discovery: 1995
Discovered by: Hartmut Thieme
Site: Schöningen, Germany

Javelin throwers hit targets 65 feet away with identical models: did Ns or H. heidelbergensis throw spears?

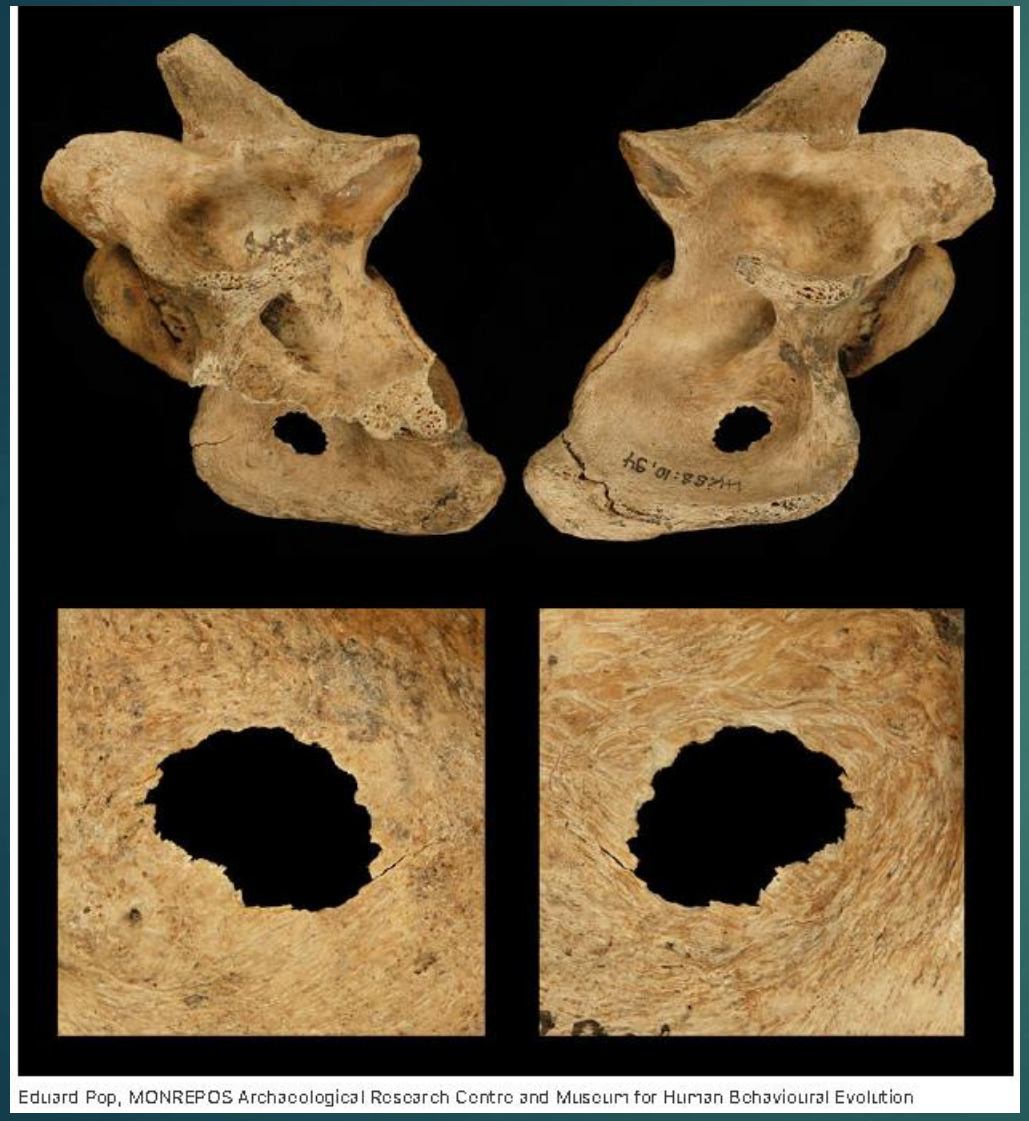
2020: 300 Ka Throwing sticks at Schöningen, Germany

25 inches long

In situ

Swan & Duck bones too.

Deer wound and N hunting technique: close range hunting



Eduard Pop, MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution

Upward thrust to hip required to make hole

Digging sticks, 171 Ka, at Poggetti Vecchi, Grosseto, Italy.

Digging sticks, 171 Ka, at Poggetti Vecchi, Grosseto, Italy.

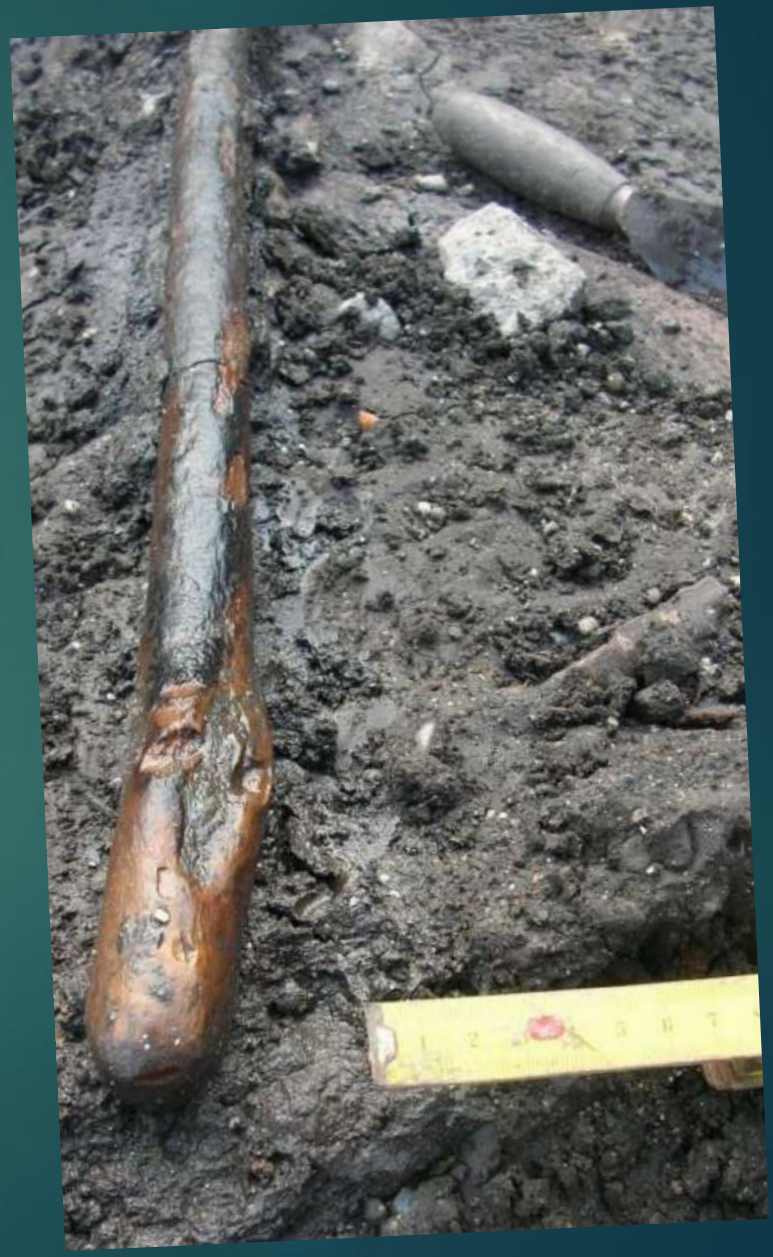
- Oldest known multipurpose tool forged in fire; earliest use of fire for toolmaking among Neandertals.
- Neanderthals using fire to craft tools;

- 39 3-foot-long sticks made of boxwood that had been rounded at one end and sharpened at the other; made mostly of hard boxwood, but also of oak, ash, and juniper

- Identical to digging sticks used by hunter-gatherers to gather tubers

- 200 stone artifacts at the site; but no hominin bones

Aranguren et al. 2018



Pointed tool immediately following its recovery. b) Current appearance of the point fragment following preservation efforts.

- Two wooden tools: N, 90 ka
- Aranbaltza III (Spain),
- It is a wooden tip of yew that measures 15 cm and was manufactured by Neanderthals 90 Ka.
- They applied fire to it to harden it or to carve it, and they used it to dig, to extract roots and tubers, as a spear, or to release silex cores embedded in clay.
- During its treatment it was curved when losing water.

Rios-Garaizar J, López-Bultó O, Iriarte E, Pérez-Garrido C, Piqué R, Aranburu A, et al. (2018)
A Middle Palaeolithic wooden digging stick from Aranbaltza III, Spain. PLoS ONE 13(3): e0195044.

N hunting vs gathering

- By the 1960s, it was widely believed that Neanderthals were primarily carnivores who dwelt in frigid surroundings with very little vegetation.

- This was in part based on
  - ignorance of Indigenous plant use in comparable habitats,
  - And because anthropology was male-dominated, and particularly focused on the lives of big-game hunters.

N hunting vs gathering

- Reactions against this perspective, – including from feminist scholars, pointed out that a significant proportion of calories came from the ‘slow and steady’ second part of the hunter-gatherer equation: not only plants, but small-game hunting and fishing.

- In reality, people who live by foraging are deeply embedded in their environment, and everyone, including women, elders and young children, takes part.

Neanderthal hunting

- Negative N Hypothesis: Neandertals were less effective hunters.
- Originally, Binford theory that Ns were scavengers -- disproved.

- Old idea that Ns killing ability was limited to thrusting spears equipped with simple stone points.

- Current idea: Hunting encounter technique involved high risk close contact with large prey animals resulting in high trauma rates; lots of healed bone breakage
- All adult Neandertal skeletons show extreme physical activity and healed upper-body fractures

Hunting

- Hunting was the main method of meat procurement by Neandertals.

- Extremely successful ambush hunters
  - Thrusting spears (not thrown?) w/ hafted stone points
  - No long-distance hunting (locally available game)
    - Cave bear, Deer, Woolly rhinoceros, mammoth, wild cattle, reindeer, horse, wild ass, ibex, saiga, goat

- Presence of twisted fibers implies possible use of snares

Hunting

- They also adapted their hunting strategies to the environment:
  - ambushing solitary prey and groups of animals in forests,
  - stalking bison and other herd animals on the steppes,
  - harvesting birds, rabbits and seafood at the shore

N hunting: use of topographic traps

- Hunting was the main method of meat procurement by Neandertals.

- Evidence shows that Ns were able to
  - organize game drives using landscape features as natural traps,
  - intercepting groups of animals at repeatedly used locations.

- Hunting efficiency is hardly a measure of modernity. Modern San have weak bows & slow acting poison; they get more calories from gathering.

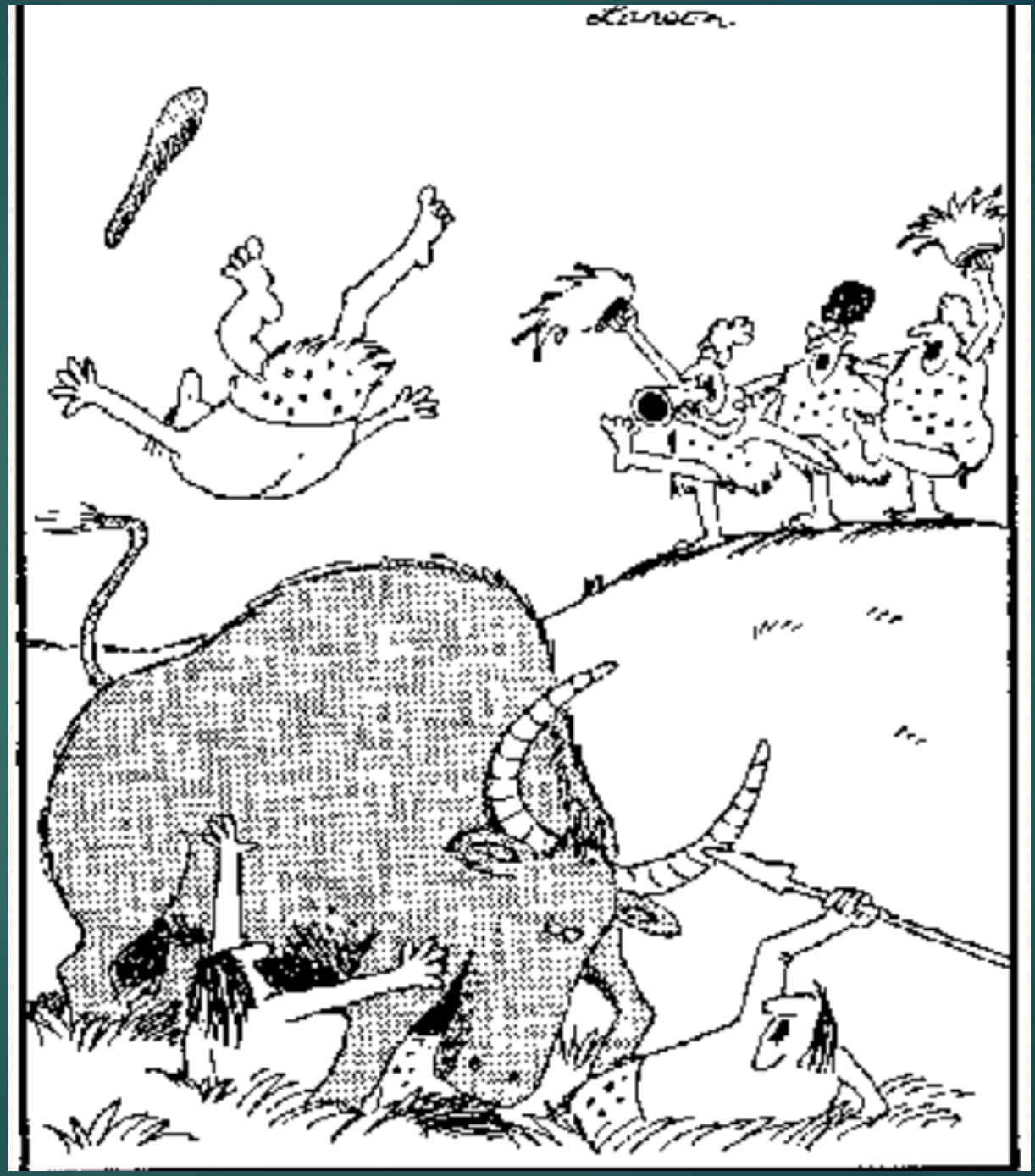
Hunting

- Evidence they used stone-tipped spears to hunt. For instance, it has been observed that Levallois points often bear impact scars on their tips (Shea 1988).
- Retouched **Mousterian points** from several sites in western Europe (La Cotte de St. Brelade, Bouheben, Oscurusciuto, and Abric del Pastor) have been identified as bearing impact scars too (Villa & Soriano 2010).
- These stone-tipped spears were probably used at close-range for thrusting, or thrown short distances as part of an ambush hunting strategy —
- Historical perspective = no projectiles: neither the stone points nor the features of Neanderthal anatomy support the notion that Neanderthals used long-distance projectiles (Shea & Sisk 2010, Churchill & Schmitt 2002, Rhodes & Churchill 2008); this view has been challenged

Comparison of MH thrown spear vs N thrusting spear force

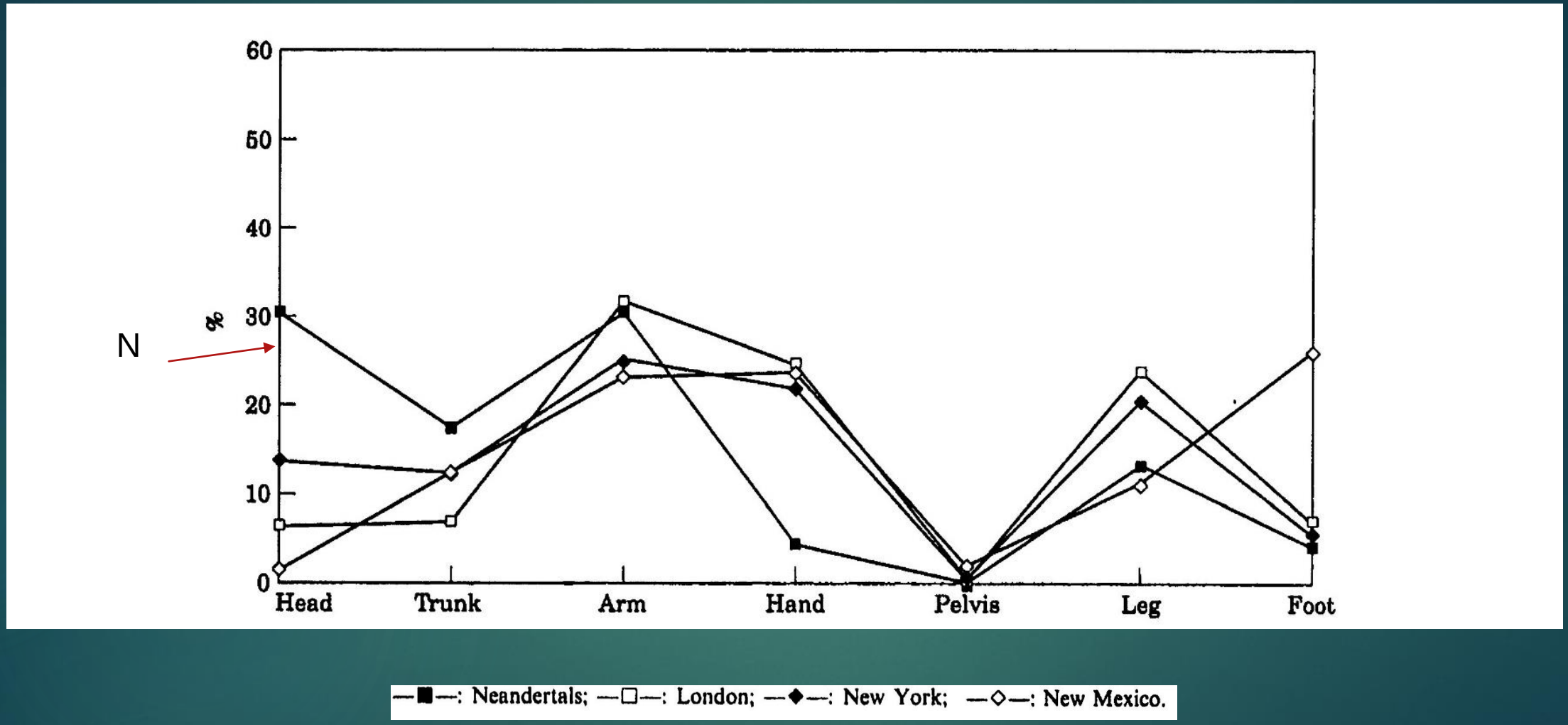
- Study: Using forensic gel:
- Thrown spear had about 30% of penetrating power of N thrust; only the spear head entered
- N thrust entered 8-10 inches

Rodeo Neandertals



1995 Berger & Trinkaus study: Neandertal injuries had identical injury profiles with American rodeo riders

N upper body trauma



Percentage distributions of traumatic lesions by anatomical region for Neandertals without Degenerative Joint Disease vs. Recent human clinical samples

Neandertal and American Rodeo Riders

- Of 500 N fossil skeletons, all 50% of adult fossils have broken mended bones in upper torso (like American rodeo rider injuries)

- In 1995 Berger and Trinkaus (J. Archaeol. Sci. 22, 841–852) proposed that the anatomical distribution of Neandertal trauma, with a predominance of upper body lesions (esp. heads and necks), reflected close-quarter ambush hunting (the “Rodeo rider” hypothesis).

Injuries: Rodeo Riders?

- Traditional explanation for why Neanderthals appeared to have the same injuries as rodeo riders:
  - Ambushing large animals and attacking them with spears
  - which brought their upper bodies within striking distance of large, hoofed animals

Injuries: Rodeo Riders?

- Signs of injury can be found on almost every well-preserved adult Neanderthal skeleton (Trinkaus 1995; Berger and Trinkaus 1995)
  - concentrated in the head and neck, producing an uncommon pattern of injury that may have
  - resulted from hunting strategies requiring proximity to large prey animals (Berger and Trinkaus 1995),
  - or interpersonal aggression? (e.g., Churchill et al. 2009).
- Berger & Trinkaus: all of the Neandertal injury distributions provide a close match to the Rodeo traumatic lesion pattern, primarily as a result of a high incidence of head & neck trauma; similarity to the Rodeo lesion distribution suggests frequent close encounters with large ungulates unkindly disposed to the humans involved.

Injuries: Rodeo Riders?

- The majority of injuries are healed or partially healed, therefore suggesting that
  - Neanderthals showed some level of compassion:
  - Many of the injured individuals would not have survived the period of convalescence without being cared for by others (Trinkaus 1983).

- *** Update: Most recent comparisons to MHs show that MHs had very similar injuries.
- Trinkaus has now rejected Rodeo hypothesis. Traumas identified in Neandertal skeletal remains are no different from same period MHs or extant hunter-gatherers.

Bone Beds: “Shoot first, ask questions later: Interpretative narratives of Neanderthal hunting”.

- 2018 study: Mark White, Paul Pettitt and Danielle Schreve:
  - comparison of 5 N “kill sites”
  - where they hunted and butchered animals in France, Germany, and Poland
- The five N sites represent different species of prey animals: bison, horse, rhinoceros, reindeer, and aurochs. The sites vary in geological age from the last interglacial, from 120 to 50 Ka.

- Neanderthal hunting involved superb tactical planning, using the landscape to disadvantage prey.

Mark White, Paul Pettitt, Danielle Schreve, 2016

Shot first: use of topography in hunting

- Individually, each site shows Neandertals making effective use of geographic features of the landscape, such as
  - changes in topography,
  - narrow side branches to valleys, and
  - marshes next to steep hillsides,
  - which enabled them to channel fleeing animals into situations where they were cornered, and then to kill indiscriminately.
- Strategy: Hunting communally, killing animals at a topographical and seasonal advantage, and making use of the most valuable parts of carcasses was.

Mark White, Paul Pettitt, Danielle Schreve, 2016

Shoot first, ask questions later: use of topography

- Their conclusions indicate that
  - Neanderthals did not necessarily pre-select individuals from a herd, who they then isolated, pursued and killed
  - Ns exploited their prey's avoidance and flight behaviors
  - And ambushed whole groups, which they slaughtered indiscriminately in these topographic traps

Shoot first, ask questions later: use of topography

- Strong evidence that Ns were highly selective in the carcasses they then chose to process. After the kill, only the ‘prime’ animals were chosen to butcher.

- Ns were excellent careful tacticians, casual executioners and discerning diners.

- These sites show Neandertals maximizing the chance of successful kills by using topography, while minimizing need for chase and tracking injured animals.

The bison bone beds: social hunting

- Late and Middle Paleolithic faunal assemblages in Europe have produced convincing evidence of communal hunting of large ungulates: hypotheses concerning the skills of Neanderthals as social predators.
- Evidence for Neandertal prey selectivity at five sites.
- One of those, Mauran, France, was a site where Neandertals repeatedly killed groups of bison, amounting to more than 130 animals over many years.
- Similar pattern of bison hunting in Gran Dolina, Atapuerca, Spain:

  ~ 400 Ka, hominins left the partial remains of more than 60 bison, forming a bone bed of more than 22,000 specimens.

Bone Beds: N hunting of single species

- Monospecies sites indicate that
  - Neanderthals were selectively hunting specific species and that
  - Neanderthals were deliberately targeting and selectively taking specific individuals (i.e. prime adults) within the group
- The resulting picture is of a selective hunting strategy, involving
  - tactical planning about the seasonal availability of certain taxa at specific points in the landscape,
  - regular ‘on the spot’ decision making about which specific individuals were to be targeted, presumably in order to maximize gain rather than to minimize risk.

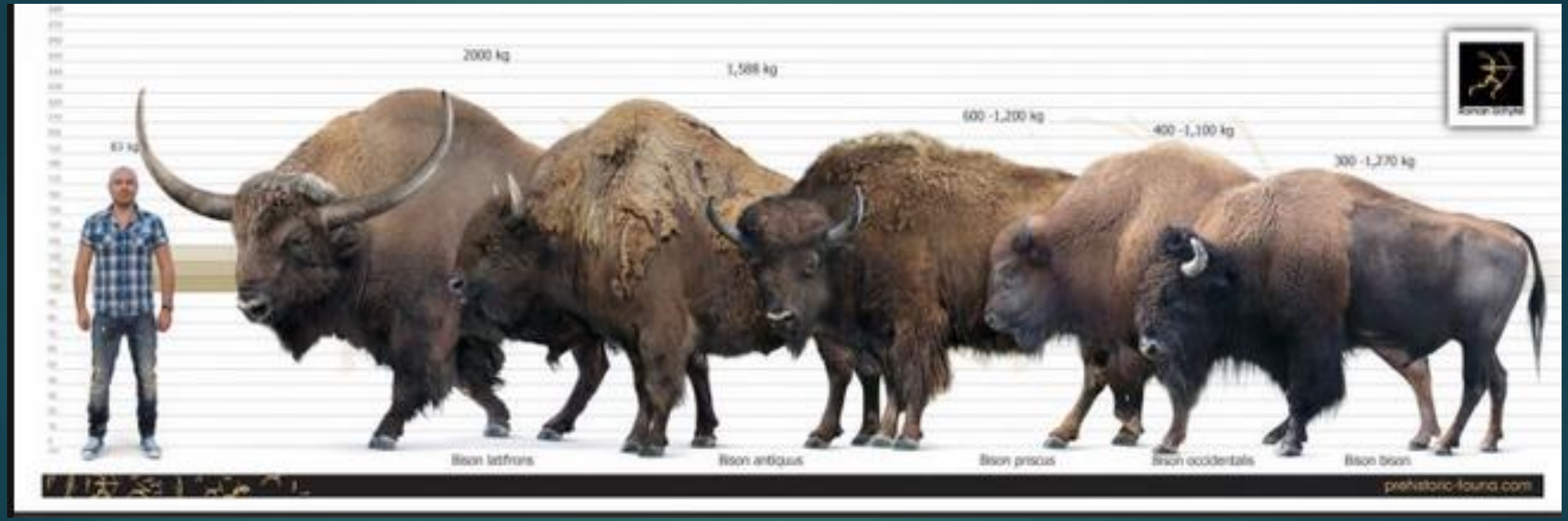
Mark White, et al., 2015

Bison Beds

- A series of kill sites from the Middle Palaeolithic of Europe
  - Mauran, La Borde, Taubach, Zwoleń and Salzgitter Lebenstedt.

- The five sites represent different species of prey animals:
  - bison, horse, rhinoceros, reindeer, and aurochs.

Bone Beds: Eurasian steppe bison (Bison priscus) at Mauran



N Bone beds: Mauran & Bison

- Mauran, France: Neandertals repeatedly killed groups of bison,
  - 137 animals over many years; estimated that >4000 bison were killed at the site,
  - multiple hunting events over a long period of time, perhaps a millennium with individuals and small groups taken each time.
- The topography—
  - kills took place at the end of a small gully bounded by limestone escarpments,
  - a rocky limestone barrier fronted by open vegetation and marshy ground — provided a natural trap into which Neanderthals could drive and corral bison
- Cows and young make up 80%, and adult males only 20%; in late summer and early autumn; unselectively slaughtered from among all animals within a typical cow herd

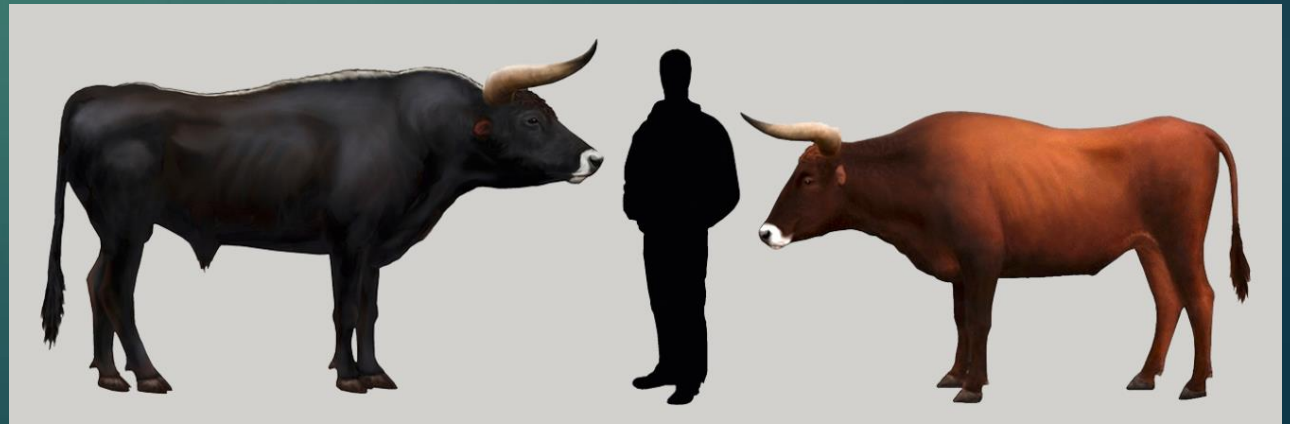
(Farizy et al., 1994).

Mauran & Bison

- Neanderthals repeatedly used the natural topography of Mauran:
  - a cul-de-sac with open vegetation and marshy ground, to disadvantage the bison.
  - Exploiting their own flight behavior to engineer a stampede
  - Ns = a case of ‘shoot first and ask questions later’.
- The use of locally available lithics also shows that this can be seen as a planned practice in a well-known landscape

N Bone Beds: Aurochs: La Borde, France

- Aurochs: nursery herds i.e. females and sexually immature individuals, the implication being that Neanderthals selected animals based on their relative vulnerability and lower levels of aggression. Animals were butchered on-site using a tool kit of local quartz,
- representing the wholesale slaughter of cow herds, perhaps numbering 10 to 20 individuals and dominated by female and young aurochsen; steered them around the foot of the hill, into an existing hole where killing occurred



Bone Beds: Rhinoceros: Taubach, Germany

- The Taubach, Germany, site preserves evidence of multiple single-animal kills of rhinoceros over time.
  - Neandertals were targeting young individuals with a strategy that separated them from other adults.
- Streams and pools at Taubach probably acted as magnet locations for rhinos
- The authors boldly put forth a challenge: However, we eagerly await a convincing Middle Palaeolithic example of a targeted, isolated killing of a medium-large gregarious herbivore.

Bone Beds: Zwolen, Poland & Salzgitter Lebenstedt, Germany

- Horse: Zwolen, Poland:
- Horse trap: Deep ravine valley narrowed to only tens of meters wide, with steep sides some 6 m high; a bottleneck trap near a river

- Reindeer: Salzgitter Lebenstedt, Germany:
- 58 to 54 ka: autumn reindeer hunting by Neanderthals. Driving animals along the main valley, and diverting them into the mouth of the tributary, Neanderthals then slaughtered them.
- The average Inuit required 25 reindeer skins each year

Shoot first, ask questions later

Summary of organisation of hunting at the five sites considered.

Taxon	Site, age	Hunting tactics: Locating the prey	Hunting tactics: Disadvantaging the prey	Hunting tactics: Exploitation of prey behaviour	Hunting tactics: Killing techniques	Hunting strategy	Butchery practises
Bison	Mauran, MIS5a	Predictable autumn rutting and feeding grounds	Use of topography as natural trap	Exploits flight behaviour	Unselective killing of mixed herd	Driving and trapping	Selection of choicest fat, fillets and rump
Aurochs	La Borde, MIS5	Animals probably present in region all year-round	Use of topography as natural trap	Exploits flight behaviour	Unselective killing of mixed herd	Driving and trapping	Little evidence of selection
Rhino	Taubach, MIS5e	Animals predictably attracted to springs as water sources and salt licks	Use of topography for concealment and observation	Exploits inexperienced calves separated from mothers	Selective killing of calves when opportunity presents itself	Stalking and ambush	Butchery of selected individuals
Horse	Zwoleń, MIS5a or 4	Animal movements predicted by the distribution of their resources	Use of topography (bottleneck) as means of disadvantaging and ambushing	Exploitation of flight behaviour	Unselective killing of mixed herd	Driving and ambush	Selection of choicest meat
Reindeer	Salzgitter-Lebenstedt, MIS3	Predictable (i.e. known) autumn migration route	Use of topography (valley) to channel prey	Exploits avoidance behaviour, possible use of noise to 'attract' reindeer	Unselective killing of mixed herd	Driving and ambush	Selection of largest & fattest individuals

El Sidrón Cave
Spain

El Sidrón Cave, Spain, 1994: *Tunnel of Bones*

- 13 Neanderthals that date to 47 to 51 Ka.
- The site is infamous among anthropologists who study the Paleolithic period for the evidence of what appears to be the massacre and possible cannibalization of a family:
- Their bones seem to have been hacked at by stone tools and hammers, probably by another group of Neanderthals, to remove their flesh and marrow.
- 2,300 Neanderthal fossil remnants in Ossuary Gallery; a single deposit, called Stratum III (3 feet deep, 18 feet square)
- Researchers; Javier Fortea & Marco de la Rasilla; Antonio Rosas & Carlos Lalueza-Fox

El Sidrón Cave, Spain, 1994: *Tunnel of Bones*

- 13 people:
  - 7 adults (3 males, 3 females & 1 undetermined),
  - 3 adolescents between 12 and 15 years of age (2 males, 1 female),
  - 2 juveniles between 5 and 9 years of age (1 male, 1undetermined),
  - 1 infant
- 2017 soil sample DNA: Neandertal mtDNA
- Analysis of mitochondrial DNA supports the hypothesis that the 13 individuals represent a family group:
- Seven of the 13 individuals share the same mtDNA haplotype.

El Sidrón 2

- Dated to 49 Ka; Neanderthal lineage-derived features
- 53 stone tools, nonhuman bones are very scarce; no large carnivore tooth marks
- Died externally & deposited in cave:
  - flooding, cave collapse, and disposal by cannibals;
  - dropped into the cave in a single event via a collapse of nearby fissures above the site or, by influx of storm water;
  - in a massive flow deposit;
  - Fact of almost no carnivore teeth marks indicates a fast process removed the bodies from above after death; very rare event

El Sidrón 3

- First sequencing of the Neanderthal Y chromosome was successfully completed from a specimen from Sidrón Cave.
- Based on this sample, researchers estimate that Neanderthals diverged from MHs around 590 Ka
- DNA: diet consisted primarily of pine nuts, moss and mushrooms.
- Over 400 lithic artifacts have been recovered from the Neanderthal occupation at El Sidrón, all made from local sources, mostly chert, silex and quartzite. Side scrapers, denticulates, a hand axe, and several Levallois points are among the stone tools. These artifacts represent a Mousterian assemblage; the makers of the lithics were Neanderthals.

El Sidrón 3: cannibalism

- Although there are no carnivore tooth marks on the bone, the bones are heavily fragmented and show cutmarks made by stone tools, indicating that they were almost certainly killed and cannibalized.
- Evidence for cannibalism includes cut marks, flaking, percussion pitting, conchoidal scars and adhering flakes on the bones.
- Long bones show deep scars; several bones have been cracked open to obtain marrow or brains.
- The bones indicate that they suffered from nutritional stress during their entire lives, and these data together lead researchers to believe this family was a victim of survival cannibalism by another group. No MHs in area at that time.

El Sidrón 5: genetics

- Nuclear DNA Genetics: red hair, O & A blood group, bitter taste perception, FoxP2 (language)
- mtDNA: family related;
  - 3 males have same mtDNA
  - 3 females had different mtDNA
  - Like modern hunter gatherers, males stay in group, females join new groups; genes moved across N populations via the women
- 2 of women directly related to children
- Familial inbreeding would have caused reduced genetic diversity

El Sidrón 6: Ns were thin on the ground

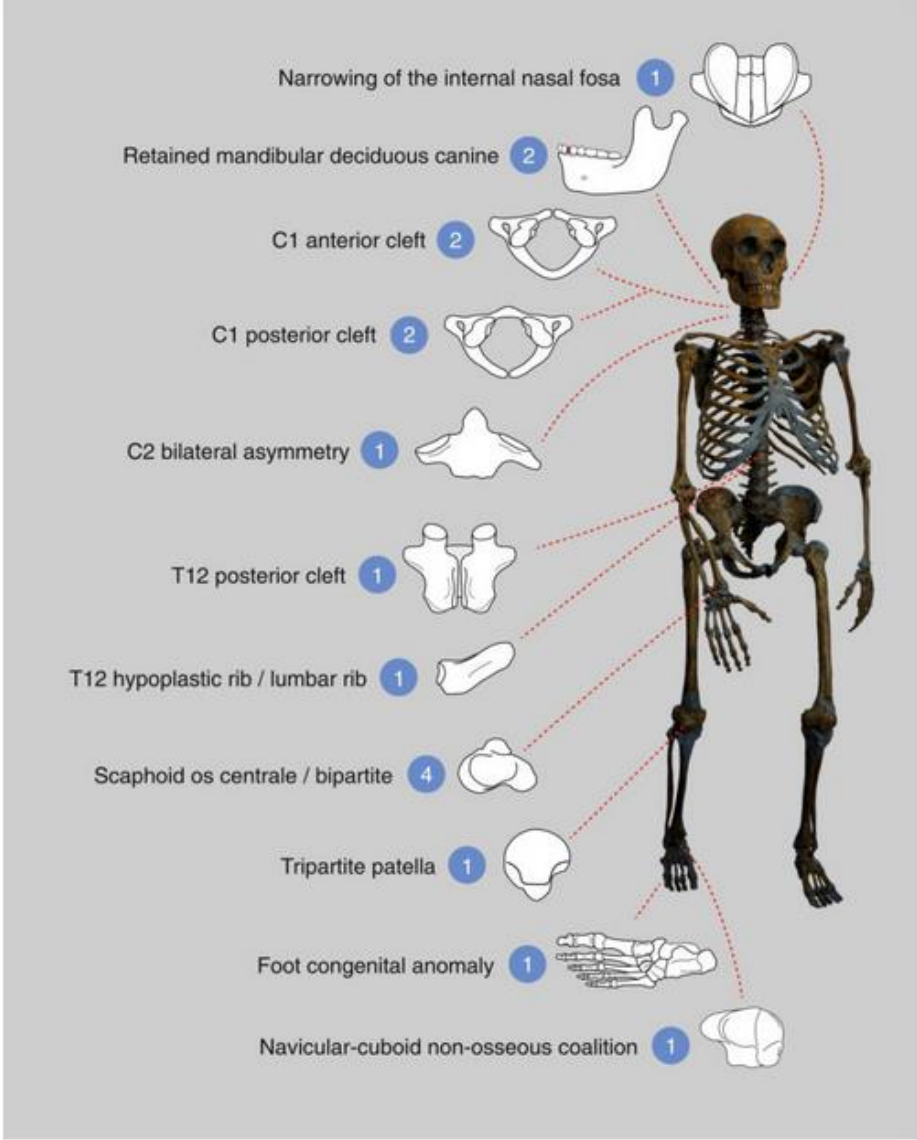
- Populations of N began to shrink;
  - climate between 50 and 30 K, varied between cold dry periods and warm wet periods;
  - El Sidrón occurred in the former cold period;
  - wooded areas for ambush hunting began to shrink
  - populations more isolated,
  - less gene flow between them,
  - suffered from genetic inbreeding

El Sidrón, Spain: Inbreeding

- DNA tests from these bones indicate that inbreeding and a small population size were likely factors contributing to the physical peculiarities in this family.
- Anomalies and deformations suggest that the members of this group (and their parents) were mating with their close kin.
- Found 17 examples of congenital anomalies due to inbreeding
- The 13 El Sidrón Neanderthals share much longer segments of their DNA than would be expected if they were the offspring of non-relatives.

Family inbreeding at El Sidrón: 17 congenital anomalies

Structural malformations of various body parts:
Narrowing of the internal nasal fosa 1
Retained mandibular deciduous (baby tooth) canine 2
C1 anterior 2
C1 posterior cleft 2
C2 bilateral asymmetry
T12 posterior cleft
T12 hypoplastic rib / lumbar rib
Scaphoid os centrale / bipartite 4
Tripartite patella
Foot congenital anomaly
Navicular-cuboid non-osseous coalition



Researchers catalogued 17 congenital anomalies in a group of Neanderthals in the El Sidrón Cave in Spain. (The number of instances of each type of deformation is shown in blue.) Ríos et al./Nature

El Sidròn

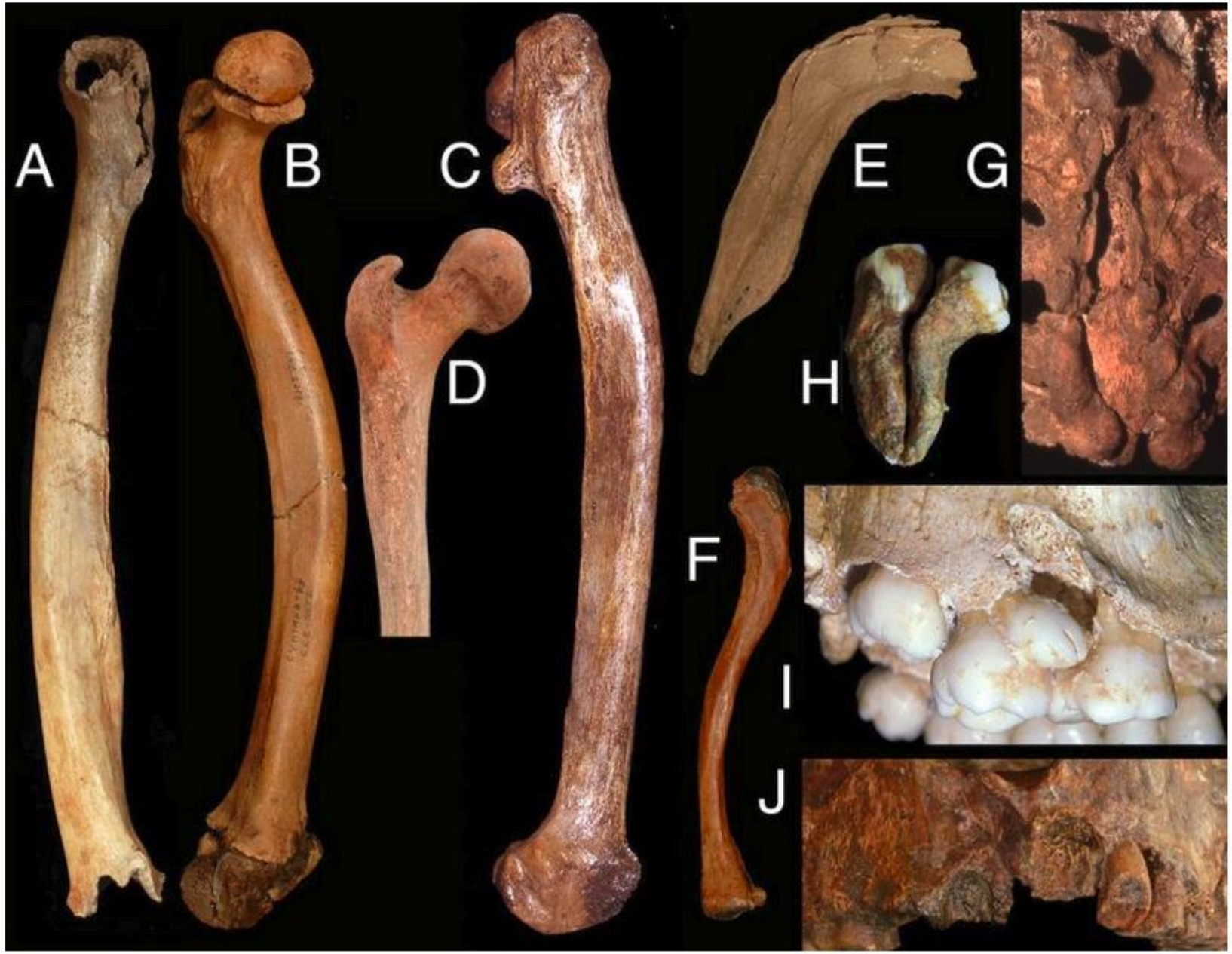
- Genetically, the three adult males in the group were closely related enough to be brothers, cousins, or uncles,
- Four adult females in the group came from three distinct genetic lines.
- Male-Kin bonding: males exchanged females with another local, slightly less closely related group.
- N mating between individuals who shared recent ancestors was fairly frequent, and possibly unavoidable, if local populations were small.

El Sidrón

- In general, inbreeding leads to a problematically small gene pool. Rare harmful traits that might disappear in larger populations tend to be amplified if close kin interbreed.

- In MHs, 1 in 3600 share 10% of DNA, meaning extremely related.

- Skeletal evidence of inbreeding, such as abnormally bowed thigh bones, deformed arm bones, and even a case of a toddler with a swollen brain case consistent with hydrocephalus



Inbreeding has caused developmental abnormalities throughout human history: These oddly shaped bones and fused premolars were found in humans who lived between 1.5 million and 11,700 years ago. Trinkaus/PNAS

El Sidrón

- Simple reason why inbreeding occurred: Pickings were slim.
- Ns were fairly isolated. Their mating patterns reflected small population size and low population density.
- With genetic and skeletal evidence of inbreeding, this family is representative of the beginning of the demographic collapse of the Ns

N weaponry

- Negative view: Neandertal weaponry was inferior to AMH projectile technology
  - Claim that upper limb morphology associated with projectile throwing occurs in Upper Paleolithic humans but is absent in Neandertals.
  - MHs used spear throwers and/or bow and arrow to launch their projectiles. But evidence indicates not until after 20 Ka
  - Schöningen spears had ballistic qualities indicating that they were thrown as javelins.
  - The humerus and shoulder morphology associated with overarm throwing were already present in *Homo erectus*.

Did Ns throw spears?

- One of the more persistent explanations of why neanderthals died out is their (allegedly) inferior throwing ability.

- Ns not throwing: cited evidence for this conclusion comes from two areas:
  - anatomical differences between us and Neanderthals and
  - pathological/lifestyle differences.

- Pathological evidence - study of upper torso injuries in Ns: getting “up close and personal” with animals (i.e. used close up spear thrusting; not using ranged weapons); rodeo theory

Did Neandertals use projectiles?

- Small sampling (3) of Neanderthal's skeletal remains: no "throwing arm“
- This anatomical feature is measured by the degree of humeral retroversion in the dominant arm and in bilateral asymmetry.
- Lack of backward displacement at the shoulder joint
- Neanderthal could throw spears short distances, but never graduated to the use of bow and arrows or spear-throwing technologies.

Throwing in the Middle and Upper Paleolithic: inferences from an analysis of humeral retroversion, Jill Rhodes and Steven Churchill, 2009

MHs superiority in hunting technology

- Humans took steps to improve their throwing ability at every possible opportunity: using lighter microliths as spearpoints, adopted the atlatl and, later, the bow and arrow.
- MH Projectile use: ~44-42 Ka: evidence for the use of (poisoned bone) arrows at Border Cave in South Africa.
- But number of quartz pieces for arrows is very small;
- Regular appearance of arrow tips only at 20 Ka;

N weaponry 2

- No evidence for Idea that bow and arrow technology was a factor in the demise of Neandertals.
-
- Australian aboriginals did not use bow and arrow; Native American used them only after 23 Ka
- So the Idea that spear throwers and bow and arrow were first developed in the MSA of South Africa before 60 ka & gave advantage to MHs as they left Africa and encountered Neandertals equipped with only hand-cast spears: there is no archaeological evidence in its support

Neandertals did not use projectiles?

- What of fact the H. heidelbergensis had German spears & that H. erectus was capable of throwing?
- I
- Lovita, R., Schönekeß, et al. 2013: experimental look at fracture patterns of Levallois points indicates they occur if thrown at high speed
-

Right-handed: pelt scraping

- Shaw CN, Hofmann CL, Petraglia MD, Stock JT, & Gottschall JS (2012). Neandertal humeri may reflect adaptation to scraping tasks, but not spear thrusting. *PloS one, 7* (7) PMID: 22815742

- Historic theory that Neanderthal right-arm muscles was a result of the right-handed use of spears to hunt large game animals.

- Another hypothesis: muscular asymmetry is the result of a much less dangerous task: the arduous scraping of the animal skins that Neanderthals used. Neanderthal stone scrapers were mostly used by right-handed individuals.
- Neanderthal skeletal record shows that 76 percent of 69 Neanderthals were dominant in their right hands
- Evidence from Neanderthal art: one handprint on the wall of Maltravieso Cave in Spain. The handprint was a left hand. The artist painted right-handed.

Arm muscle uses: scraping

- Lifestyle evidence: muscle bone attachment from specific arm uses
- When you thrust a spear, one arm “guides” the spear whilst the other one puts in all the effort, so if Neanderthals were doing this, then they should have evidence of bigger muscles on one side of the body.
- Few N skeletons with both arms preserved
- Ns – asymmetric muscle evidence: their right arm is typically larger than their left, indicating that their right arm was stronger.
- This has been cited as evidence of them using thrusting spears. Being right handed, these neanderthals would generate most of the thrust for this jabbing with their right hand resulting in the observed asymmetry.

N spear use vs hide scraping

- New study has argued that this line of reasoning is also flawed. A team of researchers used an electromyograph to record the electrical activity produced by muscles during various activities a neanderthal may have participated in, including spear thrusting.
- Contrary to what would be expected, they found that muscles in the right arm weren't used more during spear thrusting. Indeed, the left arm seemed to be used more.
- Spear thrusting cannot adequately explain the asymmetry we observe in Neanderthals.
- Their results showed that the push/pull motions associated with scraping a hide would require more effort by the right hand. So it would seem that it was actually making clothes, not thrusting, which produced the asymmetry.

Javelin Throw: 93 meters

2013 Dissertation: Biomechanics of Spear Throwing

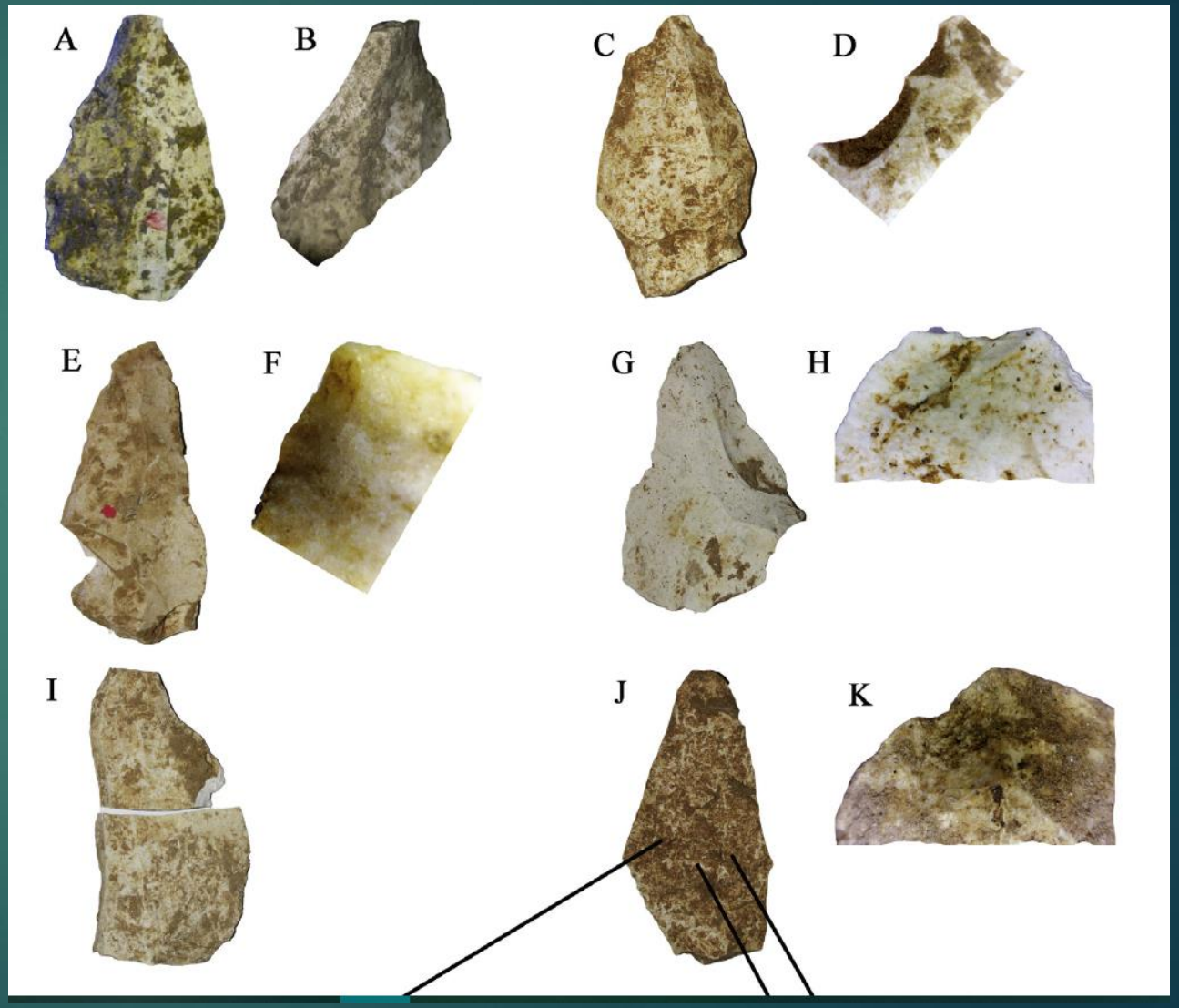
- The Biomechanics of Spear Throwing: An Analysis of the Effects of Anatomical Variation on Throwing Performance, with Implications for the Fossil Record, by Julia Marie Maki, 2013
- Conclusions: variation in throwing performance is primarily affected by the anatomy of the body, not the throwing arm; musculature of the arm is not relevant for throwing performance; legs & torso are more important than arms
- Upper limb EMA (effective mechanical advantage) and muscle sizes, glenoid fossa shape and humeral retroversion angle for spear throwing are conclusively rejected as causes of better throwing.
- The earliest known spears appear to be significantly larger than any ethnographically known throwing spears and this has been used as evidence that these early objects were not thrown but thrust.

Anatomy of Throwing ability

- In this study subjects were able to successfully throw objects much heavier than ethnographic spears, and in fact imparted 57% more energy to the heaviest spear relative to a spear within the range of ethnographic spears. There is no reason to conclude based on their size that these early spears were not thrown.
- Current data do not provide the resolution necessary to determine whether a shorter, broader body form would be superior, inferior, or comparable to a taller, narrower body form.
- But no known differences between Neandertals and other hominin populations are due to differential selection for throwing performance.
- Other anatomical measures that have been used to infer a lack of habitual throwing in Neandertals can now be conclusively rejected. Previous research using the morphology of the shoulder or arm to infer that Neandertals did not habitually throw must be rejected. No aspect of anatomy or morphology that is known to differ between Neandertals and early modern humans is indicative of selection for or more frequent throwing in early modern humans.
- Throwing ability may have been achieved from *H. erectus* onward.

Possible Projectiles: at Abri du Maras

- Hafted projectile points: Five pointed pieces from the Abri du Maras show types of impact fractures that have been suggested as diagnostic of use as weapon tips
- Size: ~ 54-79 mm (2-3 inches)
- Interpreted as possible hand-thrown projectiles; darts



Neandertal Subsistence

- Extremely successful hunters
  - Classically considered ambush hunters
  - Used spears with hafted stone points which were glued
  - No long-distance hunting (locally available game)
    - Cave bear, Deer, Woolly rhinoceros, mammoth, wild cattle, reindeer, horse, wild ass, ibex, saiga

- Fairly efficient gatherers
  - Berries, greens, roots –
  - Ns understood seasonality (limited time frame) of plants, birds, and animals

Hunting, not scavenging

- Ns as scavengers, not hunters: now discarded
- N sites with remains of prime adult animals as prey
- Schoeningen spears: weighted at front 3rd like modern javelins
- Points embedded in bone (Umm-el-Tiel, Syria - A Levallois point embedded in the vertebra of a wild ass; possibly a projectile

Eric Boeda, et al., 1999

Ns and cave bears

- Neanderthals ambushed cave bears as they awoke from hibernation and then stole their caves.

- Marco Peresani et al.: excavated the Rio Secco and Fumane caves in northern Italy - 1700 bones, most of which belong to about 50 cave bears that lived 50,000 to 43,000 years ago. Comparable to grizzly bears, they could weigh more than 600 kilograms

- Neanderthals and cave bears would have met often as they competed for the same caves. And it seems the Neanderthals were able to take the bears down.

Bears 2

- It is likely that the Neanderthals were mostly after the bears' pelts

- The bones included those of adults, cubs and newborns. That is key, since many bears give birth near the end of winter as they come out of hibernation.
- Neanderthals must have targeted the bears just at this moment. The females, while massive, would have been weak after birth and hibernation. The vast numbers of bear bones imply that Neanderthals often succeeded in killing the animals. But the bears outlasted them

Issue of Preservation Bias

- The Missing Majority: differential preservation of materials in archeological record;
- Most material culture, from Ns and MHs both, is organic and perishable, and rarely makes it into the archaeological record.
- Not only small-boned animals (birds, rabbits, fish), but material culture like string, clothing, tents, etc. do not preserve
- Preservation bias has distorted interpretation of N capabilities

N use of snares

- Negative N Hypothesis: The use of traps and snares to capture animals is the exclusive domain of modern humans. Traps indicate planning and advanced cognition.

- Catching smaller and fast moving game was already within the realm of Neandertals, as early as Middle Pleistocene times.

- This is supported by the presence of twisted fibers. Since fibers are not twisted in their natural state they provide evidence for the manufacture of strings or cordage which would facilitate the manufacture of multi-component technology such as snares

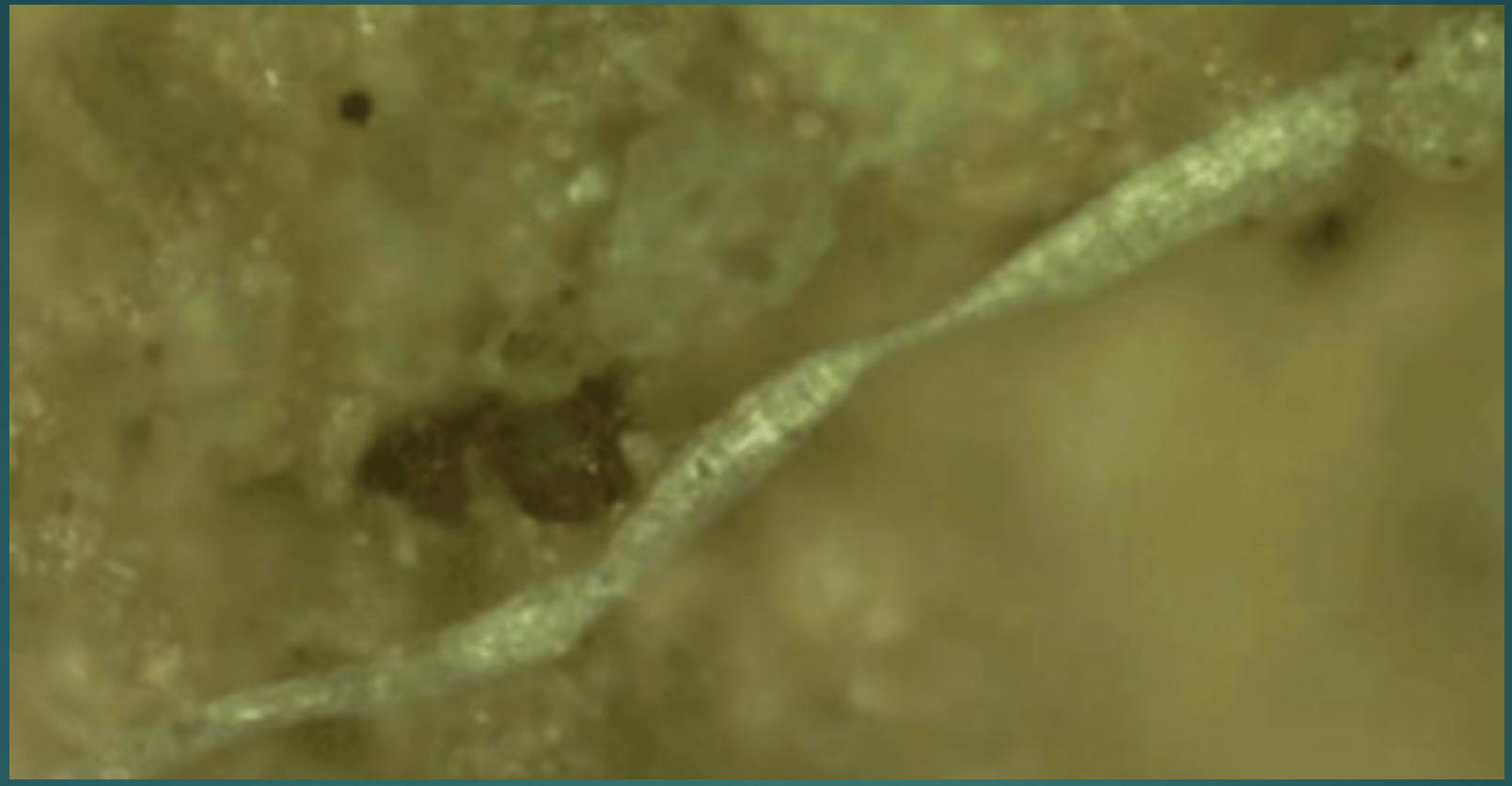
Hardy et al., 2013: Impossible Neanderthals? Making string, throwing projectiles and catching small game

- Residues on stone tools found at Payre in S France, which was occupied by Neanderthals between 250 to 125 Ka. They found traces of fish scales, feathers, wood, hide and starch, indicating that their owners were fishing, hunting small birds, processing wood and hides, and eating vegetables (mushrooms)

- Evidence, in the form of lithic residue and use-wear analyses.

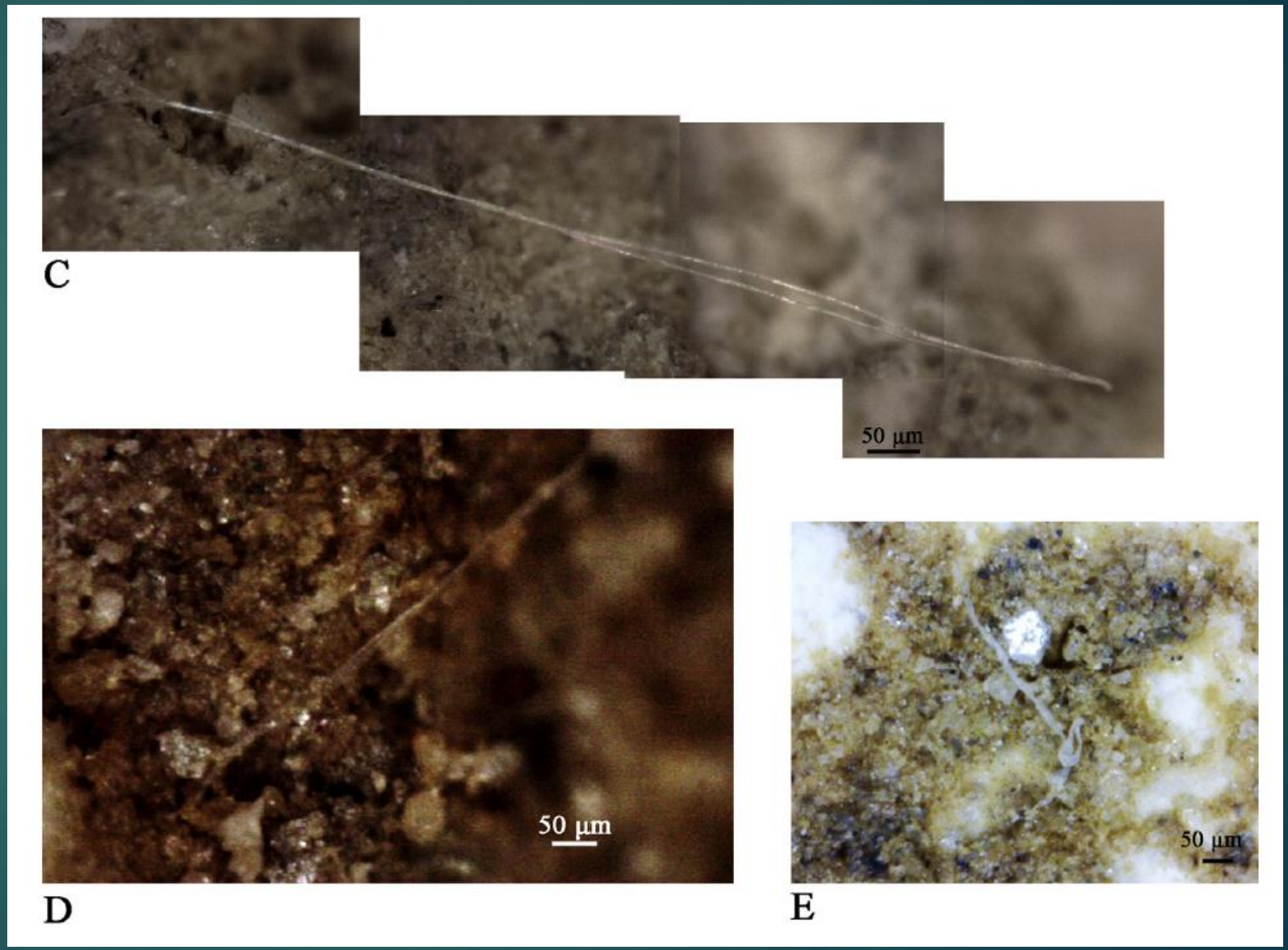
- Analysis of N lithic residues: at Abri du Maras, c 90 Ka; diet included large mammals, fish, ducks, raptors, rabbits, mushrooms, plants, wood; twisted fibers on stone tools provide evidence of making string or cordage; possible projectiles

Microscopic evidence of twisted string making on stone tool edge

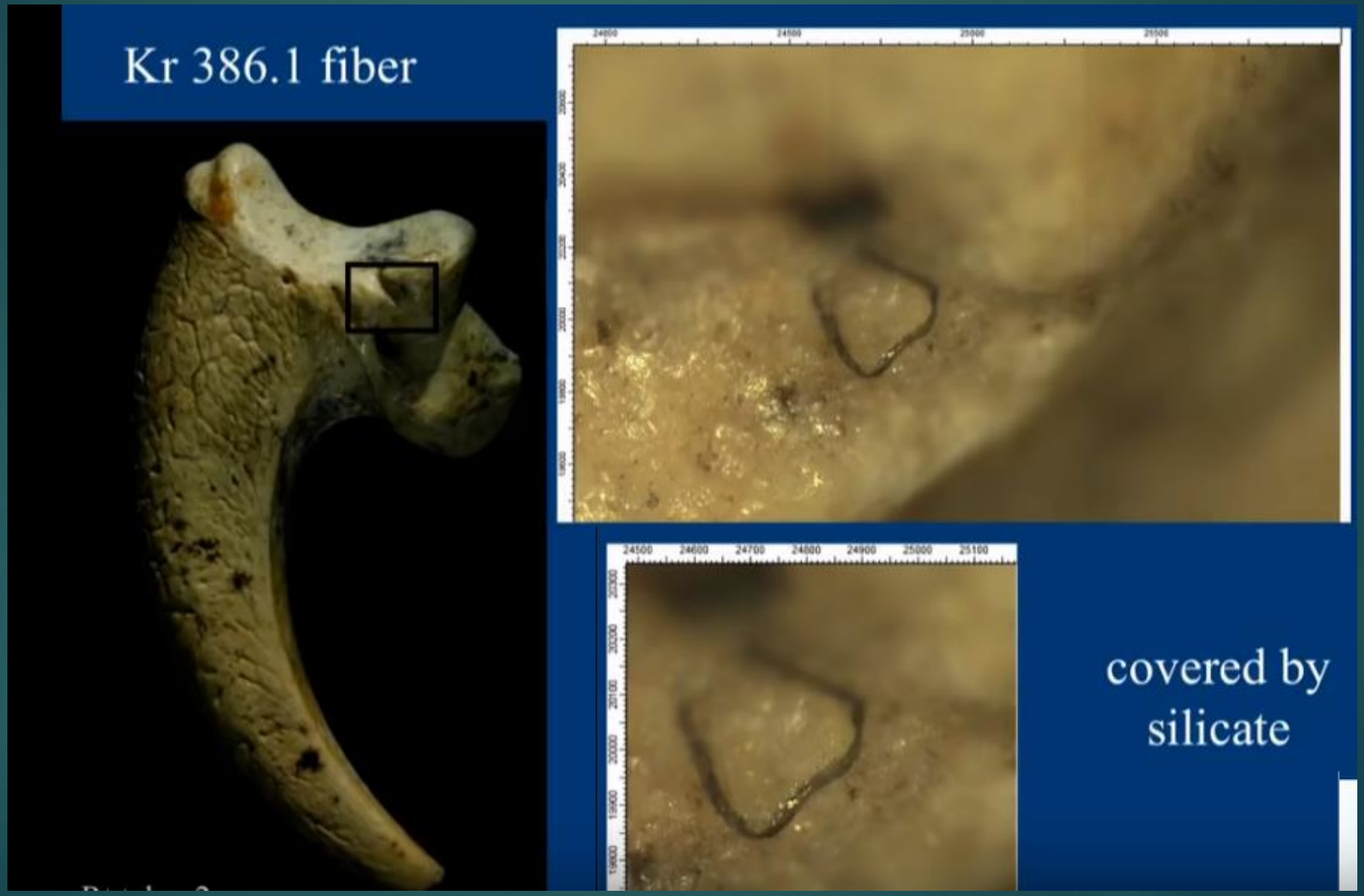


Researchers are no longer washing off stone tools to make them clean: wash off trace evidence from edges

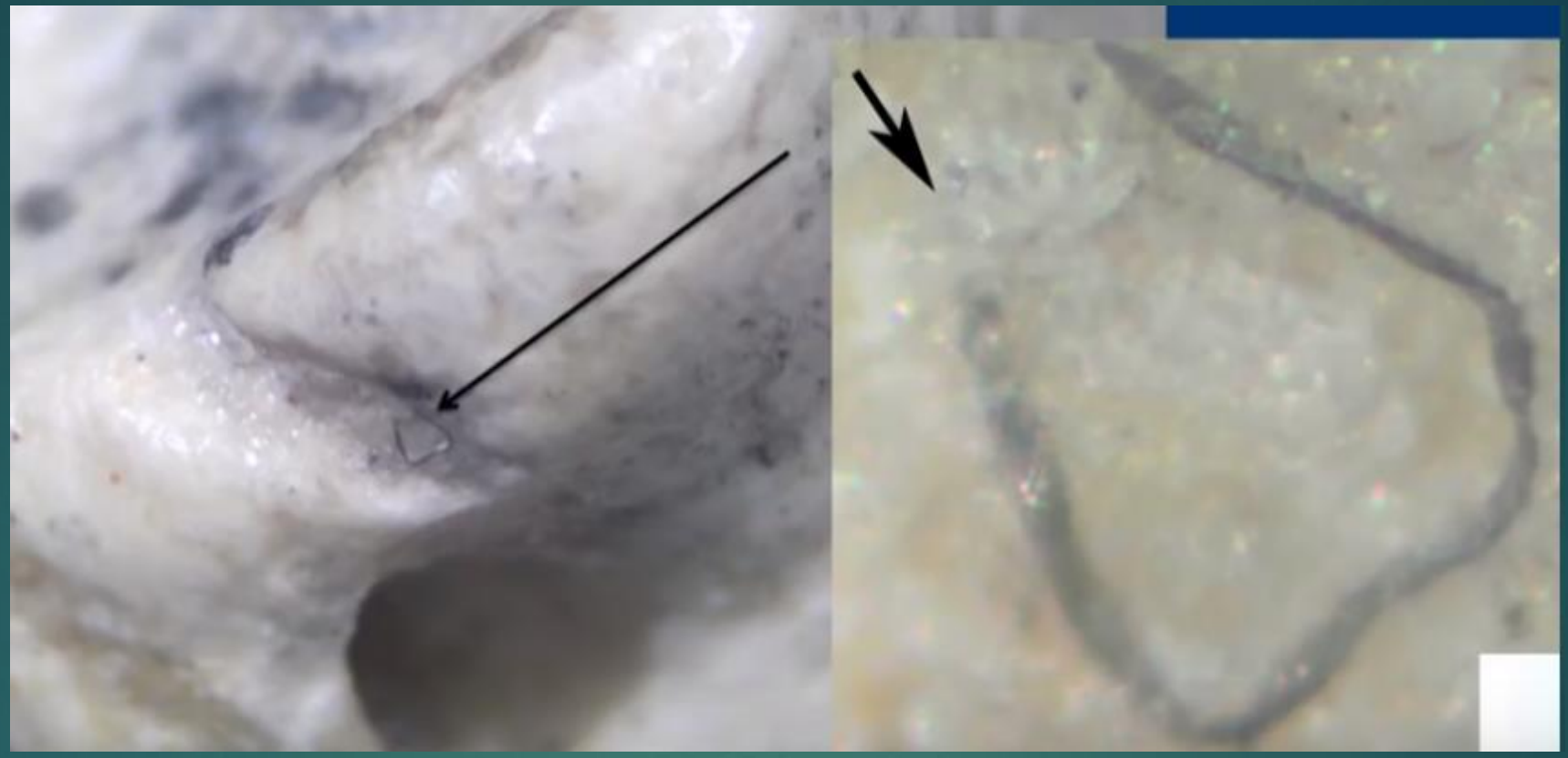
Twisted fibers



Krapina: Fiber, on eagle talon, under silicate; also other fibers



Fiber adhering to the surface in a wide cut mark on Krapina eagle talon



Synchrotron analysis: collagen, not cellulose, based fiber; it's animal, not plant, material; Remnant of fiber or sinew

3-ply cord fragment adhering to stone tool from Abri du Maras

- 2020 study: evidence of fiber technology — and perhaps, by extension, numeracy, because strands of string are combined in pairs and sets to form cord.

- The evidence is a thin three-ply cord fragment, approximately one-quarter of an inch long, found stuck to stone tool, or flake — ~ 50 Ka — and excavated from an archaeological site called Abri du Maras in southeastern France.
- Neanderthals occupied the site (they came to hunt reindeer) in several phases between 90,000 and 42,000 years ago.

B. L. Hardy, et al., 2020

Lavallois flake: ¼ inch fiber

Microscopic post-depositional film of chalcedony over the fiber

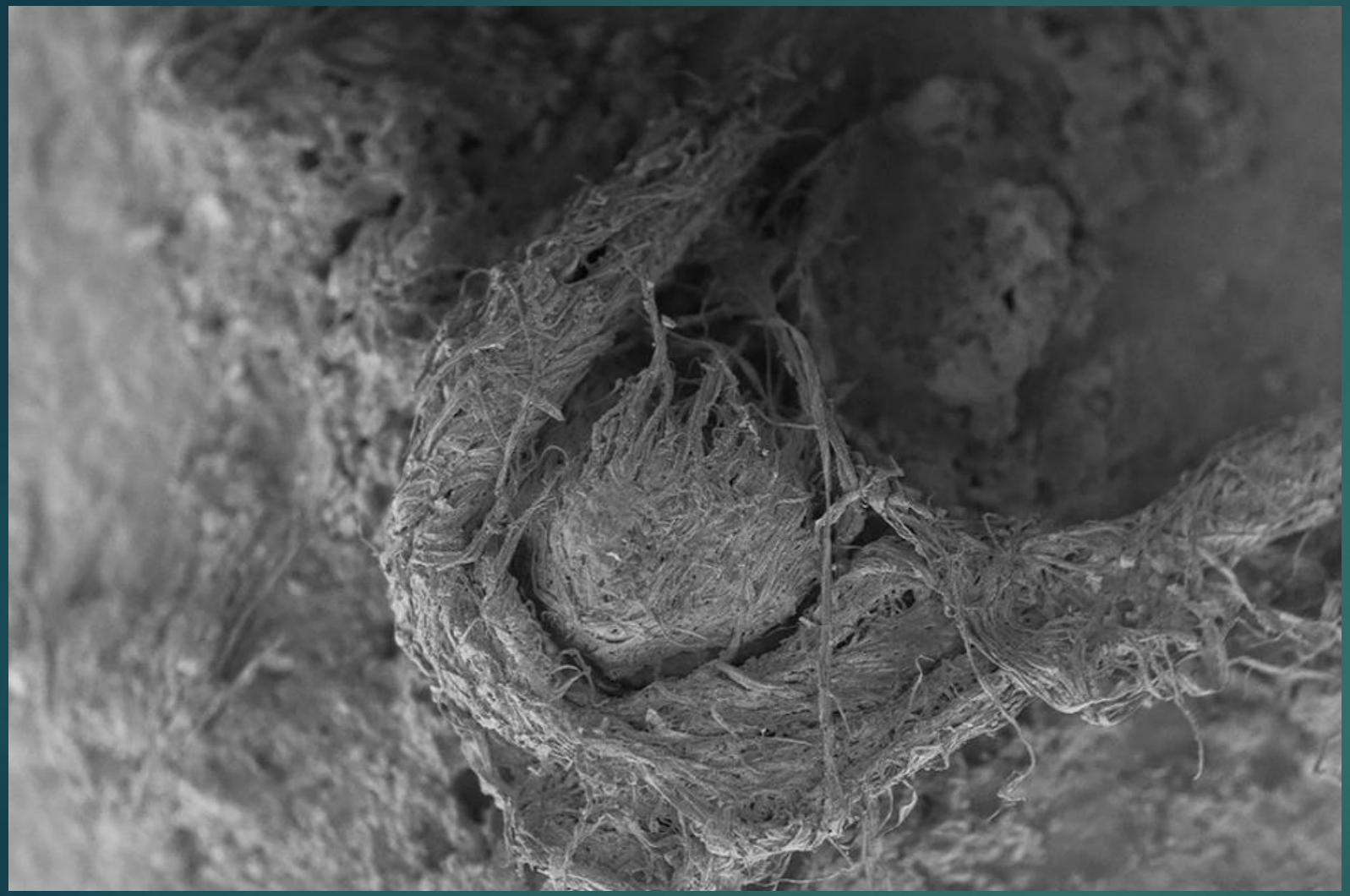
New Evidence of Twisted Cord

- Abri du Maras, France rock shelter: 4,000 artefacts longer than 15 mm; Levallois flakes

- A fragment of three-ply cord attached to a stone tool uncovered in Abri du Maras, France, represents “the oldest direct evidence of fiber technology to date.” Dating back to between 41 to 52 Ka, the cord is composed of inner bark fibers and may have been a handle or part of a net or bag.

- This finding confirms Neanderthals’ ability to manufacture cords,

- Indicates that they possessed a sophisticated understanding of trees along with mathematical and operational abilities.



The excavated fragment of cord was likely derived from the inner bark of a conifer or evergreen tree, such as a pine or juniper. Ns had extensive knowledge of the growth and seasonality of these trees

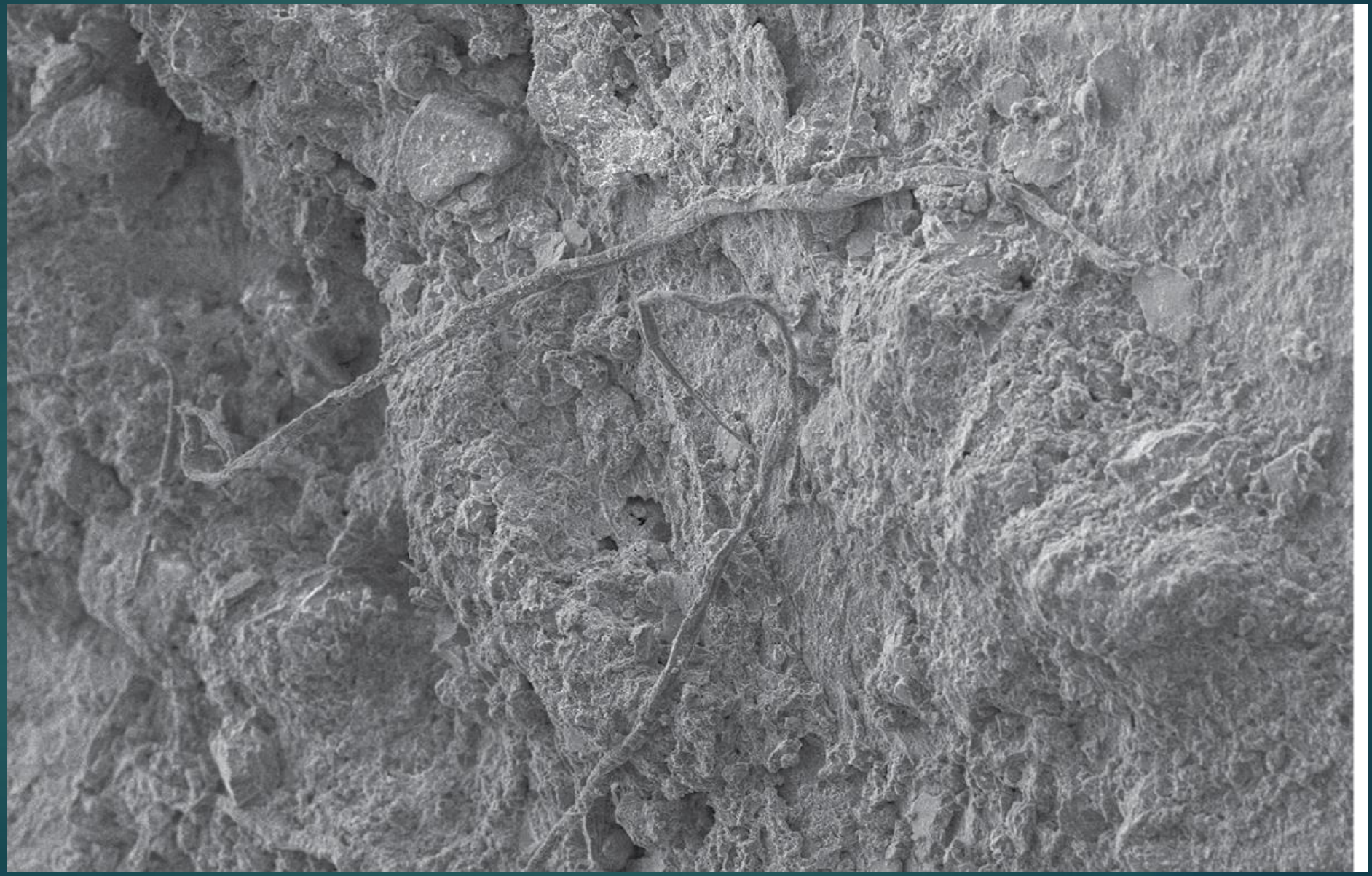
Juniper, spruce, cedar, and pine bast have been used archaeologically and historically in the manufacture of cordage and textiles.

Oldest Handmade String = N

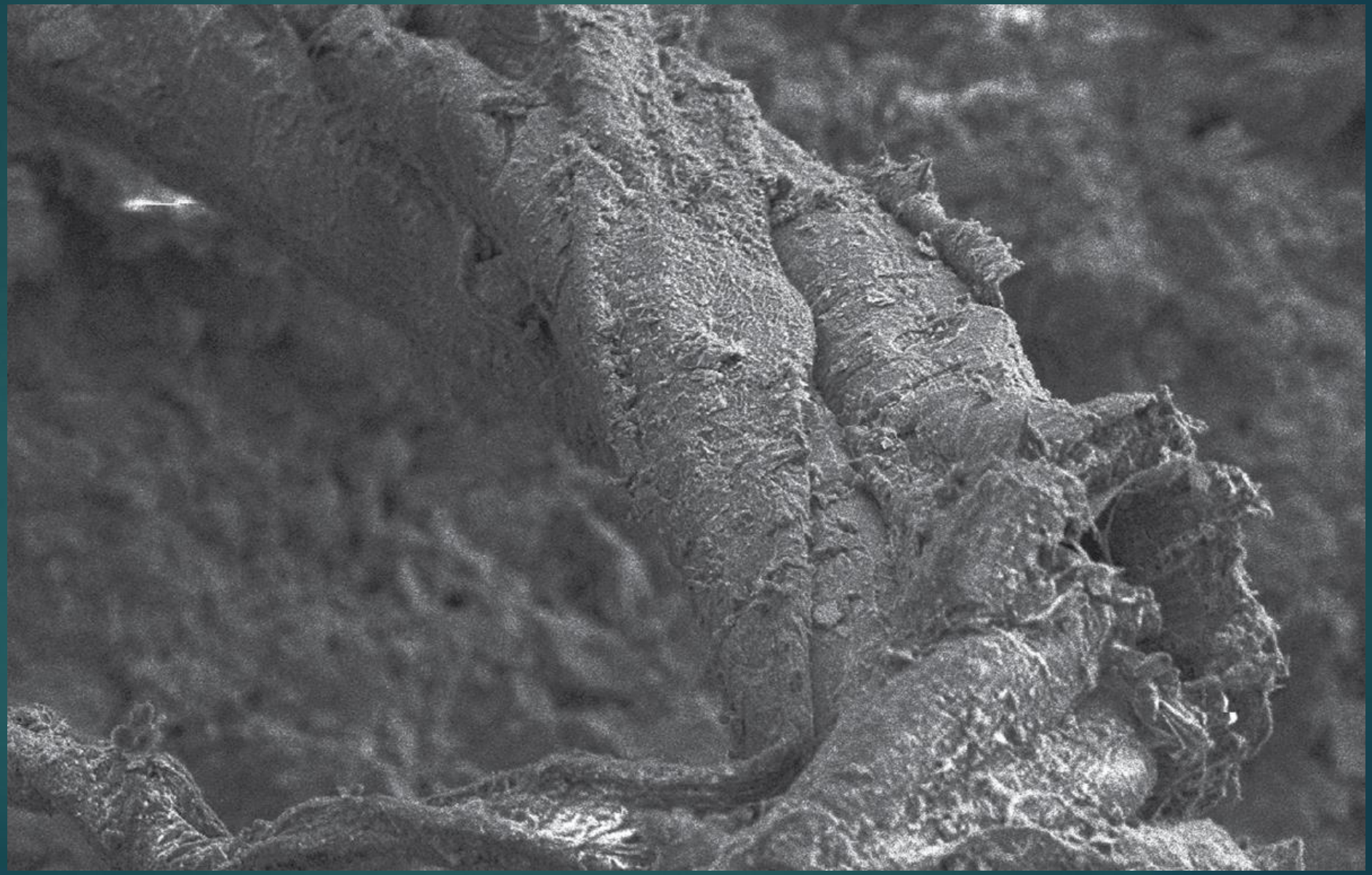
3D microscope photos of cord fragment. (Hardy et al., Scientific Reports, 2020

6.2 millimeter (0.24 inch) fiber fragment which is dated to ~41-52 Ka – so quite a bit older than the previous record holder, a 19,000-year-old fragment found in Israel.

Untwisted treads on artifact



Multiple fibers showing a Z twist on artefact L6 791.



N Twisted Cord: clear evidence of multistep process

- Multistep process: It was composed of fibers plied together:
  - numerous fibers twisted counterclockwise, in an "S-twist" to make yarn; and
  - then three strands of yarn twisted in the opposite direction, clockwise with a "Z-twist," to make cord.
  - Three groups of fibers were separated and twisted clockwise (s-twist). Once twisted the strands were twined counterclockwise (Z-twist) to form a cord.

- Lengths of cord could have been combined into larger structures such as bags, mats, nets, fabric, baskets, snares and even boats.

N Twisted Cord

- “Cordage production entails context sensitive operational memory to keep track of each operation.” “As the structure becomes more complex (multiple cords twisted to form a rope, ropes interlaced to form knots), it demonstrates an ‘infinite use of finite means’ (like language) and requires a cognitive complexity similar to that required by human language.”
- Dr. Hardy noted the cognitive parallels. “I can’t have a sentence without words, and I can’t have words without the individual sounds that carry meaning,” he said. “So I can’t have a rope or a cord or a bag or a net without the other steps along the way.
- “Cognitively, they are us,” Dr. Hardy said. “They’re not us exactly, but they are close enough.”

N and trees

- Attest to Neanderthals detailed knowledge of trees.
- The production of cordage is complex and requires detailed knowledge of plants, seasonality, planning, retting, etc.
- Based on this evidence, the utilization of bast fibers from trees requires intimate arboreal knowledge: best only seasonally; must be dried for certain period
- To make cordage from these plants, their fibers must first be harvested and cleaned of the surrounding tissue. Bladelike leaves are typically shredded longitudinally. Some need to be soaked in water first.

N use of multicomponent hafting technology

- Hafting, heat treatment and modern cognition:
  - complex hafting procedures dates back to about 70 ka in South Africa and earlier in Europe
  - MHs hunters used a mixture of plant gum, beeswax and powdered ocher to produce an adhesive that had to be carefully dried using fire

Technological complexity: spears and digging sticks

- Both the Schöningen spears and Poggetti Vecchi digging sticks required application of several types of stone tools—applied at different points during the sequence—to complete the production process.

- Especially important is the technological application of fire in a Neanderthal context, as part of the algorithm for wooden digging sticks

- The complexity of the technology, as measured by the number and variety of production steps says something about cognitive ability.

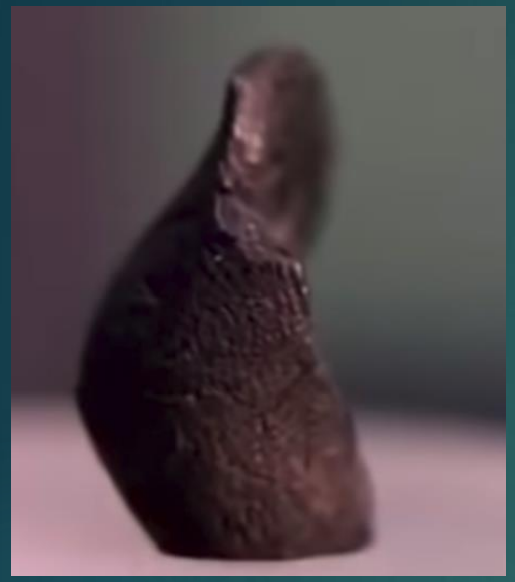
Complexity of N technology: multistep processes

- 3 MP technologies:
  - Neanderthal wood artifacts
  - lithic technology
  - hafted or composite artifacts

- Levallois: stone blanks of specific size and shape through a multistage process of core preparation and flake or blade production

- 3 component tools: Some blanks were attached to wooden handles or shafts with a binding agent to render hafted or composite artifacts (as early as ~500 ka)

Neandertals discovered glue: oldest synthetic substance



1963: German Mine: birch bark glue & N fingerprint

They discovered pitch glue from birch bark,

Ns used glue to haft spears; invention or discovery of glue?

- The identification of tar in the archaeological record has been used as a proxy for technological and cultural complexity.

- Birch tar production has been assumed to require a cognitively demanding setup, in which birch bark is heated in anaerobic conditions, a setup whose inherent complexity was thought to require modern levels of cognition and cultural transmission.

- Ns used glues to haft stones on spears

- Ns used glue from birch bark, at 200 Ka; known from the MP sites of Campitello (~200 ka, Königsaue (~84 to 40 ka, and possibly Inden–Altdorf (~120 ka),

- First MH use of compound adhesives in Sibudu, South Africa at 70 Ka

Did Ns invent glue?

- Many researchers proposed birch tar production using heating systems that create anaerobic conditions in containers or underground (e.g., “clay castle,” eggshell, ash mounts, ceramic containers)

- Original N tar studies indicated complex methodology: Heated birch bark in an oxygen reductive environment to temperatures of ca 300 to 400º C in order to obtain pitch for hafting flint flakes. The procedure was hot enough to produce thick tar, as the resinous bark disintegrated.

Goose egg containers covered with mud

Stone age superglue: Complex birch bark glue recreation

- Modern researchers attempted to recreate N method for creating birch bark glue: requires 400-750 degree temperature and no oxygen (which would ignite the bark)
- Bury a large goose egg with circular hole at top to collect the pitch
- Place another goose egg above it with birch bark inside
- Mud applied to conceal the 2 eggs and surround them to prevent Ox from entering;
- Covered with hot burning coal for 30 minutes;
- 30% of birch bark becomes pitch

Scientific parsimony: You can produce tar glue easily

- Patrick Schmidt, et al., 2019: demonstrate that recognizable amounts of birch tar were likely a relatively frequent byproduct of burning birch bark (a natural tinder) under common, i.e., aerobic, conditions.
- When birch bark burns close to a vertical to subvertical hard surface, such as an adjacent stone, birch tar is naturally deposited and can be easily scraped off the surface.
- Chemical analysis of the resulting tar showed typical markers present in archaeological tar. Mechanical tests verify the tar's suitability for hafting and for hafted tools use.
- Thus, the presence of birch tar alone cannot indicate the presence of modern cognition and/or cultural behaviors in Neanderthals.

Patrick Schmidt, et al., 2019

Easier tar production in 3 hours

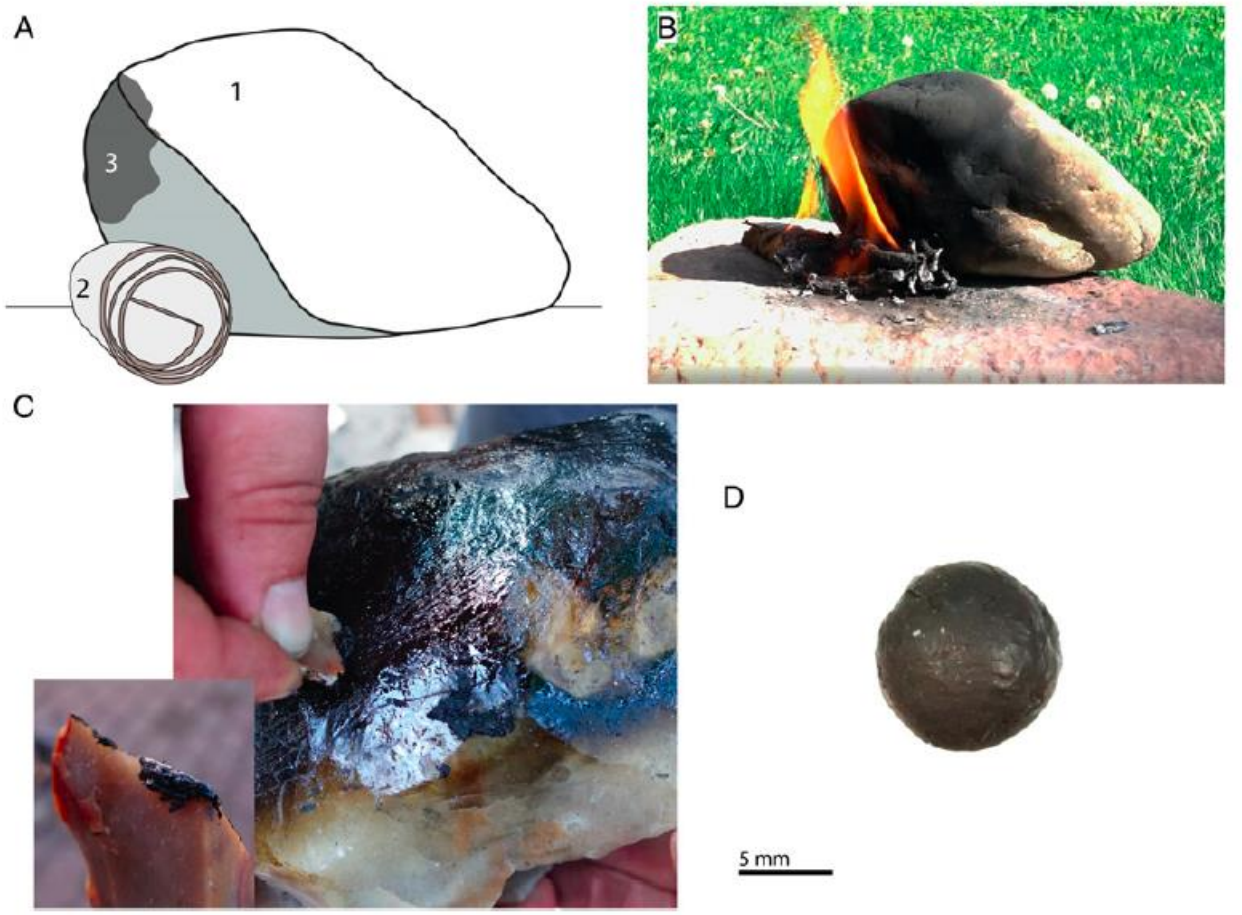


Fig. 1. Experimental birch tar making with the condensation technique. (*A*) Schematic drawing of the experimental setup: a cobble (1) with an inclined surface overhanging a piece of birch bark (2) is used as support for the condensation of birch tar directly above the burning bark (3). (*B*) Photo taken during experimentation using the setup shown in *A*. (*C*) Photo of the cobble surface where tar can be scraped off and the stone tool used for scraping. (*D*) Photo of a 0.62-g piece of tar produced in a single 3-h session (including bark collection).

Need to find archeological proof of steps in a process

- Tar production can be an accidental, and indeed even a likely, outcome of everyday activities for any group building fires with birch

- Tar production is not a smoking gun of N complex behavior. Derived from simple juxtaposition of 2 everyday objects for Neanderthals (birch bark and stone or bone surfaces) derived from fire making/tending.

- Our findings do not necessarily lead to the conclusion that Neanderthals were not able to conduct complex procedures, nor that they were not capable of abstract thinking or high planning depths.

Parsimony: Keep it simple

- Parsimony: in archaeological science, arguing for abstract concepts like complex cognition in past populations should not rely solely on highly interpretative models of the production pathways of specific material finds. It should rather rely on the interpretation of the actually performed steps, as proven by direct archaeological data.

- It is therefore no longer possible to use early birch tar making as proxy for complex cultural behaviors in Neanderthals

N Clothing

- Remember those very worn front teeth in Ns?. Why were they holding animal skins? Clothing?

- Given cold northern climates, it is safe to assume that Neanderthals wore furs as clothing.

- And Shara Bailey at New York University thinks that, like today's traditional Inuit, they softened animal skins with their teeth.
- "If you get an adult skull, their incisors are often worn down to nubs, while the molars are fine. So they were probably using their front teeth to process skins."

(*Proceedings of the National Academy of Sciences*, vol 105, p 14319).

N invention of bone 'lissoirs‘ for leather working; 51Ka

Four views of the most complete lissoir found during excavations at the Neanderthal site of Abri Peyrony in France. Photograph: Abri Peyrony/Pech-de-l'Azé I Projects

Lissoirs, made of deer ribs, would have been used by Neanderthals to prepare hides. Eventually the tips would break off. Illustration: Abri Peyrony/Pech-de-l'Azé I Projects

The slender, curved implements called "lissoirs" were shaped from deer ribs and likely used to work animal hides to make them softer, tougher and more waterproof. Similar tools are still in use by leather workers today,

Found the first large piece of a lissoir at a cave called Pech-de-l'Azé I on a tributary of the Dordogne in southwest France, dated to 51K; also another site, 41-48 K

Start here ***

Why static electricity can help you identify ancient bones

New method for the entirely non-destructive sampling of bone artifacts including those that may be fragile, rare, or small

N lissoirs (French for “smoothers”): rib bone animal hide tool

- *N lissoirs*.:
- (**a**) Pech-de-l’Azé I (PA I)
- (**b-e**) Abri Peyrony (AP)
  - (**a**) PA I G8-1417.
  - (**b**) AP-4209.
  - (**c**) AP-4493.
  - (**d**) AP-10818,
  - (**e**) AP-7839.

ZooMS, or Zooarchaeology by Mass Spectrometry

- ZooMS, or Zooarchaeology by Mass Spectrometry: non-destructive method to identify species based on collagen; usually need breadcrumb size fossil piece for analysis

- New method for taxonomic id: analyze plastic bag that bone had been kept in; static charged plastic attracts tiny collagen molecules away from the bone.
- Many MP artifacts have been traditionally stored in plastic containers for various lengths of time, allowing taxonomic identification of bone artifacts otherwise inaccessible for destructive molecular analysis

Naomi L. Martisius, et al., 2020

N lissoirs: better bone selection

- 2020 Martisius study:
  - archaeological layers where the bone tool pieces had been found, the majority of the animal bones were identified as belonging to reindeer.
  - ZooMS identified every one of the *lissoir* pieces as coming from bison or aurochs (a large, extinct species of cattle).
  - Ns hunted plentiful reindeer for food but stuck with the larger animals when it came to choosing raw materials for tools.

- The ribs of bison and aurochs are larger and stronger: Larger ribs would be able to withstand a good deal more of repetitive pressure, and so they would be a more effective material for a *lissoir*.

Neandertal Art and Abstract designs

- The earliest secure abstract designs, engraved on bone and ochre, are found in South Africa and are dated to ca 77 ka.

- Examples are the complex geometric patterns on ochre from approximately 100 to 70 ka levels at Blombos Cave and from MSA layers at Klein Kliphuis in the Western Cape, and approximately 73 ka old notched and engraved bone from Blombos and Klasies.

- Abstract designs on artefacts seem to disappear in southern Africa between approximately 70 ka and 55 ka, after which they reappear at Diepkloof shelter in the form of engraved ostrich eggshells.

- No African representational art before 31 Ka.

Classic AMH UP figurative art

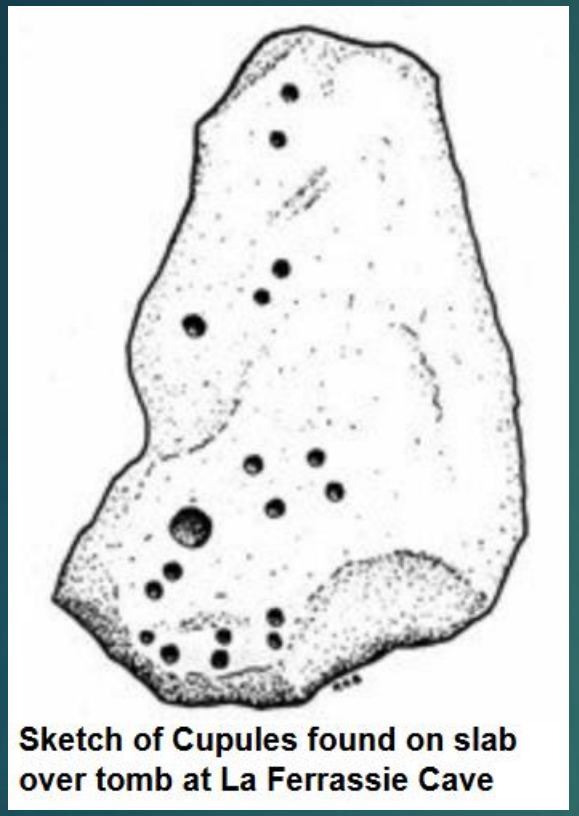
MH Figures and Engravings, ~35 Ka

- Figurative representations consisting of painted, engraved and carved animals, are so far only well dated to much later
  - ~31 Ka in Africa, at Apollo 11 shelter. Namibia, and
  - ~35 Ka in Europe, at Chauvet, Fumane and in southern Germany

- Pre 40 Ka, Neandertal engraving of :
  - non-figurative markings on bones
  - cortical areas of flaked stone artifacts,
  - immobile rock surfaces (i.e., at Gorham's Cave)

(Majkic et al., 2017, 2018 ; Rodríguez- Vidal et al., 2014)

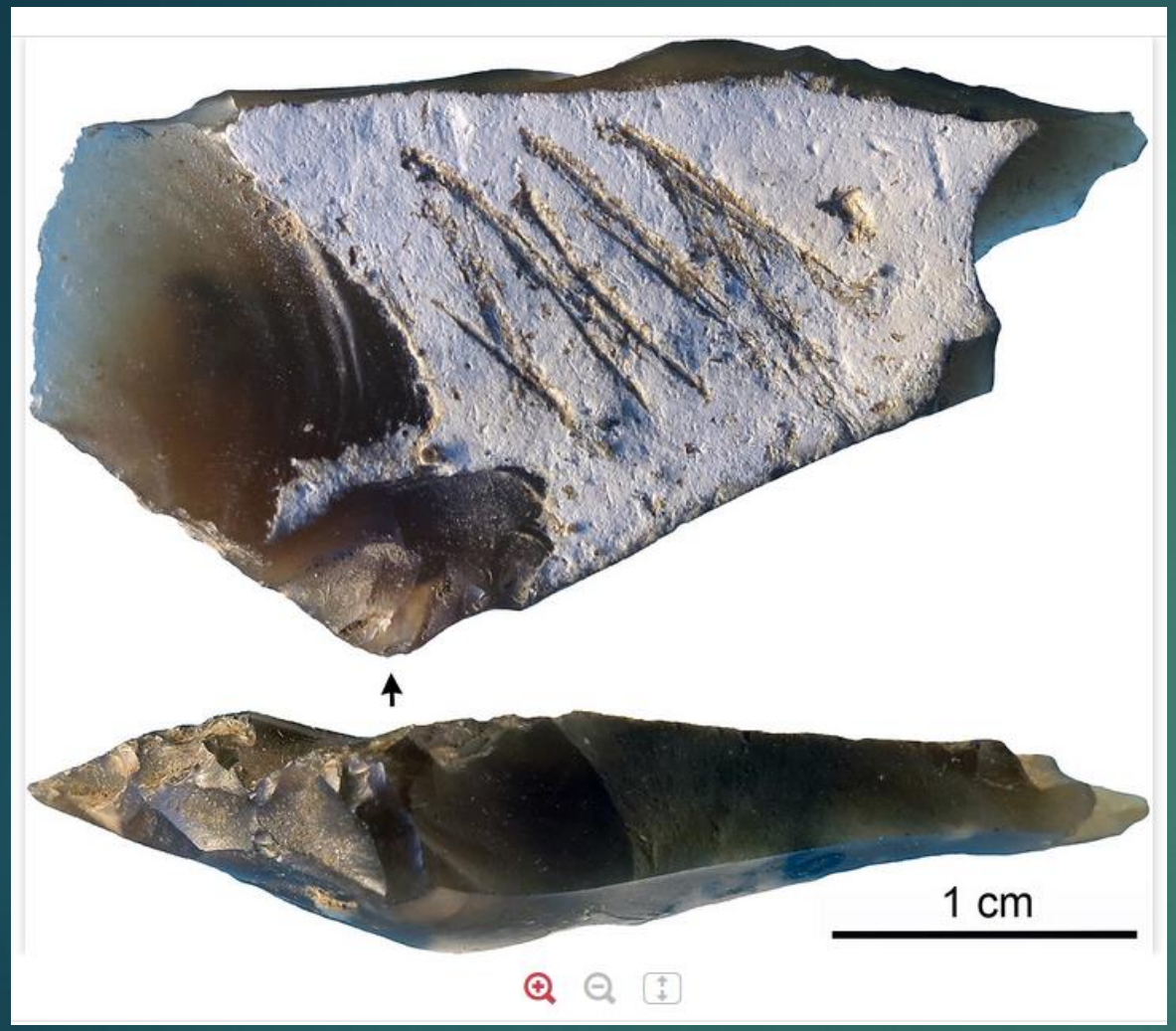
La Ferrassie Cave Neandertal Cupules (~ 60 Ka)



Sketch of Cupules found on slab over tomb at La Ferrassie Cave

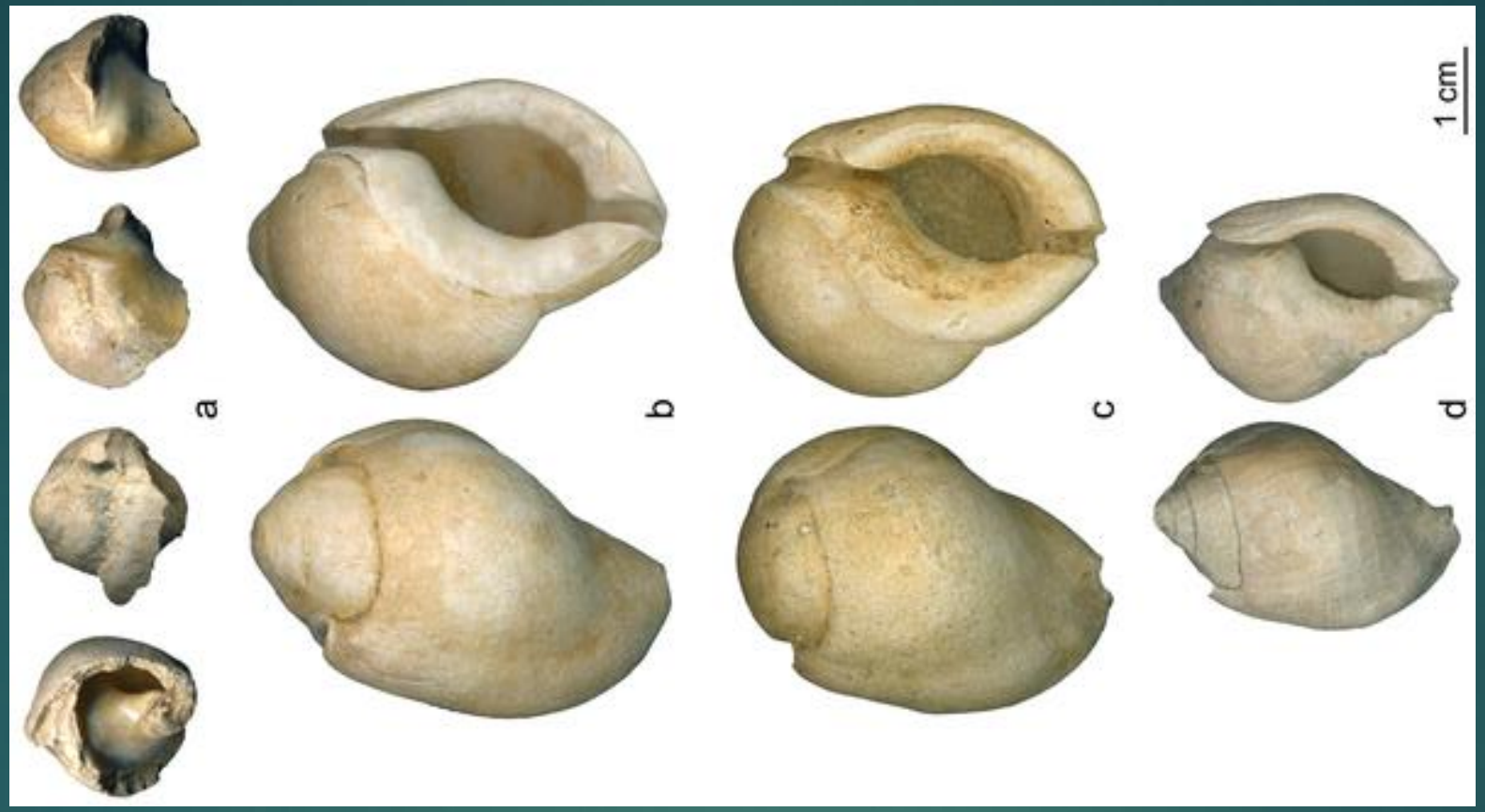
- Series of cupules - a primitive form of rock art - dating back to Mousterian culture (c 60 Ka), which makes it among the oldest prehistoric art in Europe.

At *La Ferrassie burial 6*, a large limestone slab was found covering the grave of a Neanderthal child.
On its underside was found an arrangement of cupule-art, consisting of 2 larger hollows and 8 pairs of smaller holes.



- Neandertal engraved flint flake from Mousterian Kiik-Koba, Crimea site; 37 Ka.

Fumane, Italy: Mousterian Ochered Aspa marginata shells.



Dated 47 Ka: transported 100 Kms to Cave; then ochered; pendant?

Peresani M, Vanhaeren M, Quaggiotto E, Queffelec A, d'Errico F (2013) An Ochered Fossil Marine Shell From the Mousterian of Fumane Cave, Italy. PLOS ONE 8(7): e68572. doi:10.1371/journal.pone.0068572
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0068572

Cueva de los Aviones: Perforated shells, 115-120 Ka

- Cueva de los Aviones (southeast Spain) is a site of the Neandertal-associated Middle Paleolithic of Europe.

- It has yielded ochred and perforated marine shells, red and yellow colorants, and shell containers that feature residues of complex pigmentatious mixtures.

- Similar finds from the Middle Stone Age of South Africa have been widely accepted as archaeological proxies for symbolic behavior.

- U-series dating of the flowstone above are 115,000 to 120,000 years old
- Also in Slovenia, at 50 Ka

Dirk L. Hoffmann, et al., Sc Advances, 2018

115 Ka N art:

Pigments

Perforated shells, ochered

Fig. 3. Symbolic finds (after Zilhão *et al.* [12]). (A) *Spondylus* shell with remnants (indicated by the white square) of a pigmentatious compound mixing ground inclusions of hematite and pyrite in a red lepidocrocite basis. (B) Large lump of natrojarosite, a mineral whose only known archaeological use is in cosmetics. (C) Perforated *Acanthocardia* and *Glycymeris* shells (red hematite residues were found adhering to the inner side of the larger *Glycymeris*).

The perforated shells from level II of Cueva de los Aviones, (Cartagena, Spain). (after cleaning): (1) Acanthocardia tuberculate, 2-3. Glycymeris insubrica

Shells: holes drilled by marine snail
Ns collected these and brought to their cave.

João Zilhão et al. PNAS 2010;107:1023-1028

N favored Dark Pigmentation: Manganese Dioxide rocks

Pigments on eagle talons

- Talon surfaces: concentrated traces of black manganese coating & occasional spots of red ochre pigment
- So besides collecting talons, they were using pigments

Manganese dioxide nodule used to color things

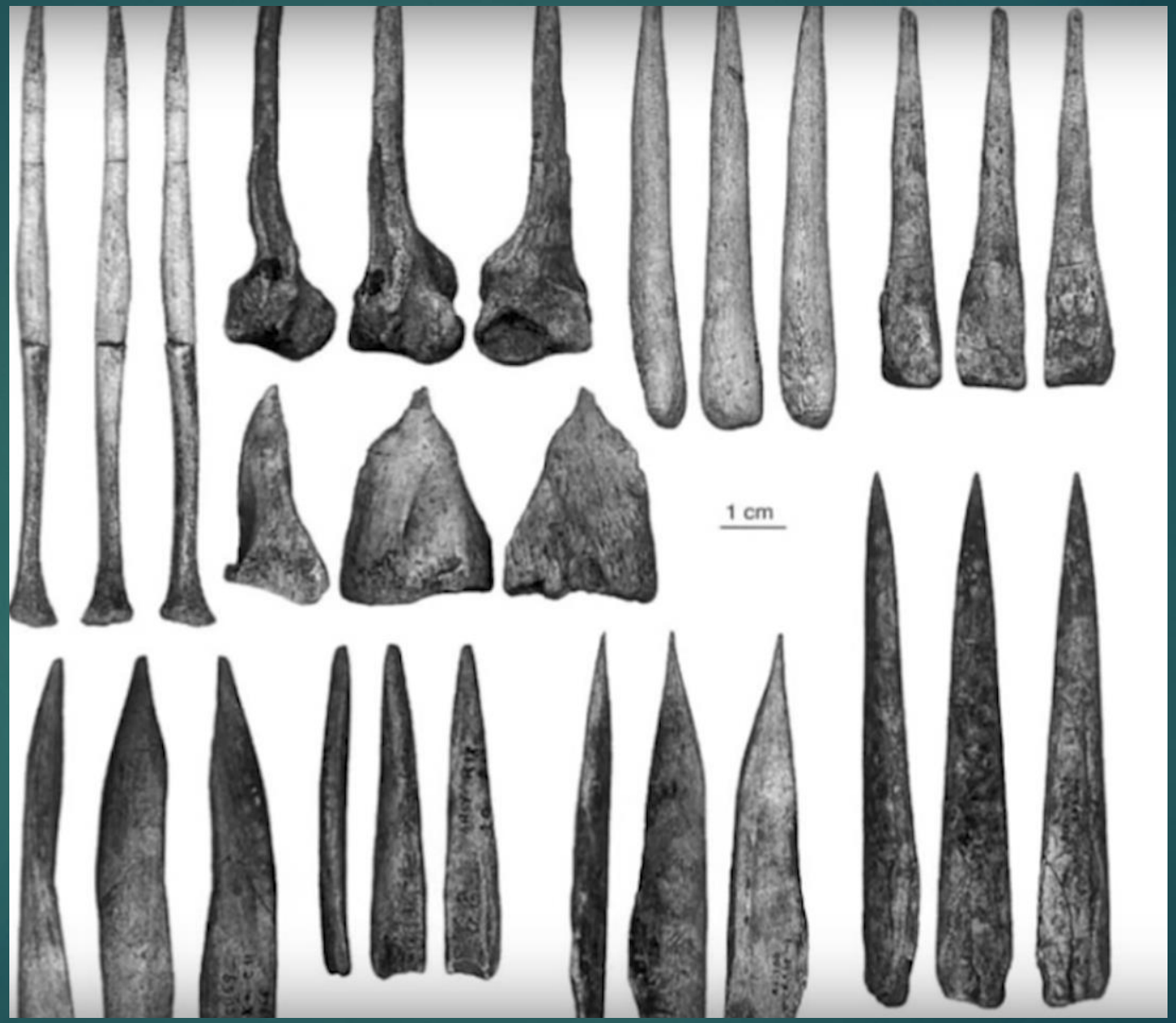
Striations are consistent with soft surface contact

K19-3, a perforated upper half-valve of Pecten maximus from level I-k at Cueva Antón (height: 120 mm). 50 Ka

The internal, naturally red side (Left)
The external (Right), whitish side that was painted with an orange colorant made of goethite and hematite to make them look similar

João Zilhão et al. PNAS 2010;107:1023-1028

N bone tools



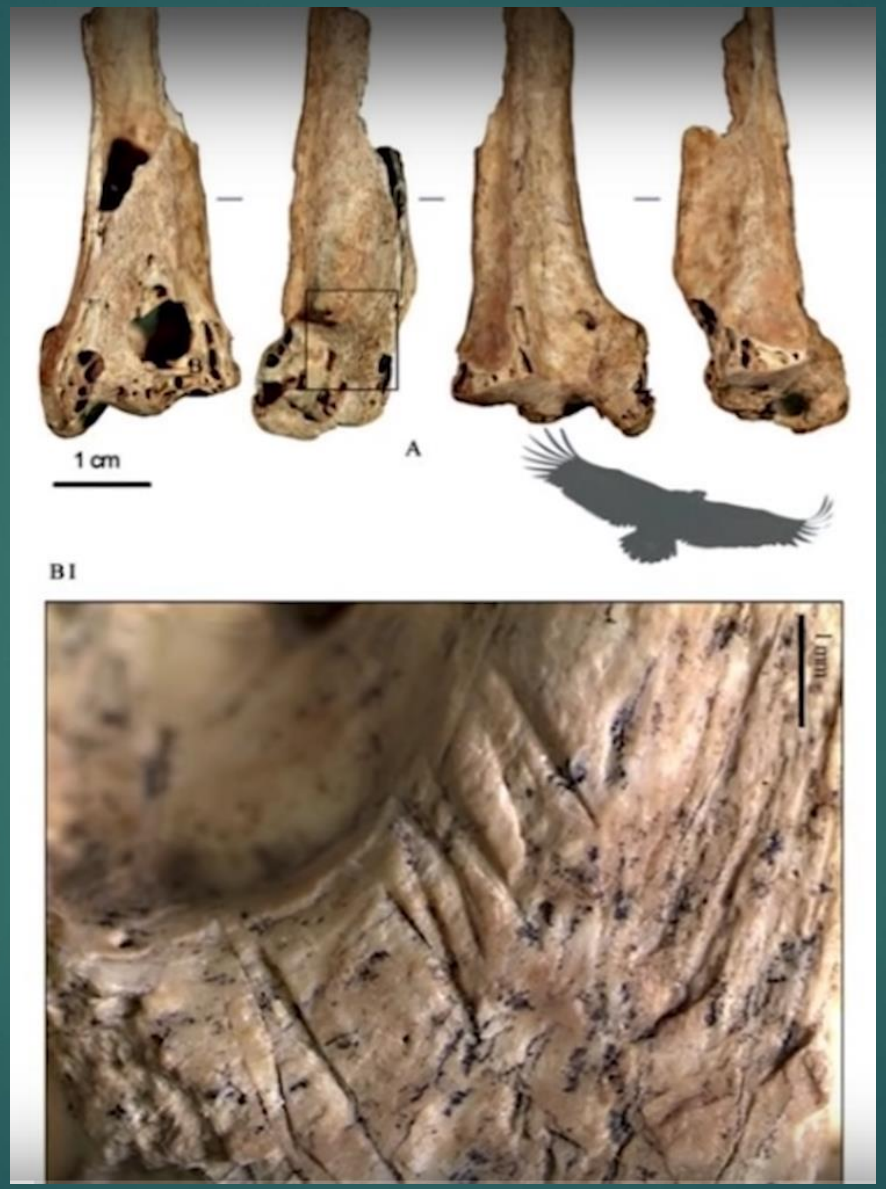
Ns were Goth:

Cutmarks on distal wing bones of vultures:

N loved wearing black feathers;

N preferred dark colored raptors

From multiple sites



Music

- First to play music?

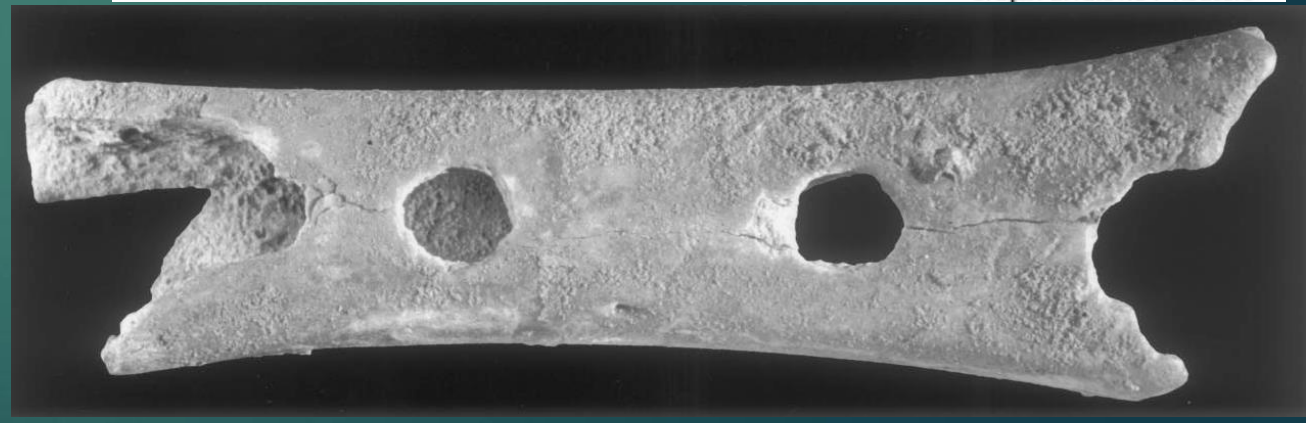
- The oldest known musical instrument has been attributed to Neanderthals by its discoverer Ivan Turk: Divje Babe flute (cave bear femur)

- Sceptics argue that the 43,000-year-old bone “flute” found at Divje Babe in Slovenia is just a cave bear femur punctured by wild animals.

I. Turk, Nature, vol 460, p 737

The Controversial Neandertal flute

- Slovenia site 82 - 43 Ka
- Possible flute = Evenly spaced holes in bone
- Or random gnawing and punctures by carnivores?
- d'Errico vs. Turk: carnivore damage vs it's a flute
- It has been demonstrated (d'Errico *et al*., 1998a,b) that holes of the same size, shape, and number as those present on the Divje Babe femur occur on cave bear limb bones from cave bear bone accumulations with no human occupation
- This does not mean that Neandertals were unable to manufacture and play musical instruments. It simply means that we cannot use *this* object to support that hypothesis



d'Errico F, et al. (2003) vs. *Turk, Matija; Dimkaroski, Ljuben (2011).*

The Origins of Iconic Depictions:

- Hodgson & Pettitt: A Falsifiable Model Derived from the Visual Science of Paleolithic Cave Art and World Rock Art

- Archaeologists have struggled for more than a century to explain why the first representational art of the Upper Paleolithic arose and the reason for its precocious naturalism.

- Derek Hodgson and Paul Pettitt, 2018: In this paper, we assert that the main precursors of the first figurative art:

  - consisted of hand prints/stencils (among the Neanderthals and early Homo sapiens) and

Derek Hodgson and Paul Pettitt, 2018

Falsifiable Model

- a body of geometric marks as well as
- a hunting lifestyle and
- highly charged visual system for detecting animals in evocative environments
- Present theory is falsifiable in that five critical, but verifiable, points are delineated.

- One of the great mysteries of archaeology is why figurative art, in the form of the stunningly naturalistic animal depictions, appeared relatively suddenly around 37 Ka

Paleolithic Art Theory

- The first clue to their origin came from the ancient hand marks (positive prints and negative stencils), Recent dating shows that they were created by Neanderthals more than 64,000 years ago.

- The second clue came from the widespread inclusion of natural cave features – such as ledges and cracks – as parts of animal depictions.

- The final clue relates to the environment in which Upper Paleolithic hunter-gatherers were stalking the large herbivores – such as bison, deer and horses – that formed their prey and which often lay hidden in camouflage in the tundra environment.

This hand stencil has been deliberately placed so its left side matches with a natural crack in the wall of El Castillo cave.

Paleolithic Art Theory

- They argue that hand marks initially supplied the idea to archaic humans that a graphic mark could act as a representation, however basic it was.
- Hunters become hypersensitive to particular animal contours.
- In such ambiguous circumstances, it's better to "see" an animal when it's not there – to mistake a rock for a bear – than not see it.
- Such better-safe-than-sorry hair-trigger cues are cognitive adaptations that promote survival

Paleolithic Art Theory

- All the hunter needed to do to “complete” a depiction was to add one or two graphic marks to the suggestive natural features based on the visual imagery in their “mind’s eye”

- Upper Paleolithic hunters conditioned themselves due to the need to detect animals, but this effect was reinforced by the suggestive features of the caves.

- For example, if someone finds depictions of animals or similar that predate the first hand marks, this would overturn our main proposition. Similarly, if earlier figurative depictions come to light that do not derive from natural features, this would also challenge our theory.

Paleolithic Art Theory

- When later humans entered the same caves and saw these, the Neanderthals may literally have “handed on” to our own species the notion that a graphic mark could act as a figurative representation.

- Thanks to the primed visual system of the later hunter-gatherers – and the suggestive environment of the caves – it was *Homo sapiens* who took the final step creating the first complex figurative representations, with all the ramifications that followed for art and culture.

2018: Dirk L. Hoffmann - N art at 65 and115 Ka

- Dating results for three sites in Spain that show that cave art emerged in Iberia substantially earlier than previously thought.
- Uranium-thorium (U-Th) dates on carbonate crusts overlying paintings provide minimum ages for 3 sites
  - Collectively, these results show that cave art in Iberia is older than 64.8 thousand years (Ka).
- This is the earliest dated European cave art so far and predates, by at least 20 ka, the arrival of modern humans in Europe, which implies Neandertal authorship.

3 Spanish sites

- In La Pasiega, in northern Spain: a red linear motif is older than 64,800 years.

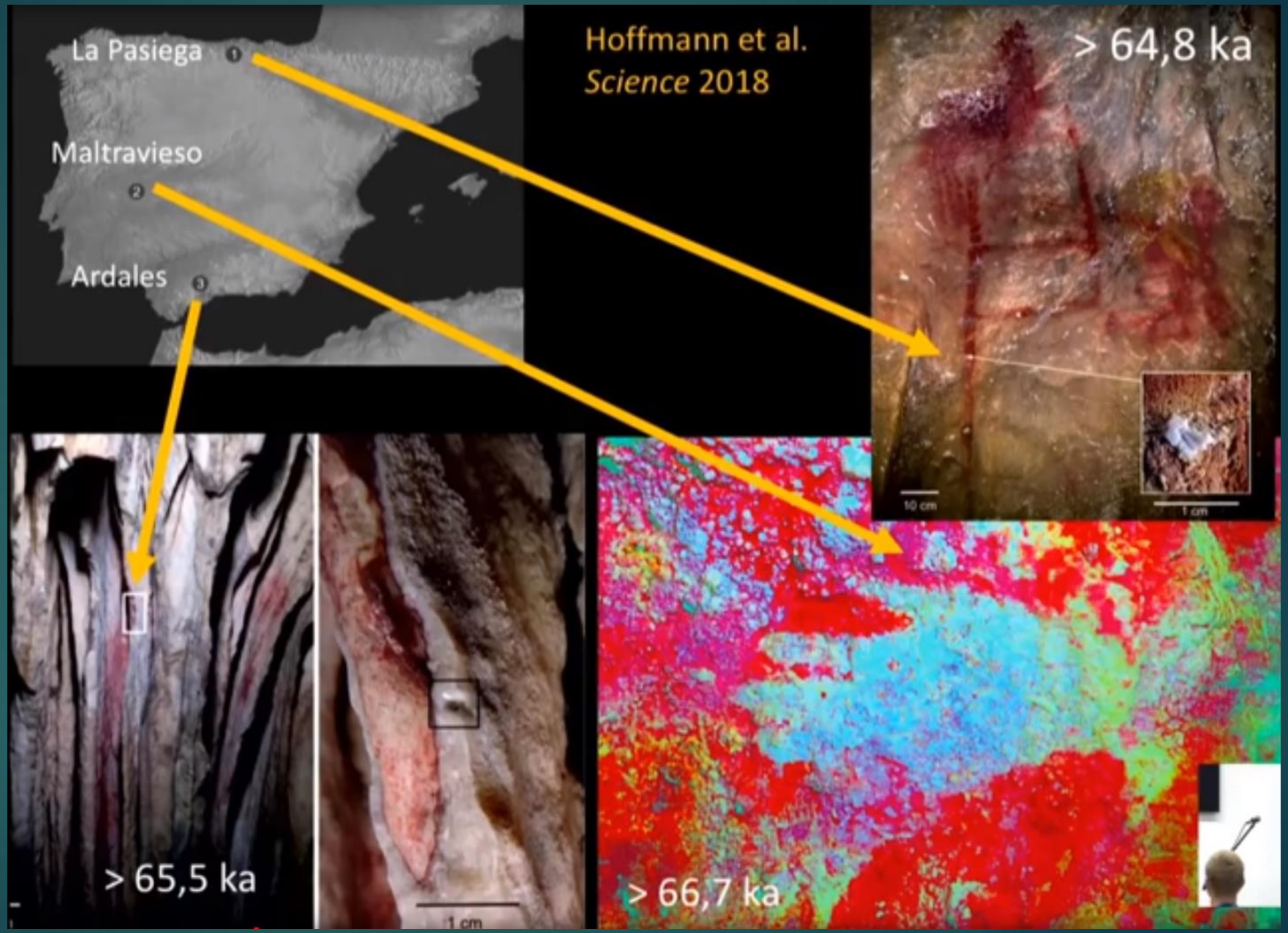
- In Ardales, in southern Spain, various red painted stalagmite formations date to different episodes of painting, including one between 45 and 48 Ka, and another before 65 Ka.

- In Maltravieso, in western central Spain: red hand stencil is older than 66,700 years.

3 cave sites: Art before MH arrival

- These results demonstrate that cave art was being created in all three sites at least 20,000 years prior to the arrival of *Homo sapiens* in western Europe.
- They show for the first time that Neanderthals did produce cave art, and that it was not a one-off event.
- It was created in caves across the full breadth of Spain, and at Ardales it occurred at multiple times over at least an 18,000-year period.
- Excitingly, the types of paintings produced (red lines, dots, and hand stencils) are also found in caves elsewhere in Europe

N Cave paintings



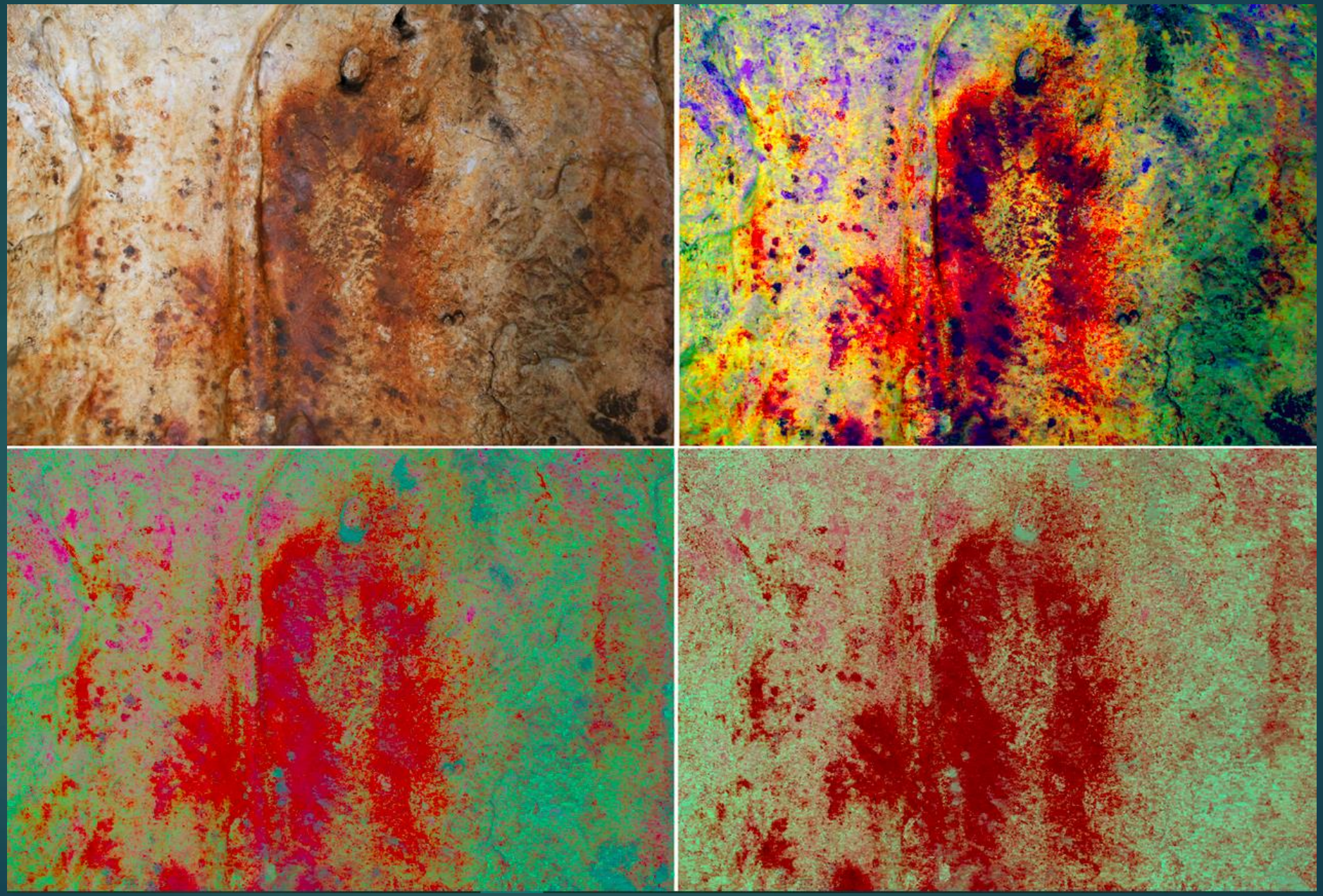
Cave of Maltravieso: 71 hand stencils -- 64 Ka

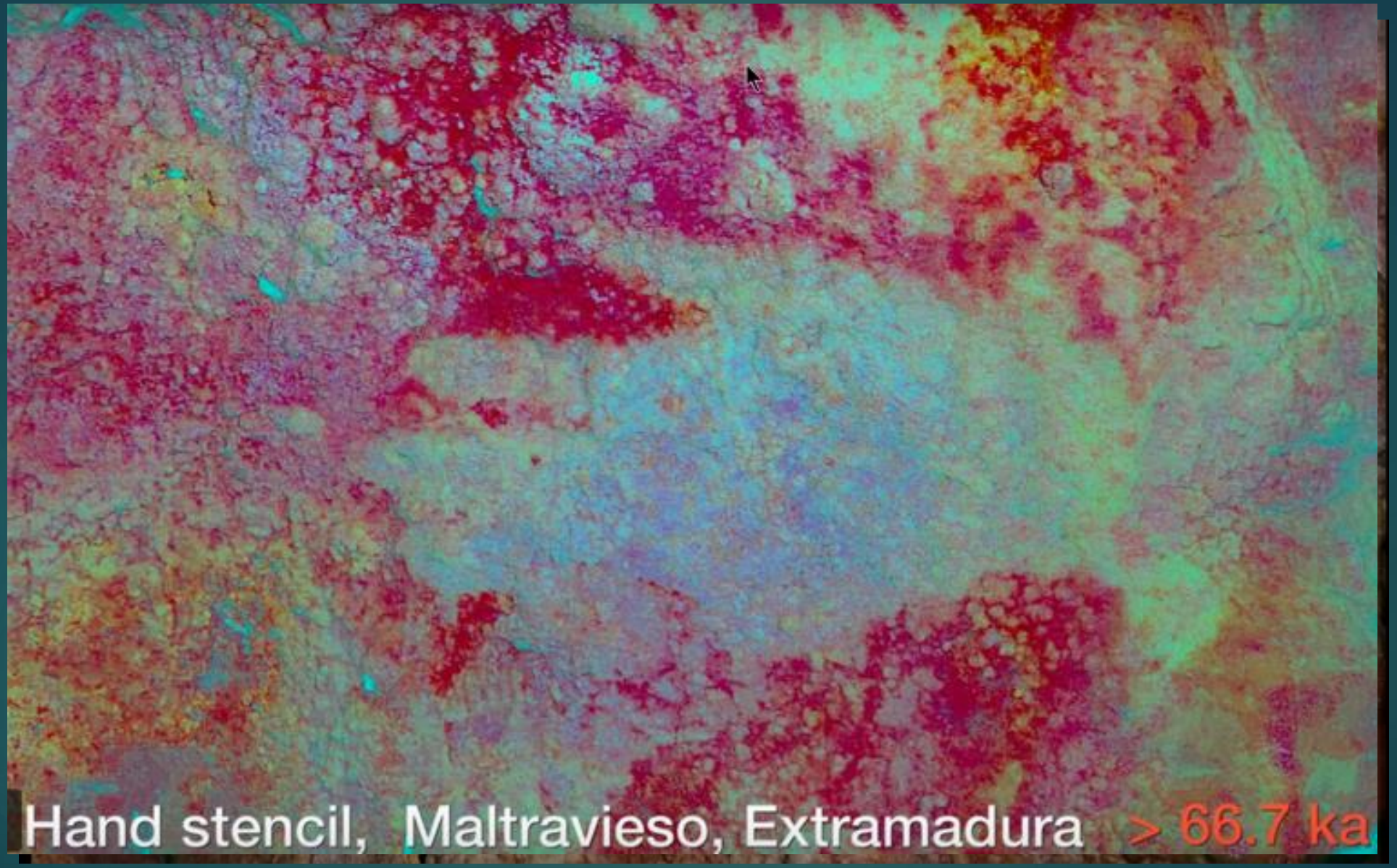
The Cave of Maltravieso in Cáceres, Extremadura, Spain, was discovered in 1951.

It contains cave art, most notably a total of 71 hand stencils, also linear designs and some animal paintings.

In a 2018 study based on uranium-thorium dating, a hand stencil from the Cave of Maltravieso was dated to 64 Ka

Cave of Maltravieso: hand prints




Hand stencil, Maltravieso, Extramadura > 66.7 ka

N art

- “That Neanderthal hand is the first evidence ever found of another species showing cultural self-consciousness. It’s not so very far from a hand print to a self-portrait to a diary to a novel. This discovery dethrones the modern human mind. It also means that if, as well as interbreeding with Neanderthals and sharing artistic ideas with them, the first groups of *Homo sapiens* to enter Europe massacred them and helped make them extinct, it was our fellow thinking beings we were killing. Not just another extinction, but the first genocide.”

Jonathan Jones, Guardian, 2018

El Castillo, Spain

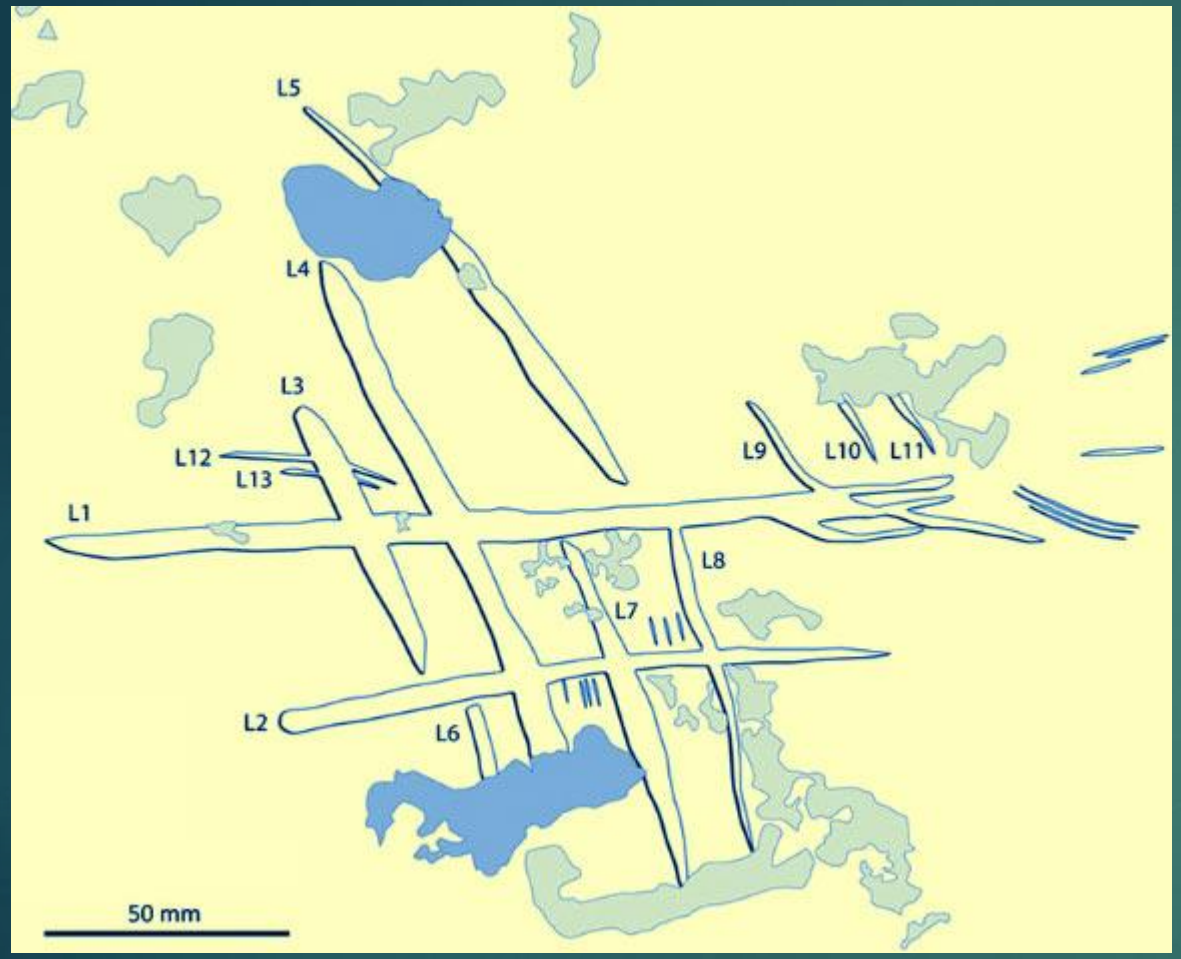
El Castillo Cave: Neanderthals were Earth's first cave painters.

- In El Castillo cave:
  - hand stencils
  - simple red disk.
- At more than 41 Ka, this is among Europe's oldest dated art

Photograph courtesy Pedro Saura via Science/AAAS

The Hash Tag: Neandertal @ Gibraltar

Gorham's Cave, 2012: 39 Ka



Neanderthal engraving from Gorham's Cave, Gibraltar. Image credit: Joaquín Rodríguez-Vidal et al.

Deeply impressed cross-hatching laboriously carved into the bedrock during several hours of work (probably more than 300 strokes). Its dimension is 20 x 20 cm and it has remained covered by an undisturbed archaeological level containing Mousterian artifacts made by Neandertals at least 39 ka.

2014: Neandertal Art

- Gibraltar Cave, 2012:
- 39 Ka, crosshatched pattern of 13 grooves in the bedrock
- took between 188 and 317 strokes with a flint tool to create the entire figure.

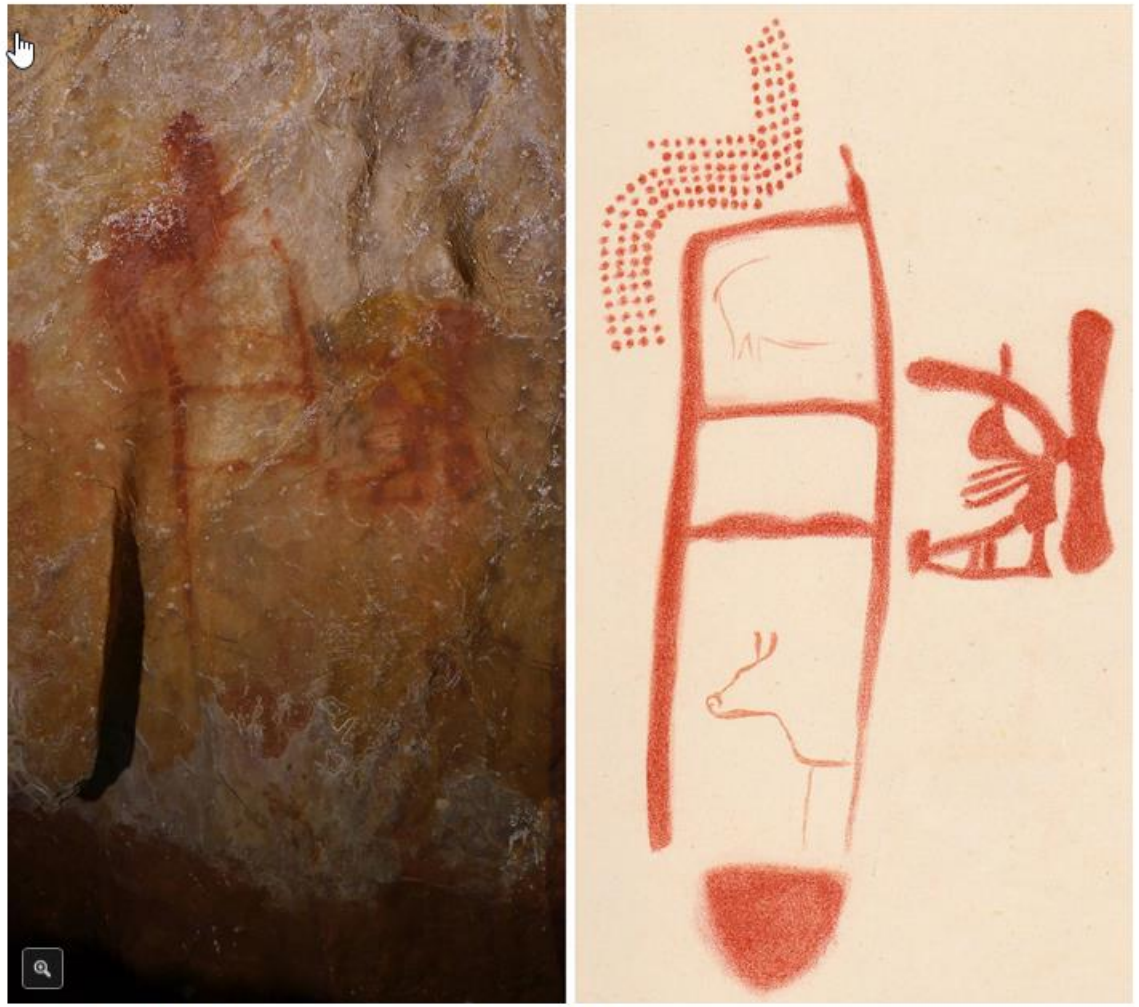
Clan Marking?

Gibraltar Cave, 2014

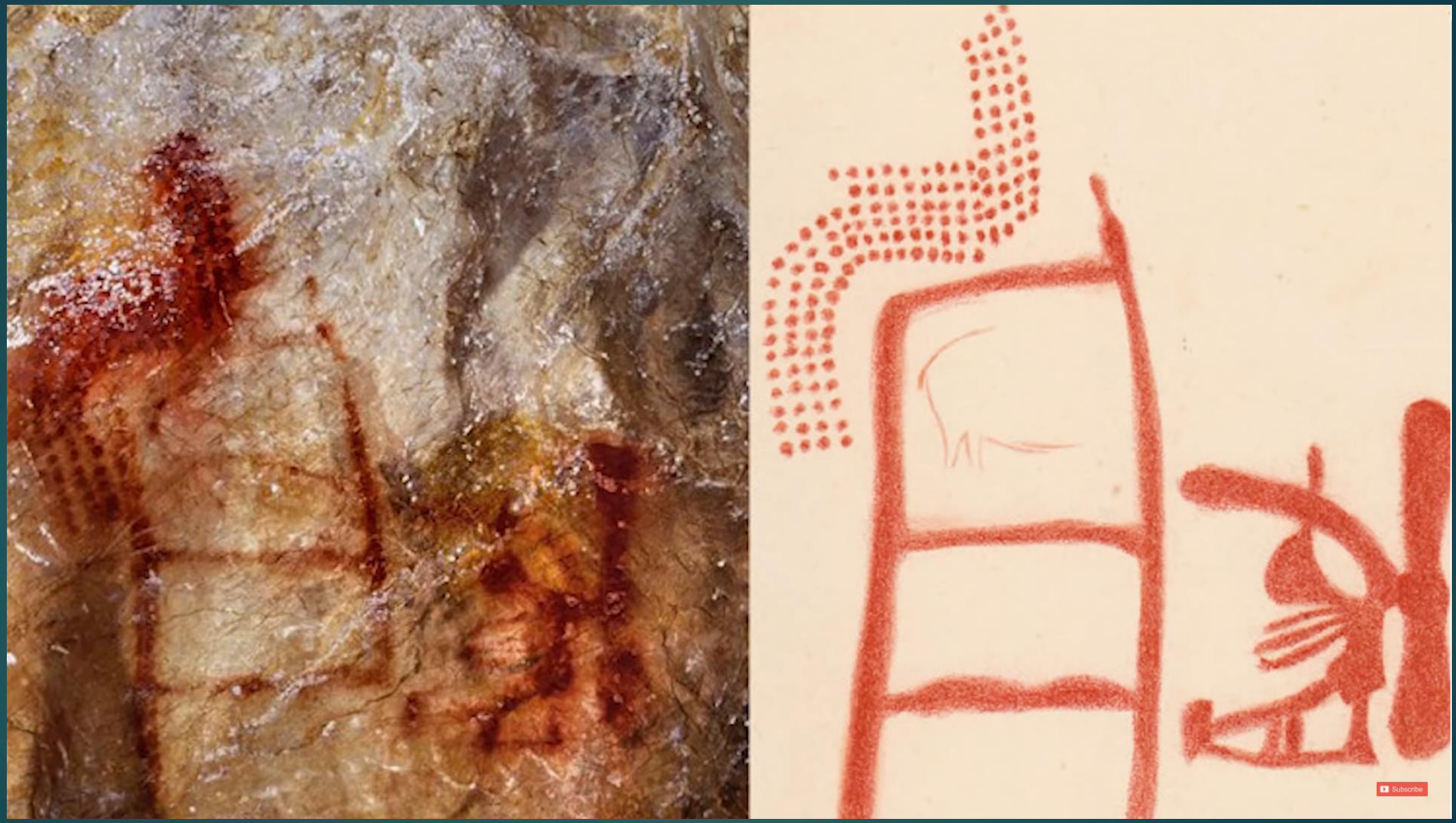
It's Official: Neanderthals Created Art

La Pasiega Cave, in N Spain: 64 Ka

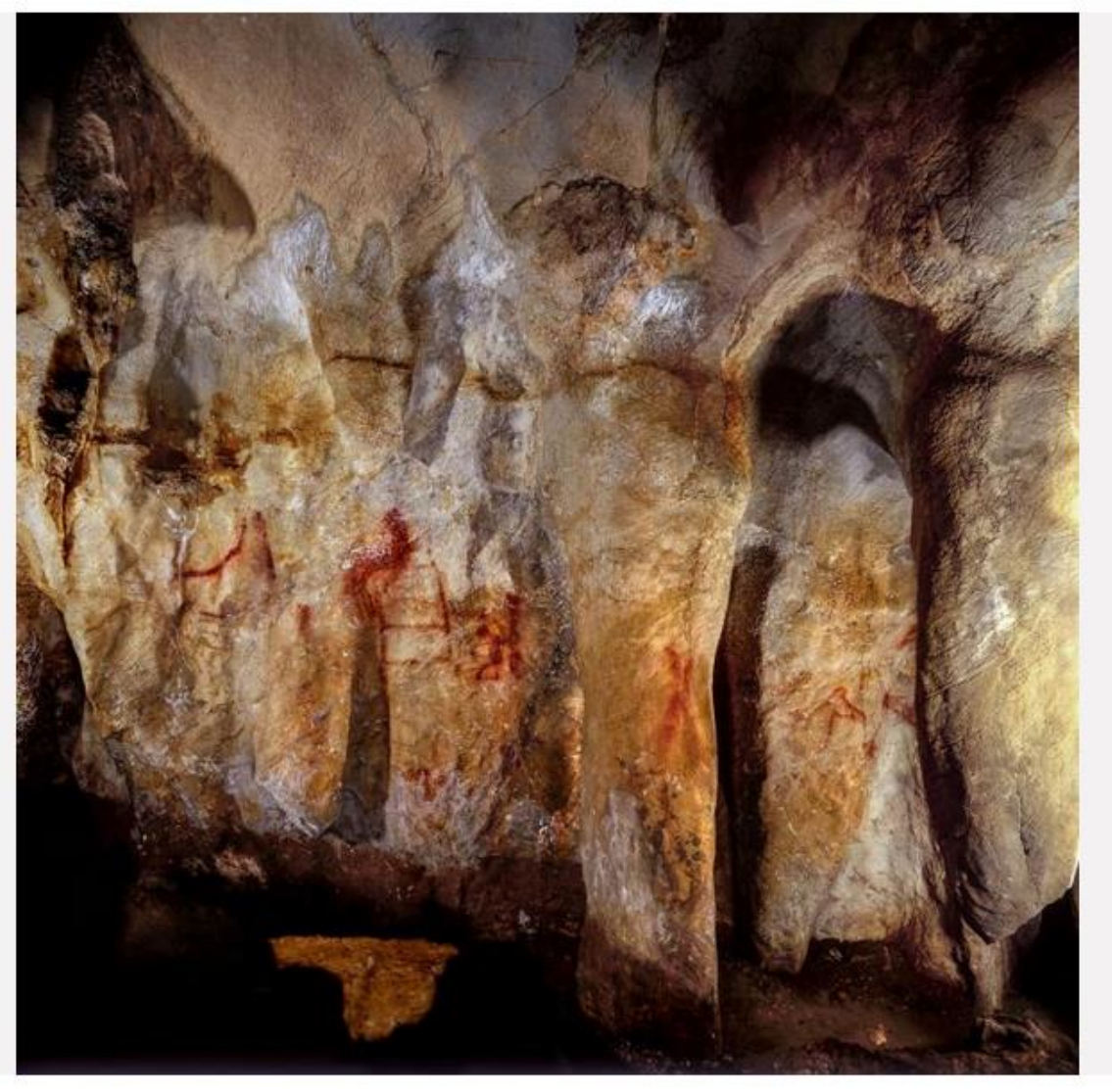
This ladder shape made of red horizontal and vertical lines. The artwork dates to more than 64,000 years ago, suggesting it was created by Neanderthals.

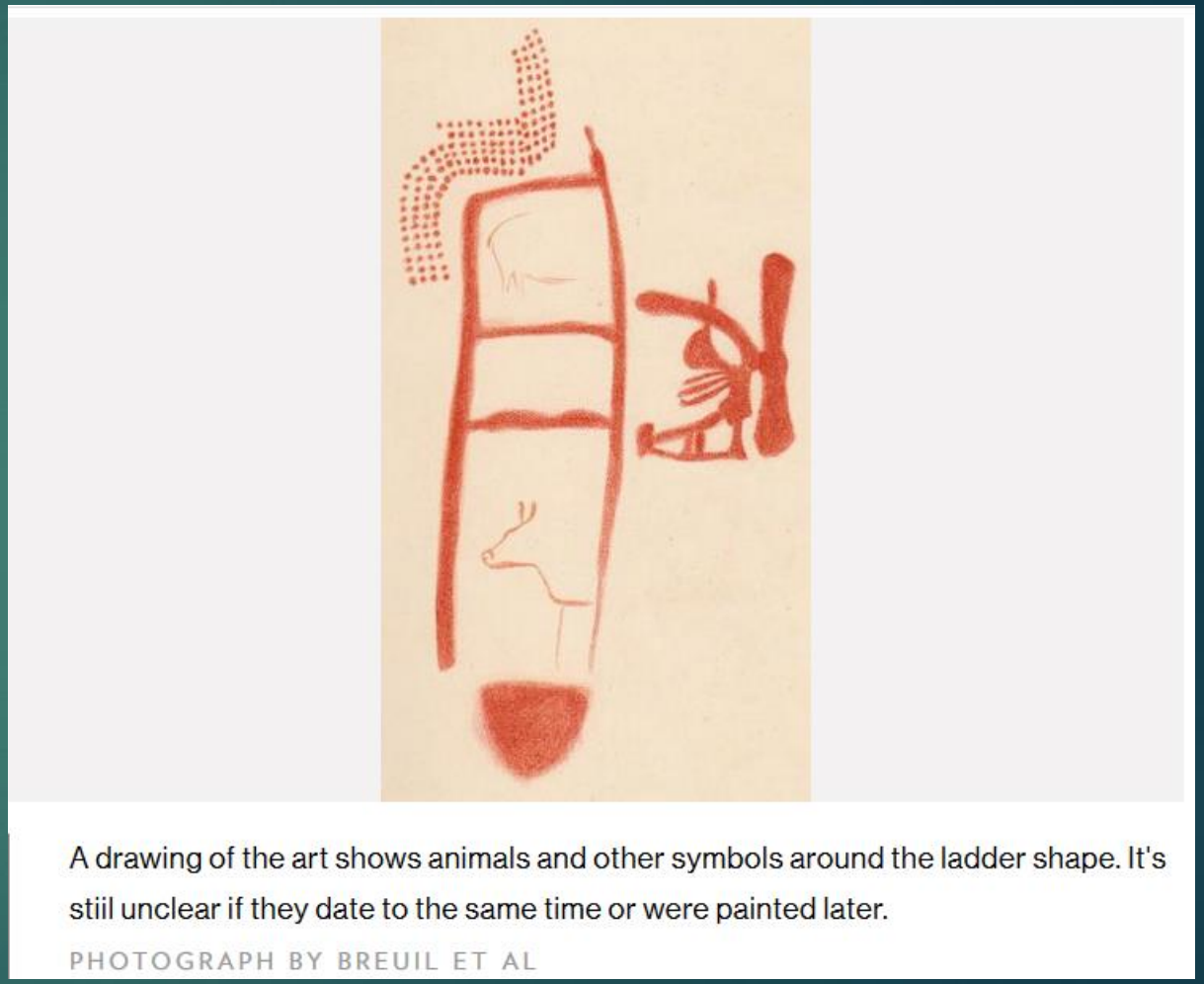


Left, the ladder-like painting in the La Pasiega cave, composed of red horizontal and vertical lines. Right, a rendering made by an archaeologist in 1913. C.D Standish, A.W.G. Pike and D.L. Hoffmann


Subscribe

This ladder shape made of red horizontal and vertical lines.





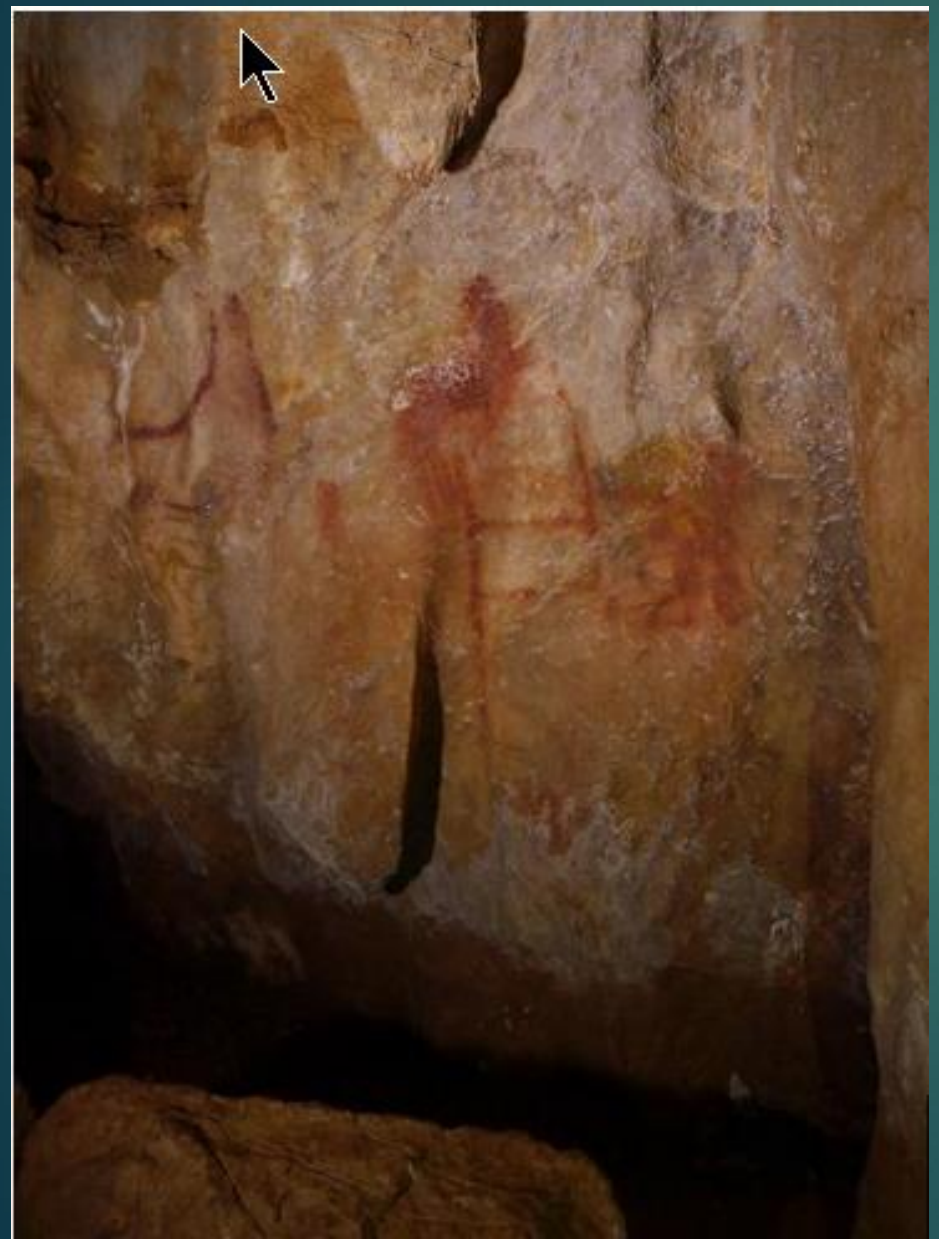
A drawing of the art shows animals and other symbols around the ladder shape. It's stiil unclear if they date to the same time or were painted later.

PHOTOGRAPH BY BREUIL ET AL

New Dating: Paintings are older than calcite above them

- Flowstones contain tiny amounts of uranium, which slowly breaks down into thorium. The older a flowstone gets, the more thorium builds up inside it. A flowstone covering a piece of cave art can give a minimum age for its creation
- It can only assign a minimum age to cave paintings.
- In three caves, it turned out, some of the art was over 64,000 years old
- Indicates the emergence of behavioral complexity in the human lineage. Neanderthals undoubtedly had the capacity for symbolic behavior, much like contemporaneous modern human populations residing in Africa.

Red Ladder



Another Maltravieso Cave showing three hand stencils (circled). One has been dated to at least 66,000 years ago and must have been made by a Neanderthal. The enhanced colour of the photo shows the outline of the hands. The research team

Dated to 65,000 years ago, the cave paintings are the oldest cave art ever found

Some of them were painted in pitch black areas deep in the caves—requiring the preparation of a light source as well as the pigment.

D. L. Hoffmann, et al., Science, 2018
Dirk L. Hoffmann, et al., Sc Advances, 2018


Red-painted spelothems
Ardales, Andalucia
> 65.5 ka

Critique of Hoffman

- Early dates for ‘Neanderthal cave art’ may be wrong
- Maxime Auberta, Adam Brumm, Jillian Huntley, 2018

- Our own critique focuses on two key points:
  - (1) whether dated red markings on flowstone curtains are evidence for rock art production
  - (2) potential problems with the sampling methodology used to infer extremely old minimum ages for clearly discernible rock art motifs.

No N art?

- But Hoffman and his team that carried out the dating of the prehistoric paintings is standing firm.

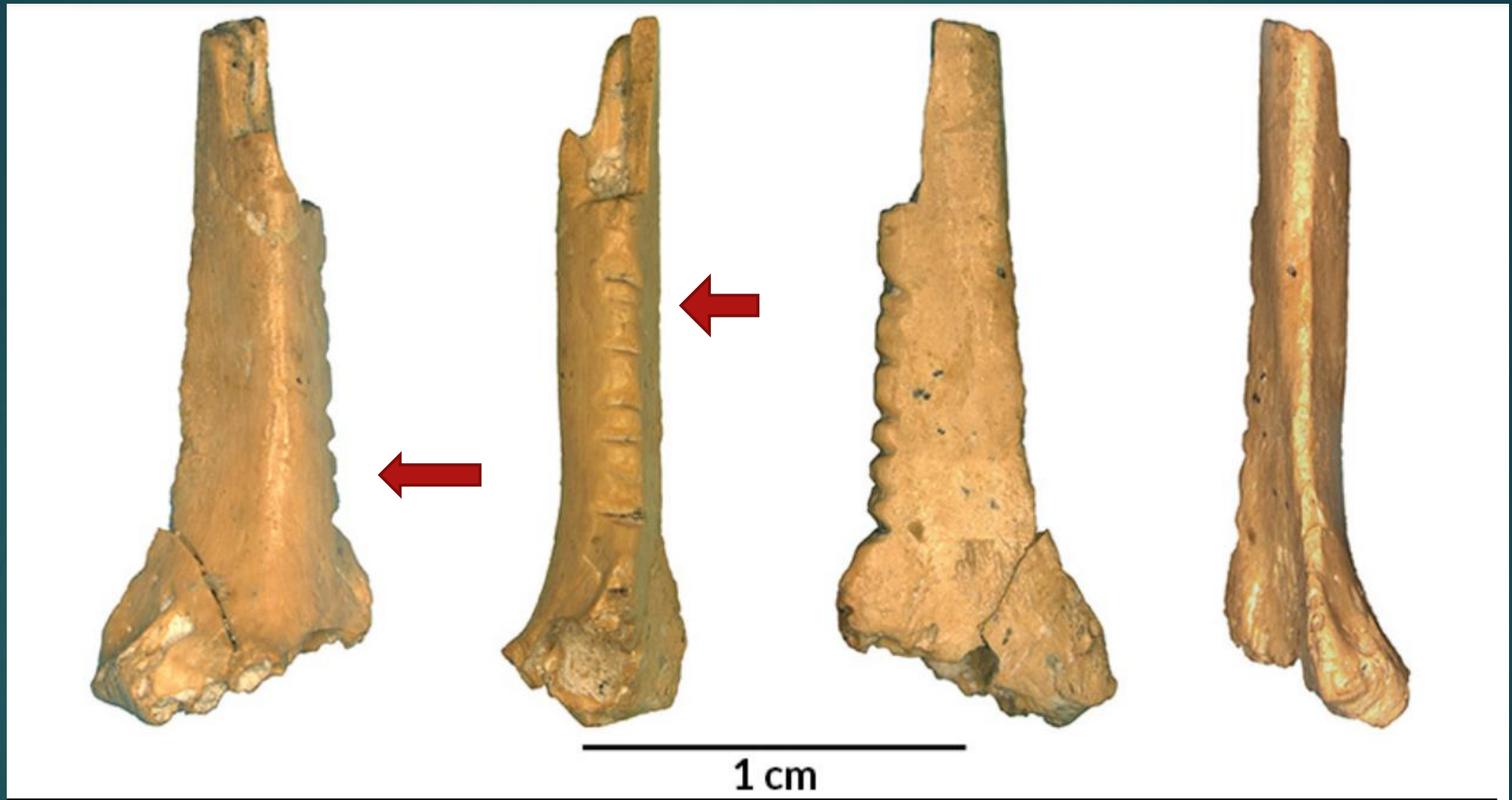
- “None of the criticisms hold,” “They seem to be driven by the belief that Neanderthals were not able to paint in caves.”

- Paleoanthropologist John Hawks at the University of Wisconsin–Madison described the critique paper as a “total rant coauthored by more than 40 archaeologists” He added: “I agree that we must be vigilant about the possibility of systematic error in ‘old’ uranium-thorium dates. […] But the idea that we can discard inconvenient data points because ‘the whole pattern of archaeology’ is against it is a strikingly nonscientific attitude.”

Ns vs MHs

- The two new studies don't just indicate that Neanderthals could make cave art and jewelry.
- They also establish that Neanderthals were making these things long before modern humans — a blow to the idea that they simply copied their cousins.
- The earliest known cave paintings made by modern humans are only about 40,000 years old (in SE Asia), while Neanderthal cave art is at least 24,000 years older.
- The oldest known shell jewelry made by modern humans is about 70,000 years old, but Neanderthals were making it 45,000 years before then.

Eye for pattern: Raven wind



CUTS ABOVE Notches carved into a raven's wing bone by Neandertals include two that were added to create a consistent, possibly symbolic pattern, scientists say. Added notches are second from bottom and second from top in the side view of the bone.

Châtelperronian industry

Classic MH Upper Paleolithic Art – 35 Ka and after

Classic UP symbolic artifacts

N Artifacts


birch bark pitch
Campitello quarry 180 ka
Belvedere Maastricht
300 ka
Sclayn 40 ka
La Chapelle-aux-Saints
Tabun 120 ka
Könisgau 80 ka
Fumane 47 ka
Neandertal innovations
Pech-de-L'Azé
Cueva Anton
Les Pradelles 60 ka
Quneitra 60 ka
Grotte du Renne 45 ka
Bruniquel 176 ka
Krapina 130 ka
Fumane 47 ka
Gorham's Cave 40 ka
Grotte du Renne 45 ka

Châtelperronian Industry Controversy

- Known as the Châtelperronian industry due to numerous artefacts and body ornaments found in this area of central France and northern Spain,

- The area is critical to the debate regarding the extent of Neandertal cognition,

- It has long been debated whether the Châtelperronian (CP), a transitional industry from central and southwestern France and northern Spain, was manufactured by Neanderthals or modern humans.

A beginning of art and modern culture?

- One site of Neandertal remains + Châtelperronian industry 45-40 Ka
  - Bone tools
  - Carved bone pendant
  - Pierced bones & teeth
  - Blade tools

Châtelperronian industry controversy

- Neandertals are accepted by many as the makers of the Châtelperronian, best known from the Grotte du Renne at Arcy-sur-Cure in France, excavated by Leroi-Gourhan and his team between 1949 and 1963.
- The interpretation of the industry, rich in distinctively “modern” cultural features such as ornaments and bone tools, has been the subject of heated debates.
- Was the CP material:
  - (i) an invention of Neandertals,
  - (ii) result of stratigraphic admixture of N remains & UP artifacts,
  - (iii) due to acculturation of Ns from MHs

Tools: Châtelperronian

- Classic lithics theory: In Europe,
  - MP (Mousterian) stone tools are invariably associated with Ns,
  - UP (early Aurignacian) toolkit are always associated with MHs

- Only exceptions come from Arcy-sur-Cure and Saint-Cesaire, France (45k), where an UP (Châtelperronian) industry associated with N skeletal fossils

- The Châtelperronian industry (*Châtelperronian* or *Castelperronien* in French) is considered to be the very last behavioral testimony of Neanderthals in France and northern Spain

Châtelperronian Wars

- Paul Mellars: Neanderthals were "acculturated" by modern humans bearing the Aurignacian type of Upper Paleolithic, and learned from them to make the blade tools and beads characteristic of the Châtelperronian (Mellars 1996, 2005).

- D'Errico, Zilhão: the Châtelperronian occurred before modern humans had arrived, demonstrating that Neanderthals had the ability to make the sophisticated material culture of the Upper Paleolithic

Grotte du Renne, debate started in 1999

A late Neanderthal associated with Upper Palaeolithic artefacts

Jean-Jacques Hublin*, Fred Spoor†, Marc Braun‡, Frans Zonneveld§ & Silvana Condemi‖

1996

Grotte du Renne....20 years ago

1999

Neanderthal Acculturation in Western Europe?

A Critical Review of the Evidence and Its Interpretation*

by Francesco d'Errico, João Zilhão, Michèle Julien, Dominique Baffier, and Jacques Pelegrin

1998

Journal of World Prehistory, Vol. 13, No. 1, 1999

The Chronology and Taphonomy of the Earliest Aurignacian and Its Implications for the Understanding of Neandertal Extinction

João Zilhão[1,3] and Francesco d'Errico[2]

The view that the Châtelperronian is the acculturation of late Neandertals brought about by contact with nearby moderns assumes an age of ca. 40,000 years ago for the earliest Aurignacian. However, the cultural meaning of the dated samples is dubious, either because they were collected from palimpsests containing other archaeological components or because the definition of the associated artifact suites as Aurignacian is not warranted. Wherever sample context is archaeologically secure, the earliest occurrences of the Aurignacian date to no earlier than ca. 36,500 B.P. This is in accordance with the stratigraphic pattern demonstrating the precedence of the Châtelperronian and equivalent technocomplexes of central and eastern Europe, consistently dated by various methods to before ca. 38,000 B.P. Given the Neandertal authorship of the Châtelperronian, it must be concluded that Neandertals had already accomplished their own Middle-to-Upper Paleolithic transition when the first Aurignacian moderns arrived in Europe. Therefore, such a transition occurred simultaneously and independently among European Neandertals and sub-Saharan moderns, across biological boundaries and irrespective of geographical proximity. This suggests that its causes lie in the domain of social process, not in that of putative biological mutations that would have bestowed symbolism upon a lineage of "chosen people."

KEY WORDS: Aurignacian; Châtelperronian; Neandertals; modern humans; Ex

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Av. da India 136, 1300 Lisboa, Portugal. e-mail: jzilhao@ipa.min-cultura.pt

0892-7537/99/0300-0001$16.00/0 © 1999 Plenum Publishing Corporation

Grotte du Renne, 20 year debate

Dental remains from the Grotte du Renne at Arcy-sur-Cure (Yonne)

Shara E. Bailey [a,b,*], Jean-Jacques Hublin [a]

Bar-Yosef, O. and Bordes, J.G., 2010. Who were the makers of the Châtelperronian culture?. *Journal of human evolution*, *59*(5), pp.586-593.

Chronology of the Grotte du Renne (France) and implications for the context of ornaments and human remains within the Châtelperronian

Thomas Higham[a,1], Roger Jacobi[b,c,1], Michèle Julien[d], Francine David[d], Laura Basell[e], Rachel Wood[a], and Christopher Bronk Ramsey[a]

PNAS 2010

OPEN ACCESS Freely available online

PLoS one

The Reality of Neandertal Symbolic Behavior at the Grotte du Renne, Arcy-sur-Cure, France

2011

François Caron[1], Francesco d'Errico[2,3]*, Pierre Del Moral[1], Frédéric Santos[2], João Zilhão[4]

PNAS

Radiocarbon dates from the Grotte du Renne and Saint-Césaire support a Neandertal origin for the Châtelperronian

Jean-Jacques Hublin[a,1], Sahra Talamo[a], Michèle Julien[b], Francine David[b], Nelly Connet[b,c], Pierre Bodu[b], Bernard Vandermeersch[d], and Michael P. Richards[a,e]

Higham, T., Brock, F., Ramsey, C., Davies, W., Wood, R. and Basell, L., 2011. Chronology of the site of Grotte du Renne, Arcy-sur-Cure, France: implications for Neanderthal symbolic behaviour. *Before Farming*, *2011*(2), pp.1-9.

PNAS

Palaeoproteomic evidence identifies archaic hominins associated with the Châtelperronian at the Grotte du Renne

Frido Welker[a,b,1], Mateja Hajdinjak[c], Sahra Talamo[a], Klervia Jaouen[a], Michael Dannemann[c,d], Francine David[e], Michèle Julien[e], Matthias Meyer[c], Janet Kelso[c], Ian Barnes[f], Selina Brace[f], Pepijn Kamminga[g], Roman Fischer[h], Benedikt M. Kessler[h], John R. Stewart[i], Svante Pääbo[c], Matthew J. Collins[b], and Jean-Jacques Hublin[a]

Historical Theories about the origin of Châtelperronians

- Invented by modern humans (Bar-Yosef and Bordes)
- Reworking of depositional layers (later mixed with earlier layer) (White 2001; Mellars 2010; Higham *et al.* 2010; Bar Yosef & Bordes 2010).
- Acculturation of Neanderthals by Modern Humans: Ns collection of MH personal ornaments, imitation, long distance influence (Hublin, Mellars, Otte)
- Independent invention by Ns (d'Errico et al. 1998)
- Cultural exchange between Ns and MHs (d'Errico et al. 1998)
- Acculturation of MH by Neanderthals: MHs collected N ornaments
- Biological affiliation does not matter anymore (Zilhão et al., Hublin)

The Châtelperronian

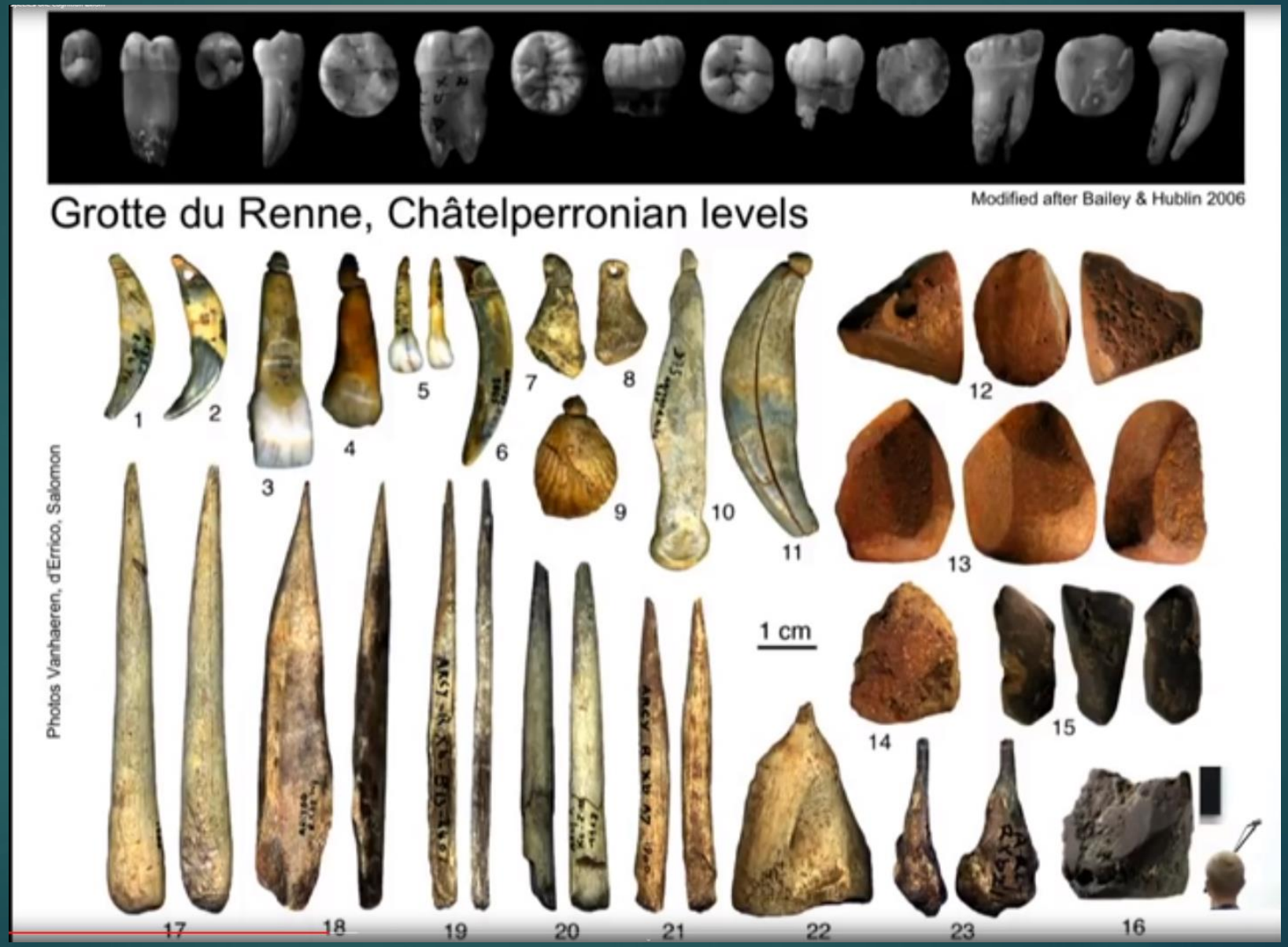
- Do the ornaments found in the lower Châtelperronian layers come from the higher Aurignacian and Gravettian layers?

- NO

  - 5 times more ornaments in the lower Châtelperronian than in the higher Aurignacian

  - 74% of the Châtelperronian beads come from the lowermost layer X

Grotte du Renne, Châtelperronian industry




IX
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12
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14
IX
Châtelperronian
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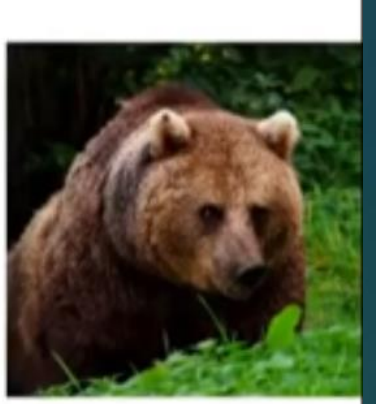
1 cm
X
White-tailed eagle,
Pygargue à queue blanche
Haliaeetus albicilla

Hyena canine

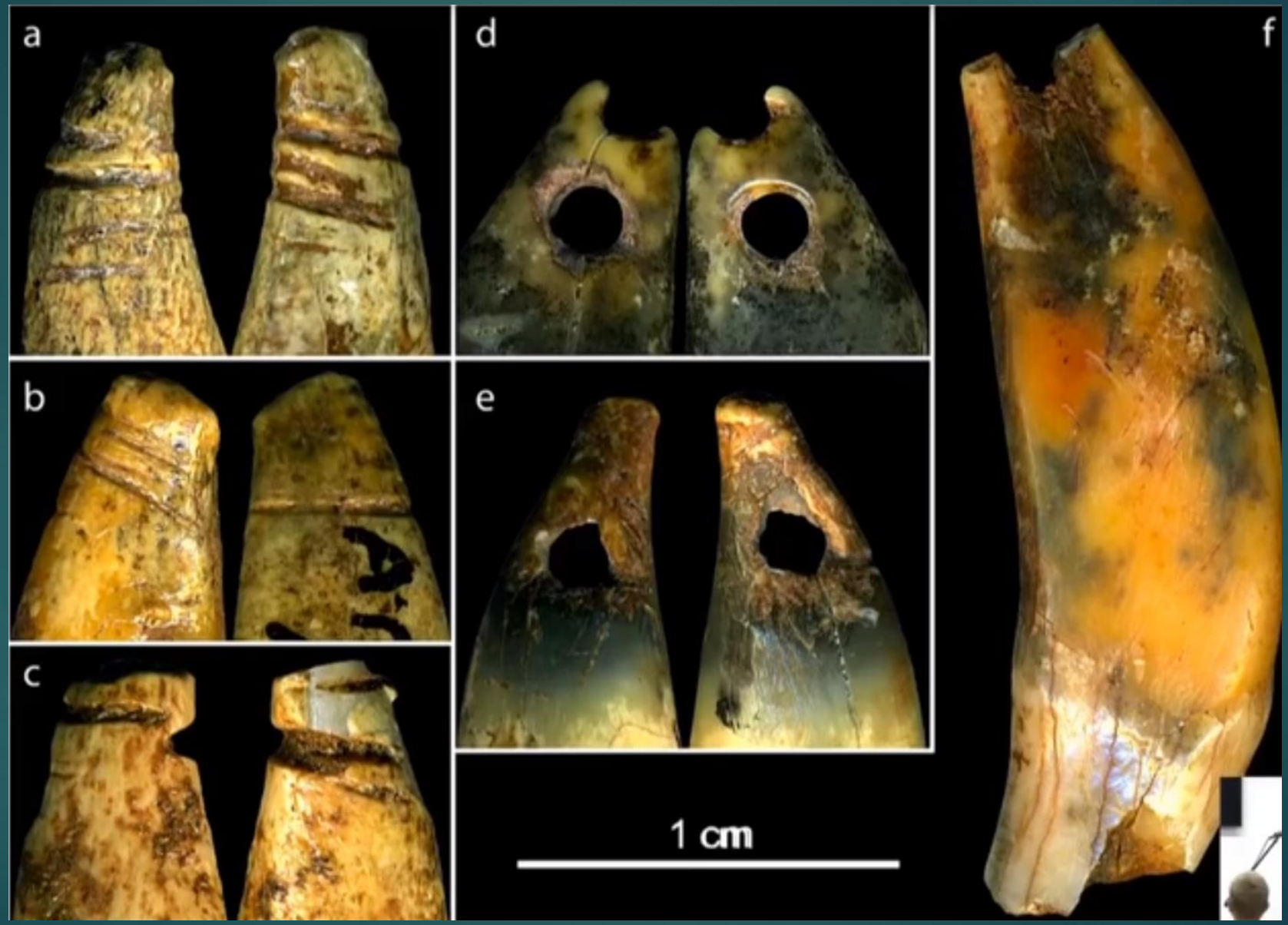


1 cm

VIII

VIII

Vanhaeren, d'Errico et al in press


a
b
c
d
e
f
1 cm


1 cm


a
b
c
d

Grotte du Renne

Châtelperronian
Levels VIII-X
Mammouth ivory

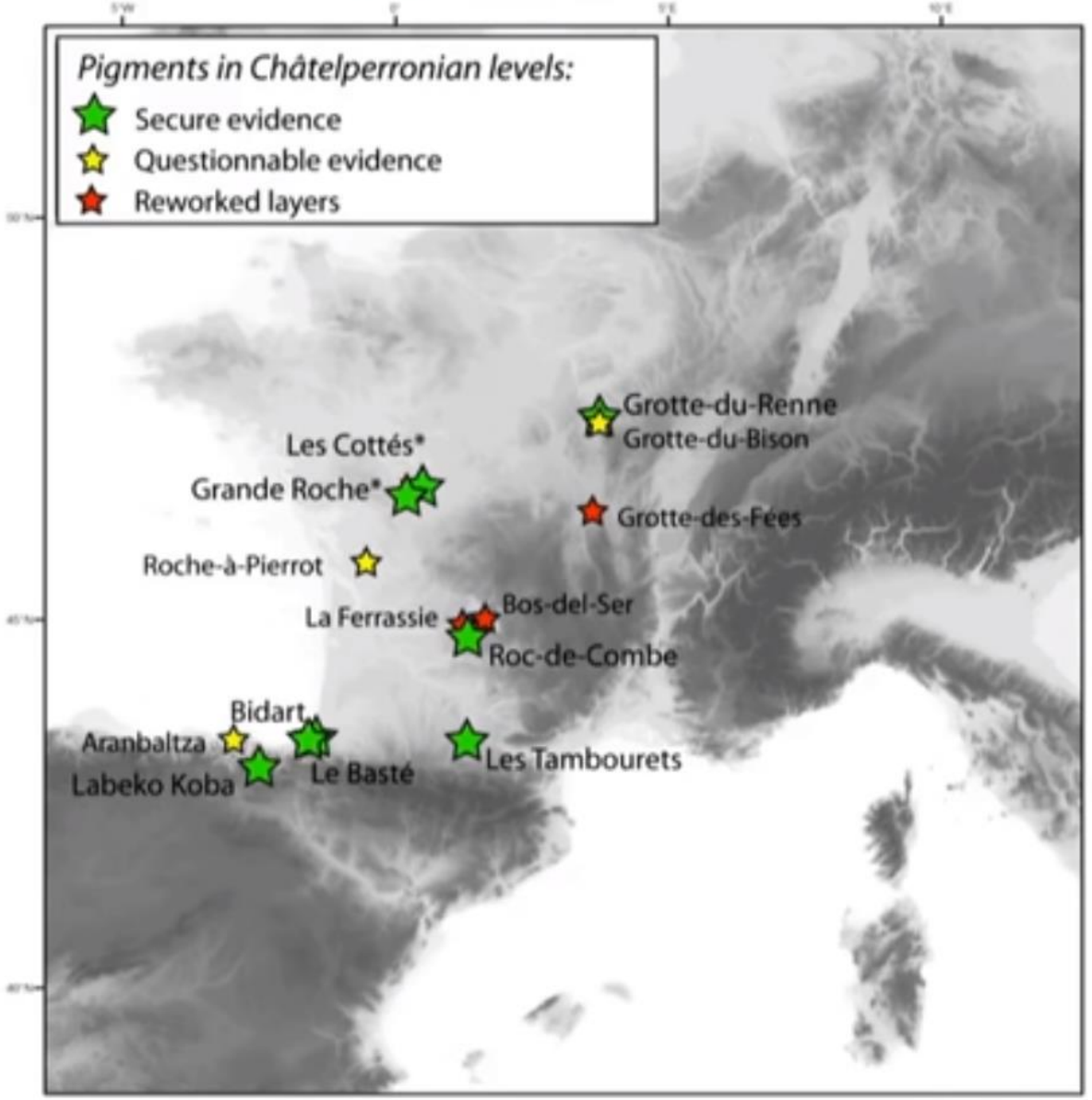
81 artifacts

- Byproducts
- Preforms
- Finished tools
- Broken tools
- Resharpened tools
- Recycled tools

Grotte du Renne, Levels VIII-X, Châtelperronian

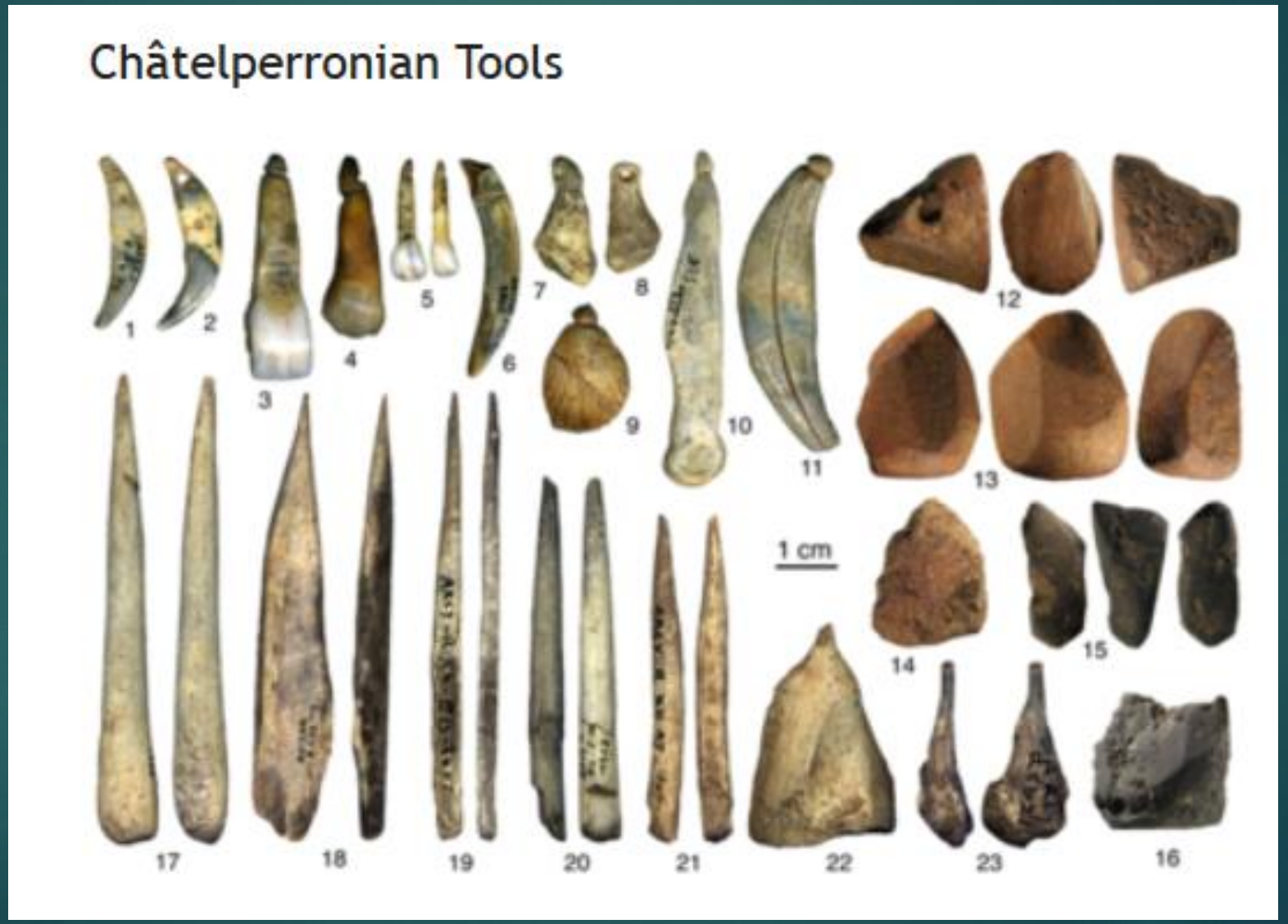
'Smoothers' made of ribs and ivory n= 14

Presence of pigmental materials at Châtelperronian sites



Dayet, d'Errico, Garcia Moreno 2015 *JAS*

Châtelperronian Tools made by Neandertals



2016: Châtelperronian tools & jewelry definitely Neandertal

Châtelperronian Neanderthal bone artefacts from the Grotte du Renne (Arcy-sur-Cure, France)

Palaeoproteomic evidence identifies Neandertals associated with the Châtelperronian at the Grotte du Renne

Frido Welker, et al., 2016

Châtelperronian Neanderthal body ornaments and awls

Châtelperronian Neanderthal body ornaments from the Grotte du Renne (Arcy-sur-Cure, France). Credit: Marian Vanhaeren und Michèle Julien

Grotte du Renne in Arcy-sur-Cure.

Châtelperronian Neanderthal bone artefacts from the Grotte du Renne (Arcy-sur-Cure, France) Credit: Marian Vanhaeren, Francesco d'Errico and Michèle Julien

Châtelperronian industry

The final Neanderthals in France (33,000–30,000 years ago) began to make ornaments from animal bone and teeth, such as this necklace from Arcy sur Cure.

Photograph © Claudio Vazquez

Fig. 1. Chatelperronian ornaments from Grotte du Renne (first six from the left) and from Quinçay. Scale = 1 cm.

Châtelperronian Industry: New older dates in 2012

- 2012: Jean-Jacques Hublin team has now analyzed bone samples from two sites in France, Grotte du Renne and Saint Césaire, and radiocarbon-dated them using an accelerator mass spectrometer.

- The new high precision dates show that the CP bone tools and body ornaments were produced by Neanderthals. The CP phase is dated to between 44,5 and 41 Ka and the CP Neanderthal skeleton of Saint-Césaire from the end of this time period ~41,5 Ka.

- Hublin: However since these late Neanderthals only manufactured CP body ornaments after modern humans arrived in neighboring regions, the study suggests that cultural diffusion might have taken place between modern humans and Neanderthals.

-

Hublin, J. et al. *PNAS*, October 29, 2012.

Châtelperronian: 1 new infant N – 28 fragments in 2016

- 2016: Frido Welker, J. Hublin, et al.: Using ancient protein analysis on the hominin remains in the Grotte du Renne, (Arcy-sur-Cure, France); team identified 28 additional hominin specimens from single, immature, breastfed N infant.

- The direct radiocarbon date obtained for this individual is fully consistent with its direct association of Ns to the Châtelperronian assemblage at the site.

Frido Welker et al., 2016

N collagen: Châtelperronian was definitely Neandertal

- For the first time, directly dated Neandertal bones from the Grotte du Renne cave in France.
- Collins and his team compared the chemical composition of the collagen in the fragments with the collagen produced by modern and archaic humans.
- Modern human collagen contains high amounts of an amino acid called aspartic acid
- CP collagen was once rich in a N amino acid, asparagine—and previously sequenced Neandertal DNA includes a collagen-producing gene that resulted in an asparagine-rich version.

Stockton On Tees, England

Food:

- N caloric need: 4,000 and 7,000 calories per day
- B. Wood: N caloric need --"great in times of plenty but catastrophic in a famine. They were the gas-guzzling pickup truck of the hominins. We were the smart car."
- Wood's suggestion, that Neanderthals were simply not energy-efficient enough to survive periods of scarcity, is compelling, but note that they survived for 400 K+ in such periods

Importance of dental plaque

Value of fossilized dental plaque

- Food analysis via DNA in Neandertal dental plaque
  - used gas chromatography and mass spectrometry
  - Contamination: Fossil Plaque DNA is 97% oral bacteria, and 3% old food.
  - Analysis of ancient foods (meat, plant), carbohydrates and starch granules, plant phytoliths (fossil plant silica), pollen, cooked/roasted, ancient microbes, spit exchange, proteins, milk
  - Can reconstruct ancient microbiomes

N diet

- Negative N Hypothesis: Neandertals had a narrow diet that proved unsuccessful in competition with modern humans that had a more diversified diet.

  - Neandertal diet was more diverse than generally acknowledged, and varied according to different regional environments.

  - The faunal remains in Mediterranean regions indicate an abundance of small ungulates i.e. gazelle, roe deer, fallow deer, goats at cave sites such as Kebara, Misliya, & Amud

N diet

- Ns = not just scavengers; but formidable hunters;
  - diet heavily based on large terrestrial herbivores, such as reindeer, woolly mammoth, and woolly rhinoceros. Ns selected prey from throughout herds (not just weak)
  - But diet was not restricted to just large and medium size herbivores.
  - Several sites document a broader diet, including aquatic foods, as well as plant resources
  - Diet included fast and slow small prey, such as wild rabbits, tortoise, birds, ducks

Neandertals: Diet

- N as meat eaters:

- Previous isotope results indicated a primarily carnivorous meat diet for Neanderthals, which matches the extensive archaeological record of animal remains found and deposited by Neanderthals.

- Teeth plaque reveal N ate 80% meat, 20% plant food; 2014 fossilized feces study indicates more plant usage

2019: N as meat eaters

- The Neanderthals from Les Cottés and Grotte du Renne, in France; data
  - from a tooth root, which recorded the diet between four to eight years of the individual's life, and on
  - a bone of a one-year-old baby.
  - the Neanderthal of Les Cottés had a purely carnivore diet: she was not a late weaned child or a regular fish eater;

- These Ns mostly hunted reindeers and horses

- Grotte du Renne Neanderthal was a breastfeeding baby whose mother was a meat eater.

Klervia Jaouen,, et al., 2019

Regional diets

- Neanderthal diets were clearly complex and variable.
- Plants in diet: either from stomach contents (chyme) of animals killed or from gathering of plants
- Regional cuisines: exploited the local food resources where they lived.
- Coastal populations: relied on less risky marine and intertidal resources, as seen at Gibraltar in the exploitation of shellfish and seals
- Fish and birds are also likely to have been exploited when available

N diet

- Neanderthals occupied regions with substantial ecological variation in time and space, and varying their diets accordingly

- Faunal remains suggest a reliance on large game, which varied according to the ecological context,
  - bison, reindeer and horse predominating within faunal assemblages,
  - But also exploited megafauna in the form of woolly rhinoceros and mammoth, such as at La Cotte de Ste Brelade.

N Ribs: A lot of meat = larger livers and kidneys; like Inuits

- The Neanderthal bell-shaped ribcage is famously much wider than that of modern humans.
- Developed these large torsos over millennia to house livers and kidneys that had enlarged to cope with high levels of meat protein.

- We modern humans can only tolerate about 35 percent of lean protein in our diets before our kidneys start to suffer.

- Some traditional Arctic populations such as the Inuit, who sometimes subsist on an all-meat diet, have larger kidneys and correspondingly longer ribs than average Europeans

N Diet: regional and food diversity

- Food diversity: The faunal remains in Mediterranean regions indicate:
  - abundance of small ungulates i.e. gazelle, roe deer, fallow deer, caprids small prey, such as wild rabbits, tortoise, ducks.
  - Capture of raptors, corvids and wood pigeons for removal of wing feathers is documented by cutmarks and bone breakage.
  - Beaver, marmot and some carnivore (bear, fox), freshwater fish (trout, chub, eel)

Diet DNA Data from N teeth plaque: regional cuisines

- Two regional cuisines:
- A. Spy cave, Belgium, Northern Neanderthal diet was
  - heavily meat based and included woolly rhinoceros and wild sheep, characteristic of a steppe environment. Also mushrooms, roots and tubers.
- B. El Sidrón cave, very northern Spain, ~50 Ka:
  - no meat was detected in the diet of Southern Neanderthals; mushrooms, pine nuts, and moss reflected forest gathering. Also consumed molded herbaceous material.
  - El Sidrón team suggests the small population experienced periods of nutritional stress.

Laura S. Weyrich, et al., Nature, 2017

Neanderthal Paleoethnobotany: Plant food

- Neanderthals consumed plant resources:
  - starch grains from legumes, date palms, and other plants —
  - some of these exhibited the transformations that happen during cooking: found preserved in dental calculus of Neanderthals from Shanidar, Iraq, and Spy, Belgium (Henry *et al.* 2011).
- Large assemblage of charred seeds and fruits (legumes, acorns, pistachios) were recovered from the Mousterian levels at Kebara Cave, Israel (Lev *et al.* 2005)
- Phytoliths (fossil plant minerals) recovered from sediments at Amud Cave suggest the consumption of grasses (Madella *et al.* 2002).

Evidence for food types

- El Sidrón: First molecular evidence for inhalation of wood-fire smoke and bitumen or oil shale and ingestion of a range of cooked plant foods.
- Evidence for
  - edible grass seeds at Amud Cave, Israel (Madella et al. 2002),
  - charred legumes at Kebara Cave, Israel (Lev et al. 2005),
  - charred nuts at Gorham's Cave, Gibralter (Barton 2000)
  - Starch granules from the site of Shanidar in Iraq and two individuals from Spy in Belgium (Henry et al. 2011)
  - Date palms (*Phoenix* spp.)
  - Many of the heat cracked grass seed starches showed damage that is a distinctive marker of cooking

Hardy, et al., 2012

Diet: cooked food

- Also at El Sidrón: cracked starch granules, which suggests the Neanderthals roasted plants before eating them.

- Importance of fire was found in the chemicals within their tartar: there were aromatic hydrocarbons and phenols, which are associated with wood smoke.

- One Neanderthal consumed yarrow, a natural astringent, and chamomile, an anti-inflammatory. those with a bitter taste and no nutritional qualities – but known medicinal properties

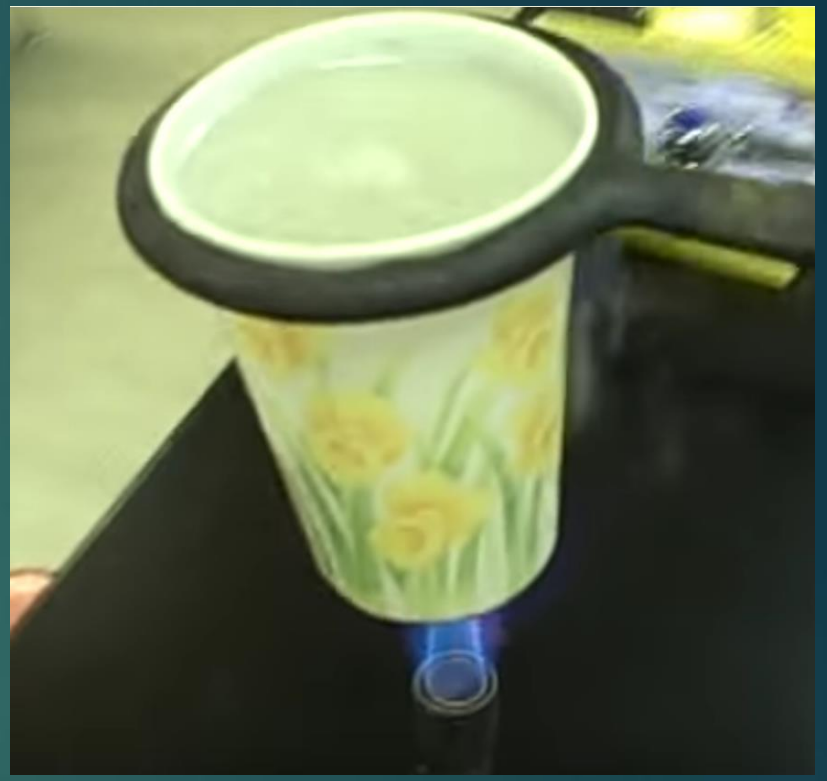
Alternative theory non-food plants

- Study methods of Neanderthal subsistence strategies
- Suggestion that Neanderthals may have been eating non-nutritionally valuable plants for medicinal reasons.
- An alternative hypothesis for the occurrence of non-food plants in Neanderthal calculus based on the modern human ethnographic literature: the consumption of herbivore stomach contents. Like Inuits.
- In effect, natural haggis

Laura T. Buck and Chris B. Stringer 2013

Diet: cooked food

- First studies:
  - Some food had been boiled in water or roasted:
    - Ns could boil using only a skin bag or a birch bark tray
    - by relying on a trick of chemistry: Water will boil at a temperature below the ignition point of almost any container, even flammable bark or hides.



N Plant Diet: N used 61 different plants & had cavities

- 2016 Study: 61 different taxa from 26 different plant families found at 17 different archaeological sites.
- Neanderthals across the entire range probably consumed as many plant species as did modern humans.
- Fairly efficient gatherers: Berries, greens, roots – plants with limited time frame (few weeks), implying knowledge of prey & plant seasonality.
- Ns in Mediterranean contexts provide the only known cases of dental caries due to ingestion of carbohydrates in the form of plant resources.

Gerhard P. Shipley and Kelly Kindscher, 2016

Gibraltar Ns: Diet

- Ancient pollen data and animal remains recovered from Gibraltar indicate Neanderthals had access to a variety of habitats—woodlands, savannah, salt marshes and scrub land—that provided a wealth of food options.
- Evidence for continuous use of coastal resources between ~150 and 40 ka

- Paella minus the rice: Remains from the Gorham's cave suggest that they exploited seafood and marine mammals, including monk seals, fish, mussels, limpets, cockles, tortoises, and even dolphin on a seasonal basis.

Gibraltar Ns: Diet – Birds

- The remains of more than 161 different species of bird
  - have also been uncovered in Gorham's cave,
  - many with tooth and cut marks,
  - which suggests Neanderthals ate them.

Rabbits and hares and fish

- Growing number of Neanderthal sites with demonstrated exploitation of leporids (rabbits and hares)
- Catching fast small animals was within the behavioral repertoire of numerous Neandertals
- Middle Paleolithic sites with fish remains do exist and continue to increase in number.
- Preservation bias: Both leporids and fish are more likely not to be preserved or recovered due to their small size and fragility

Coprolites

- Neanderthal coprolites, or fossilized feces, have been found in many archaeological sites, including El Salt, Spain.

- Fossilized poop found in abandoned hearths, some resulted from a meat-rich diet, others from someone eating a lot of plants.

- Some of the coprolites: host to a hearty population of nematodes, which might have made those individuals quite sick.

Ainara Sistiaga

La Cott

La Cotte de St Brelade on Jersey

- On island of Jersey, piles of bones of mammoths and wooly rhinos found at base of cliff
  - 250 K stone tools
  - Some are adults, too big for most predators
  - Carcasses have been butchered with stone tools
  - Skull cavity opened, to extract brain tissue
  - Bones have been sorted by body parts

Significance of barbecues: Neandertal cognitive ability at Jersey?

- Cliffs at La Cotte de St. Brelade, Jersey: barbecued piles of mammoth and wooly rhino bones

- Earlier Game Drive theory: Ns deliberately drove animals over the cliff in 2 separate incidents – requiring communication, planning & cooperation; klg that animals have predictable behaviors; (Native Americans used fire drive lanes to drive bison over cliffs)

- Martin Bates et al., 2014: Plateau was too rocky & steep for mammoths; but other studies indicate Ns used terrain klg to trap animals.

La Cotte de St. Brelade, Jersey: Ns for 140 K

- Greatest long term occupation site of N in Europe;
  - N kept returning to La Cotte for 140 K years,
  - from 180 Ka to 40 Ka; longest barbecue site in history

- Rock shelter theory --possibly N brought bones there to burn & for shelter; hundreds of thousands of flint stone tools (of “Lavallois” tradition) and bone fragments have been uncovered; 80% right-handed at La Cotte (via tool evidence)
- The site was apparently abandoned from time to time when the climate cooled, forcing the Neanderthals back to warmer territory.

Cannibalism

Mortality risks from interpersonal violence

- Little evidence of interpersonal violence among Ns.
- In pre-Neanderthal populations at Sima de los Huesos: cranium 16 shows evidence of several blunt force trauma blows to the frontal bone for example (Sala et al. 2015).
- For Neanderthals themselves there are two recorded instances of probable interpersonal violence:
  - one individual from St Cesaire (Zollikofer et al. 2002): a blunt force head wound (from which they recovered)
  - one from Shanidar (Shanidar 3) (Churchill et al. 2009b): a projectile point injury, most probably from modern human projectiles, which appear to have led to death several days later.
- Interpersonal violence has also been argued to be the most likely explanation for patterns of cranial trauma at Krapina (Estabrook and Frayer 2014)

Shanidar 3 rib with weapon injury: 1st murder evidence?

Rick Potts adds, Shanidar 3 “is the Hope Diamond of the Human Origins collection”

Intragroup aggression

- Very low population densities would argue against any significant territorial aggression (it would be quite simply impossible to ‘police’ a territory and accidental encounters with other groups would be rare)

- High genetic relatedness (Prüfer et al. 2014; Harris and Nielsen 2016) argues against excessive intragroup aggression

- But climatic stress may have led to another form of intragroup violence: Cannibalism

(Bocquet-Appel and Degioanni 2013; Sánchez-Quinto and Lalueza-Fox 2015)

Earliest site of cannibalism: Gran Dolina; and Bodo, Africa: defleshed cheekbones – nutritional desperation or ritual ?

Evidence for cannibalism

- 3 forms of evidence may imply cannibalism:
  - sheer abundance of human skeletal fragments in a site
  - occurrence of cut-marked or burned fragments
  - cut marks are similar to those on other animals in same site; same tx
- Krapina, Croatia: 900 pieces from at least 14 individuals
- El Sidrón, Spain: 1,223 fragments; extraordinary number of hypoplastic enamel defects in teeth, reflecting periods of arrested growth indicating environmental stress
- Moula-Guercy Shelter, ~100 Ka, France: 78 N bones of 6 people; most compelling; same cutmarks as on nearby deer bones

Cannibalism

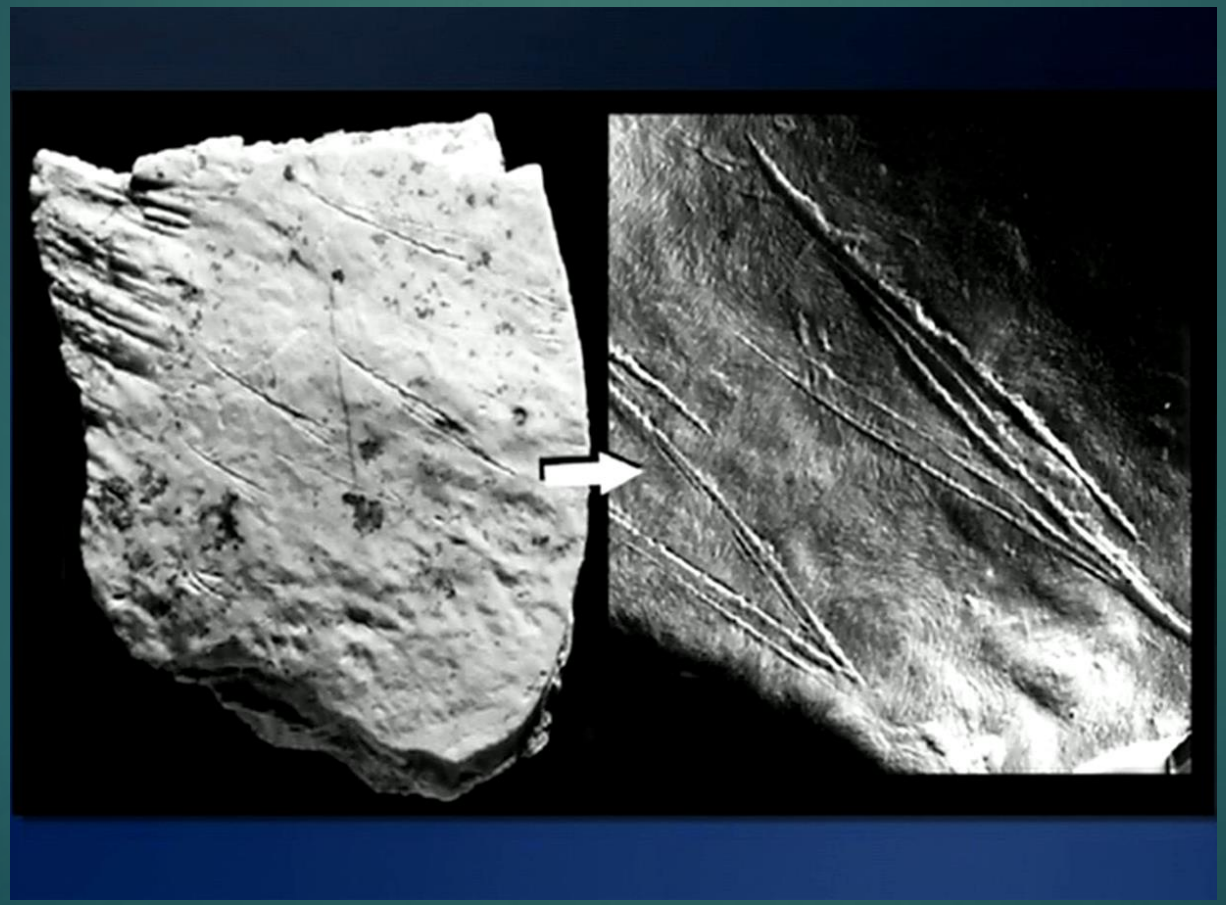
- N teeth evidence of periods of severe starvation were not uncommon
- Neanderthals occasionally practiced cannibalism.
- At the site of Moula-Guercy, France, a number of Neanderthal remains were found with butchery marks indicating defleshing and marrow extraction
- The similarity between the butchery marks on the Neanderthal bones and those on nearby deer in the cave suggests the Neanderthals were consuming their dead for food (Defleur *et al.* 1999).

Neandertals practiced sometimes cannibalism

- Modern cannibalism = mostly ritual
- No ritual in Neandertals
- Krapina, Croatia - 130 Ka
  - Long bones cracked for marrow
  - Cut marks on some bones
  - Some bones burned
- France - 100 Ka
  - 78 hominin bone fragments + hundreds of red deer bone fragments
  - Lots of cut marks
  - Long bones broken = extract marrow
  - **Deer and hominin bones treated the same**

Cut marks on skull from Krapina, Croatia

Clear evidence of cannibalism in Neandertal: defleshing marks on bones

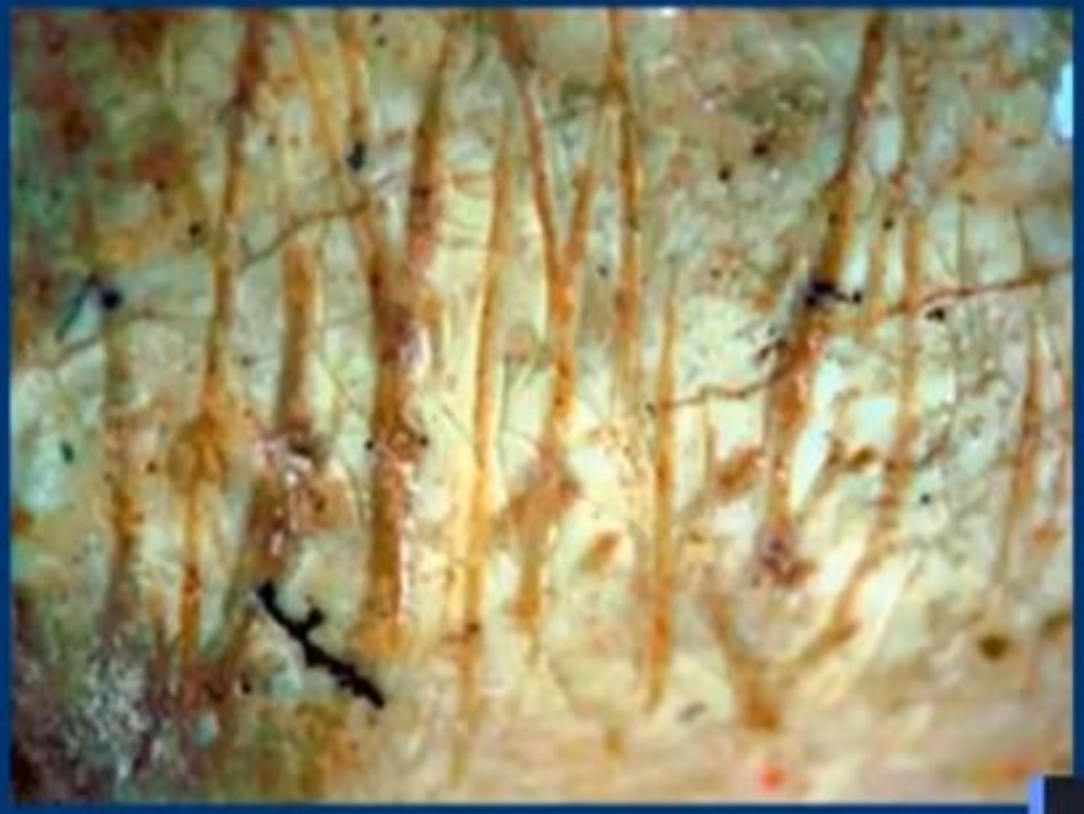


Krapina 3 skull

A female skull: some meaningful intentional marking

Etched, parallel lines that run up frontal bone;
Skull was lacquered

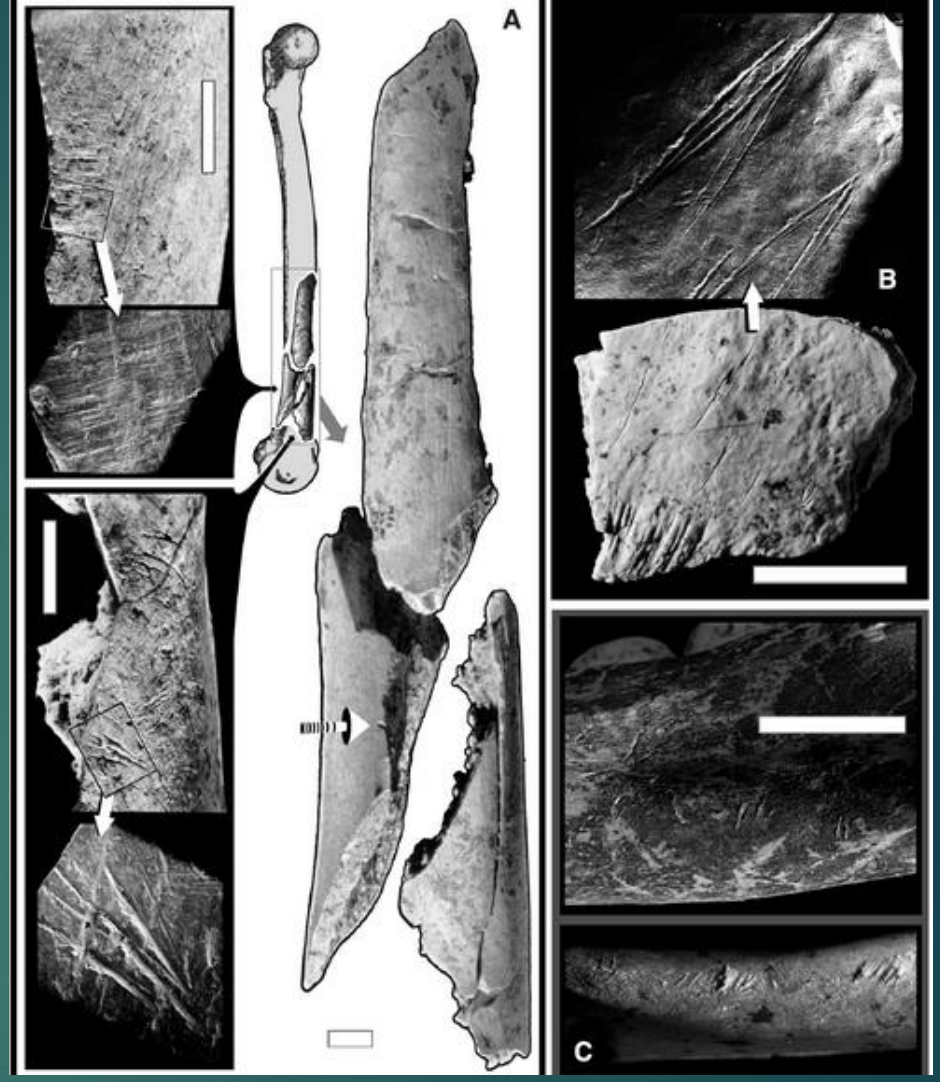
Evidence for `



Cannibalism at Krapina: Gorjanović-Kramberger's noted cut marks in 1899; hypothesized cannibalism in 1906

Moula-Guercy, France

- Cannibalism evidence:
- 1999: Butchered remains of 6 Neandertals
- Dated to > 100 Ka
- Defleshing

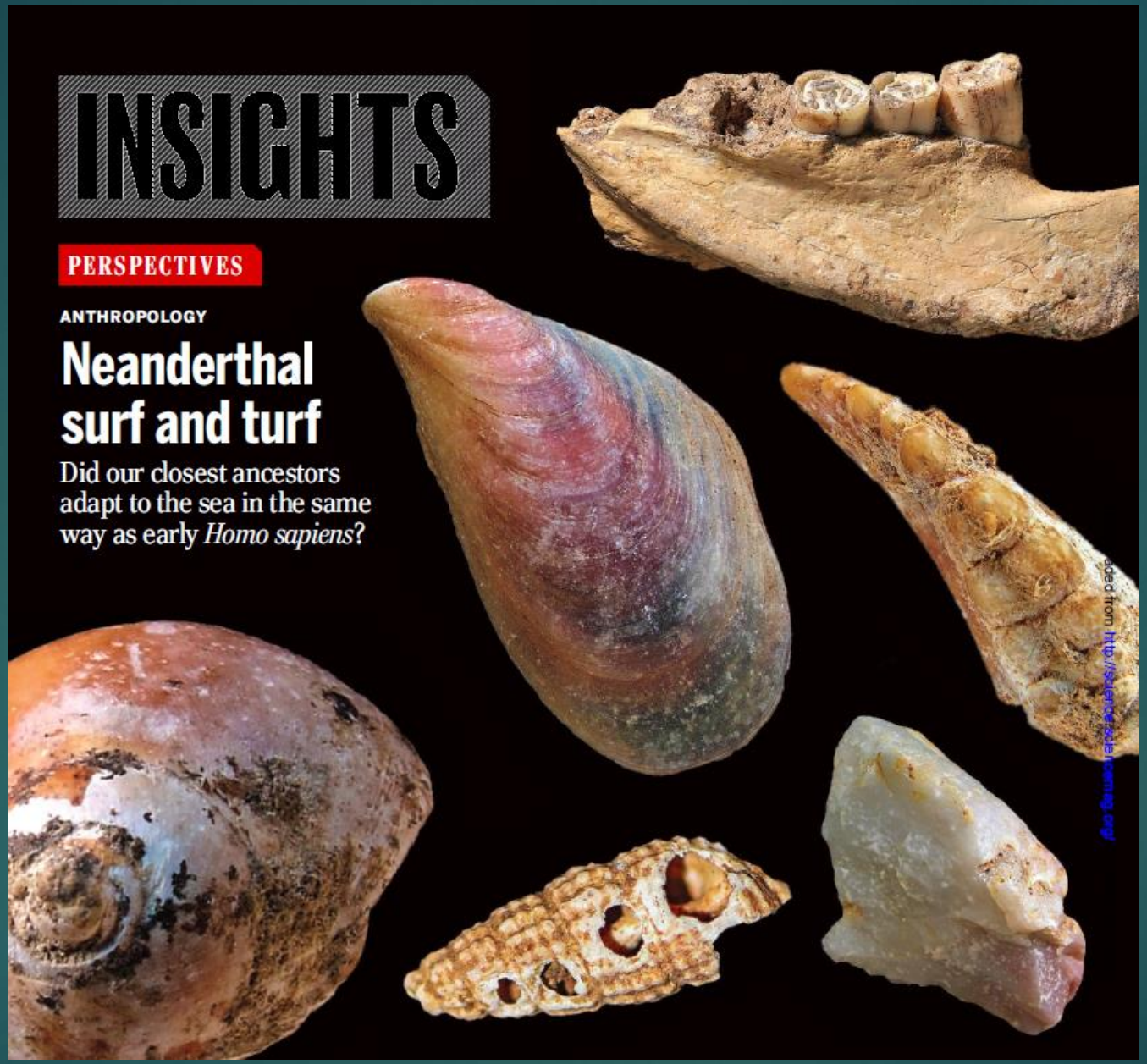


(A) Refitting set CS-2, a distal left femur. The cut marks (lower left), percussion impact scar (white arrow), anvil striae on the opposite side (upper left), and internal conchoidal scars indicate defleshing before fracture by directed percussion by a hammerstone atop an anvil. (B) Ectocranial surface of the left parietal bone with cut marks. Note the successive signatures of the same stone tool edge, indicating filleting of the temporalis muscle. (C) The mandibular corpus of a juvenile N (top) and a red deer (bottom) to show the similar position and form of cut marks made by a stone tool

Six Other Locations with evidence of cannibalism

- Zafarraya in Spain
- Hortus Cave, France: 100 fragments from 20 individuals
- Combe-Grenal Cave
- Troisième caverne of Goyet (Belgium), 40.5–45.5 Ka;
- Les Pradelles, France
- Gran Dolina in Spain (oldest site)

Neandertals:
use of marine resources and swimming



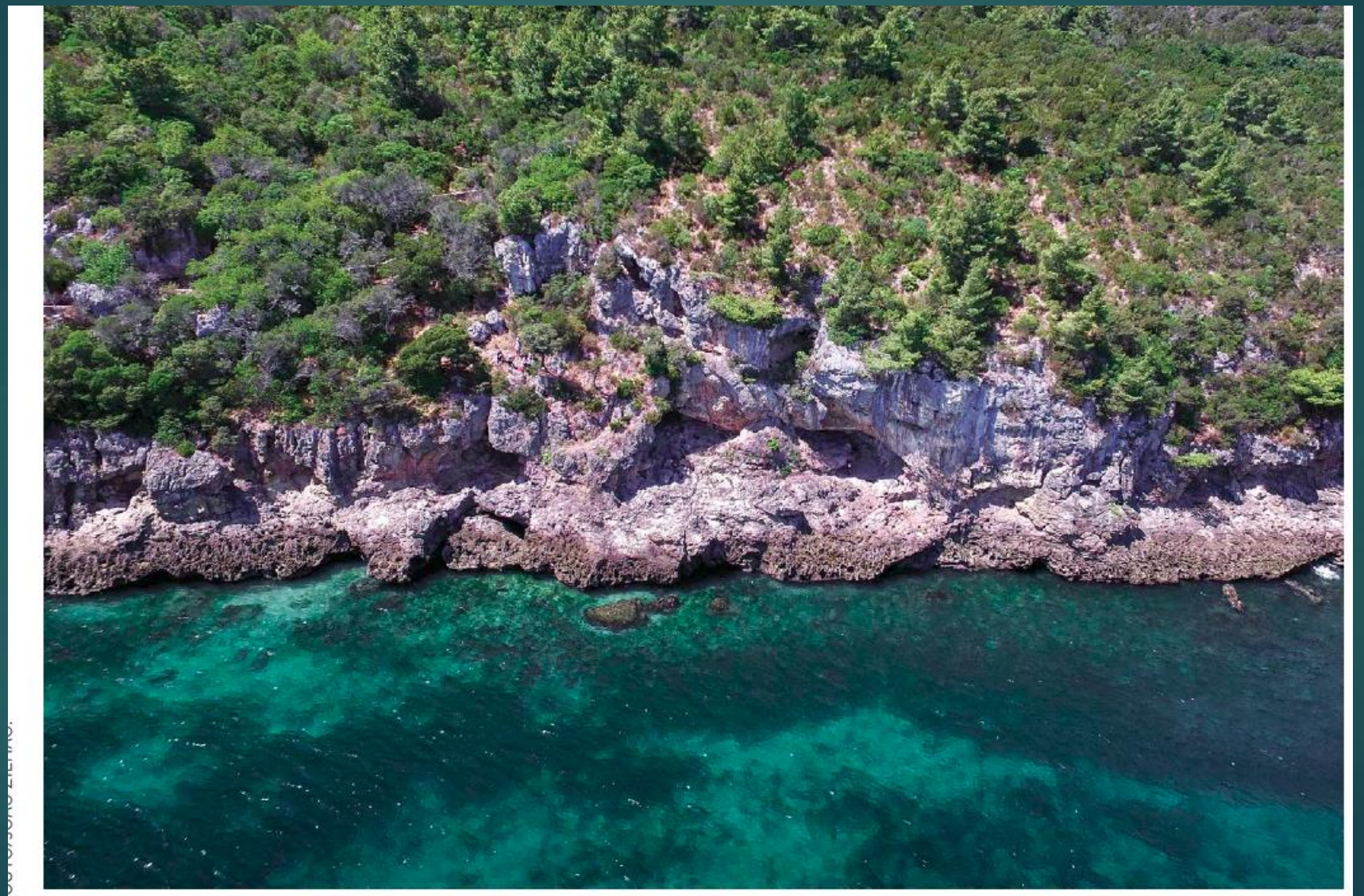
Neanderthals left stone tools and the remains of marine and terrestrial animals at Figueira Brava

Midden or Molehill: The Role of Coastal Adaptations in Human Evolution and Dispersal

- 2019 study: Comparison of coastal adaptations of MHs during the African MSA with those of contemporaneous Ns during the European MP.
- In both species, systematic use of marine resources and coastal landscapes constitutes a consistent behavioral signature over ~ 100,000 years in several regions of Africa and Europe.
- More similarities than differences between Neanderthals and modern humans, Disparities only in degree rather than kind.
- MHs exploited a wider range of marine resources—particularly shellfish—more intensively.

Manuel Will, et al., 2019

Gruta da Figueira Brava, Portugal

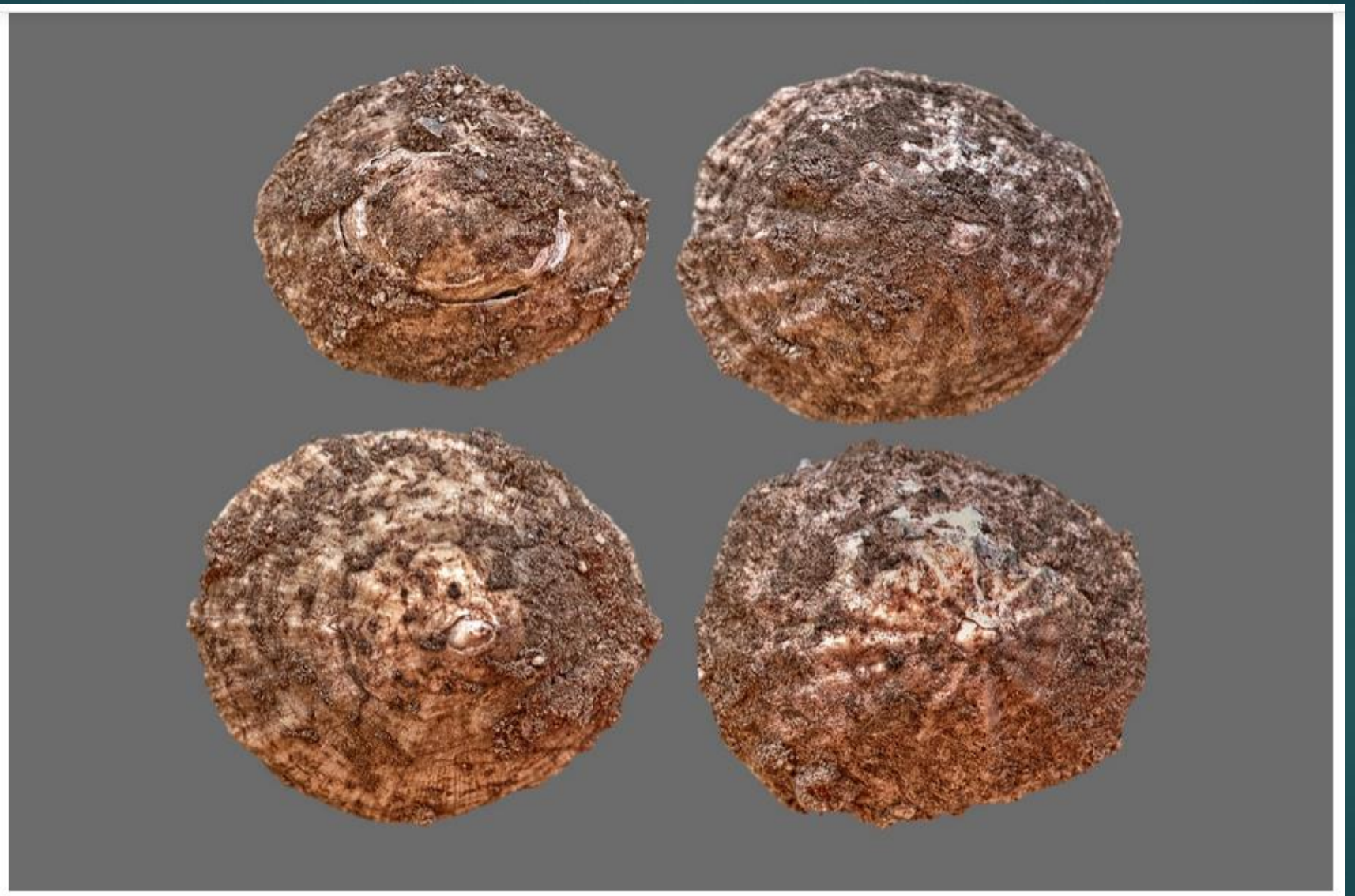


Gruta da Figueira Brava, Arrábida, Portugal. Note the Mediterranean vegetation, like at the time of the

Figueira Brava cave, Portugal: N Marine resources

- Excavations at a cave site, Figueira Brava, on Atlantic coast of Portugal, Ns at ~106 to 86 Ka.
- The menu included a variety of surf and turf: shellfish, crabs, and fish from the ocean but also waterfowl, red deer, horse, and even pine nuts.
- Discovered 560 fish bones, as well as remains from clams, mussels, crabs, waterfowl, seabirds, seals and dolphins.
- When Neanderthals were at Figueira Brava, it was about a mile from the water. Today it is right on the coast.

Limpets



Shells of Patella vulgata, or common limpet, a type of edible sea snail, recovered from a seaside cave in Portugal that was once inhabited by Neanderthals. Zilhao et al. Science, 2020

Figueira Brava cave

- The sediment contained bones belonging to sharks, eels, morays, conger (eel), mullet and sea bream.
- They also found burned and cracked claws belonging to brown crabs and spider crabs, and even sea birds; unclear if caught or scavenged
- In addition to the “surf,” they found plenty of “turf,” such as remains from horses, deer, ibex, aurochs, porcupine and tortoise.
- And pine nuts.

Brown crab claws recovered from the site. Zilhão et al. Science, 2020

Palourde clam fragments. Zilhão et al. Science, 2020

Figueira Brava

- Like Gibraltar, Figueira Brava provides robust evidence of systematic, long-term coastal adaptations by Neanderthals during the Pleistocene.

- Early MHs show more intense occupations of shorelines and use of marine resources compared with Neanderthals'.

- Figueira Brava featured seasonal harvesting and on-site storage of pine cones for deferred consumption of the nuts.

N swimming: Ns could fish and dive

- Excavated in 1949, Grotta dei Moscerini, 71 to 130 Ka is one of two Italian Neandertal sites with many retouched shells used as tools (n = 171) from 21 layers.
- Grotta del Cavallo in southern Italy (n = 126). Eight other Mousterian sites in Italy and one in Greece also have shell tools but in a very small number.
- The shell tools are made on valves of the smooth clam *Callista chione*.

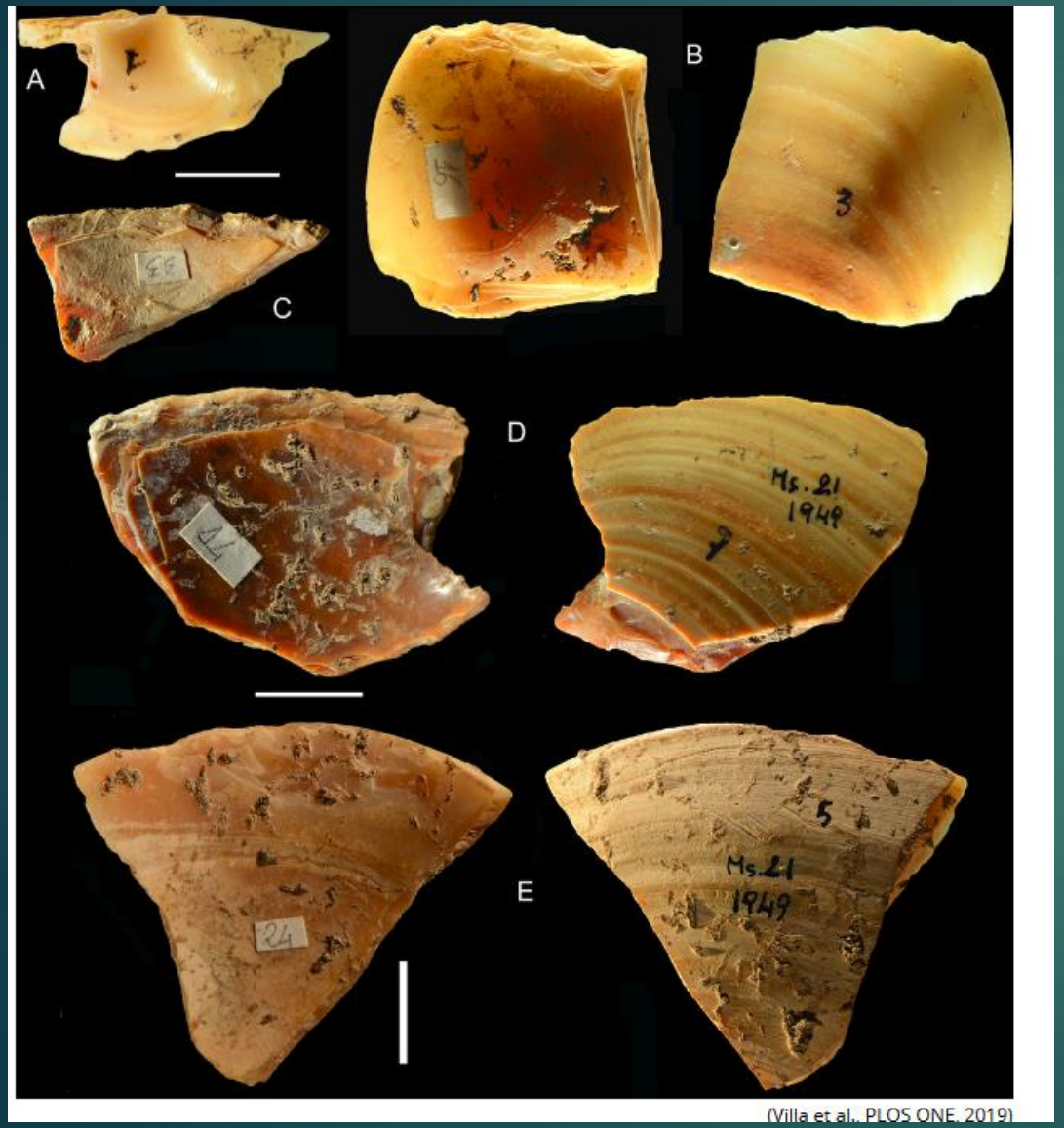
N Swimming

- Original idea that the valves of *Callista chione* were collected by Neandertals on the beach after the death of the mollusk is incomplete.

- At Moscerini 24% of the specimens were gathered directly from the sea floor as live animals at 2 to 4 meters underwater by skin diving Neandertals.

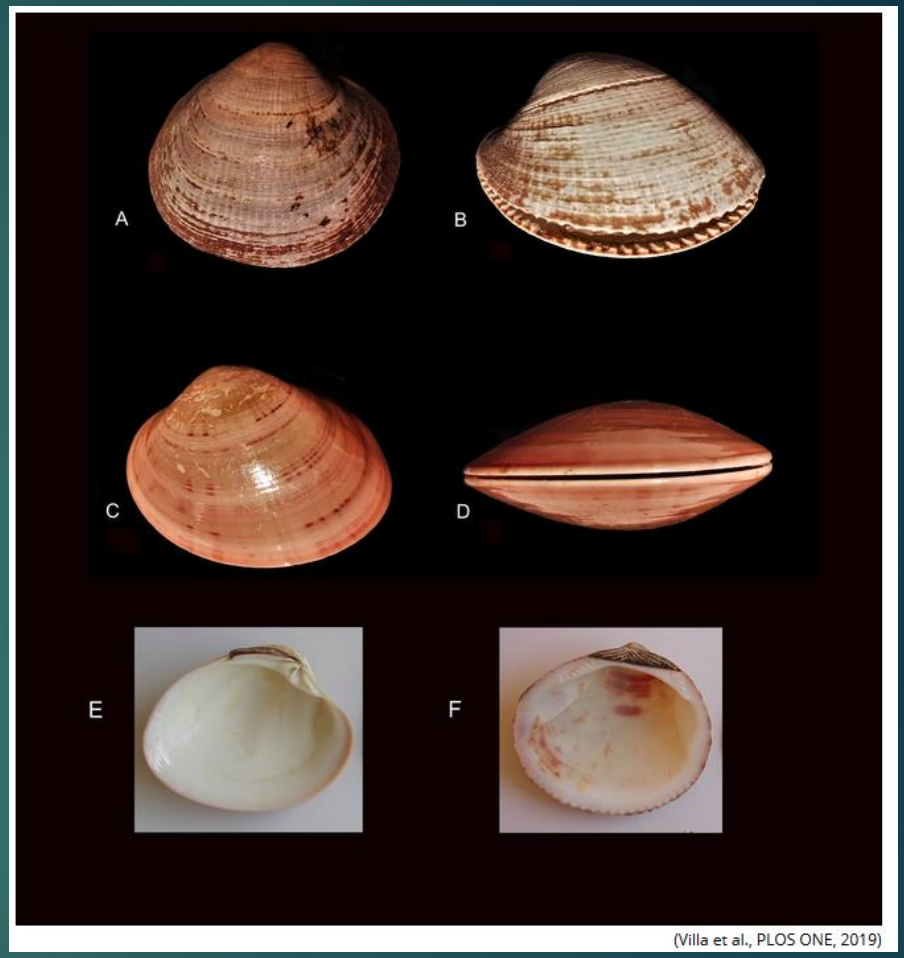
- Archaeological data from sites in Italy, France and Spain confirm that shell fishing and freshwater fishing was an activity of Neandertals, as indicated by anatomical studies recently published by E. Trinkaus.

Neandertals at the beach: *Callista chione*



Shiny = underwater gathering

Opaque, chalky = washed up



(A-B) Glycymeris; (C-D) Callista chione; (E) internal face of Callista chione; (F) internal face of Glycymeris. A-D photos by Carlo Smriglio. E-F photos courtesy of Barbara Wilkens

Callista chione: used as N tools

- *Callista chione*, the smooth clam, is a rather large, temperate, marine, bivalve mollusk that inhabits sandy bottoms

- These shells were shaped by hand into useful tools

- Mediterranean smooth clam species *Callista chione*, and by comparing various factors of their appearance - such as rough edges, shininess and encrusted barnacles –
  - able to determine which were collected from the beach, already dead,
  - which were scooped from the sandy ocean floor via diving, fresh as can be.

Shiny shells indicate N diving in 2 to 4 meter water

- "The live animals that lived in the sea had a shiny shell“
- "The ones that are thrown onto the beach, because they sat in the sun and in the sand, their outer shells are opaque and not as shiny.“
- The underwater shells which were much thicker were far better for tool-making; also found pumice stone for tools.
- Skin-diving in low waters, probably two to four meters deep, was a within the capabilities of Ns

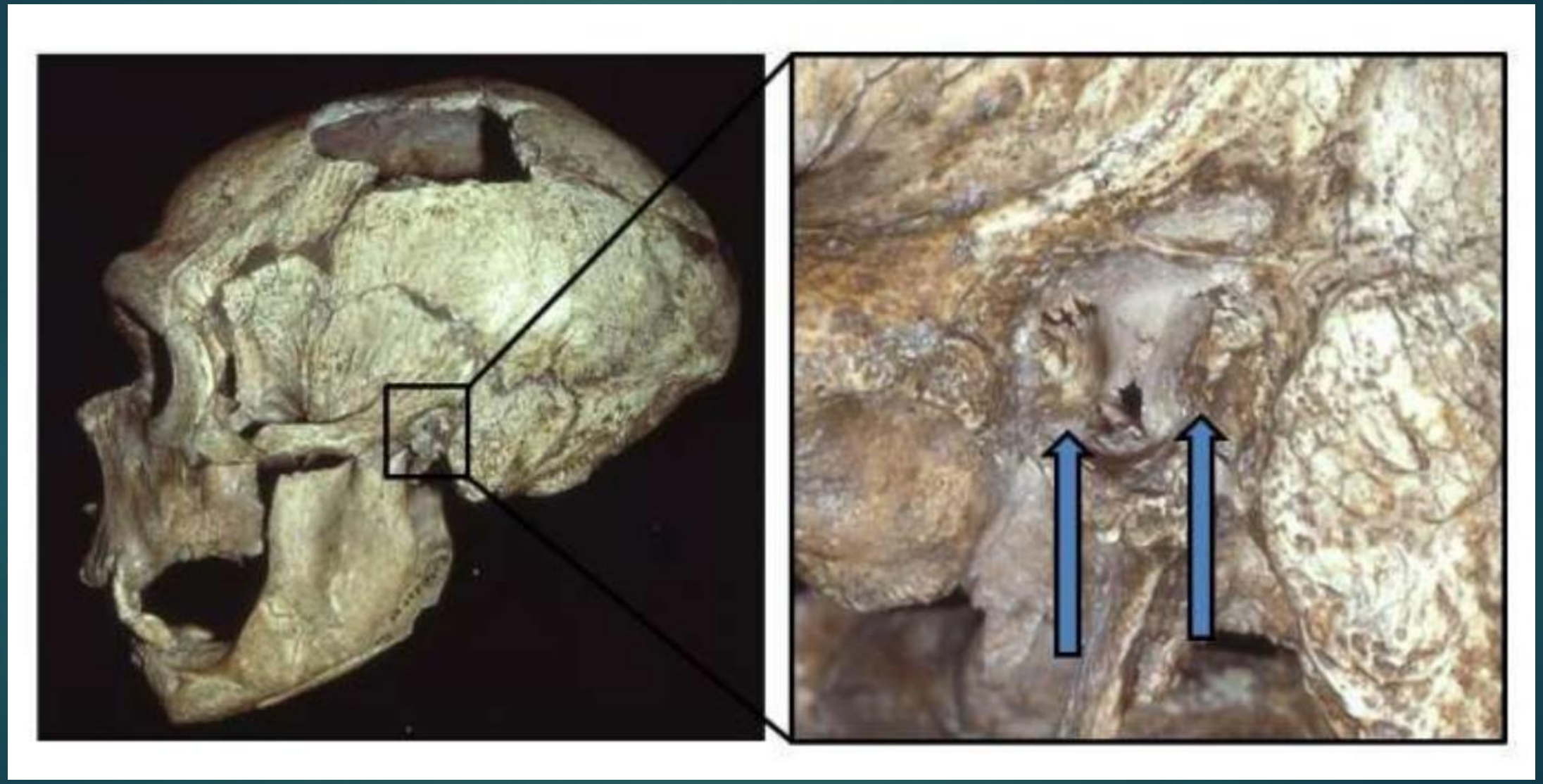
Ns had surfer's ear: They were swimmers

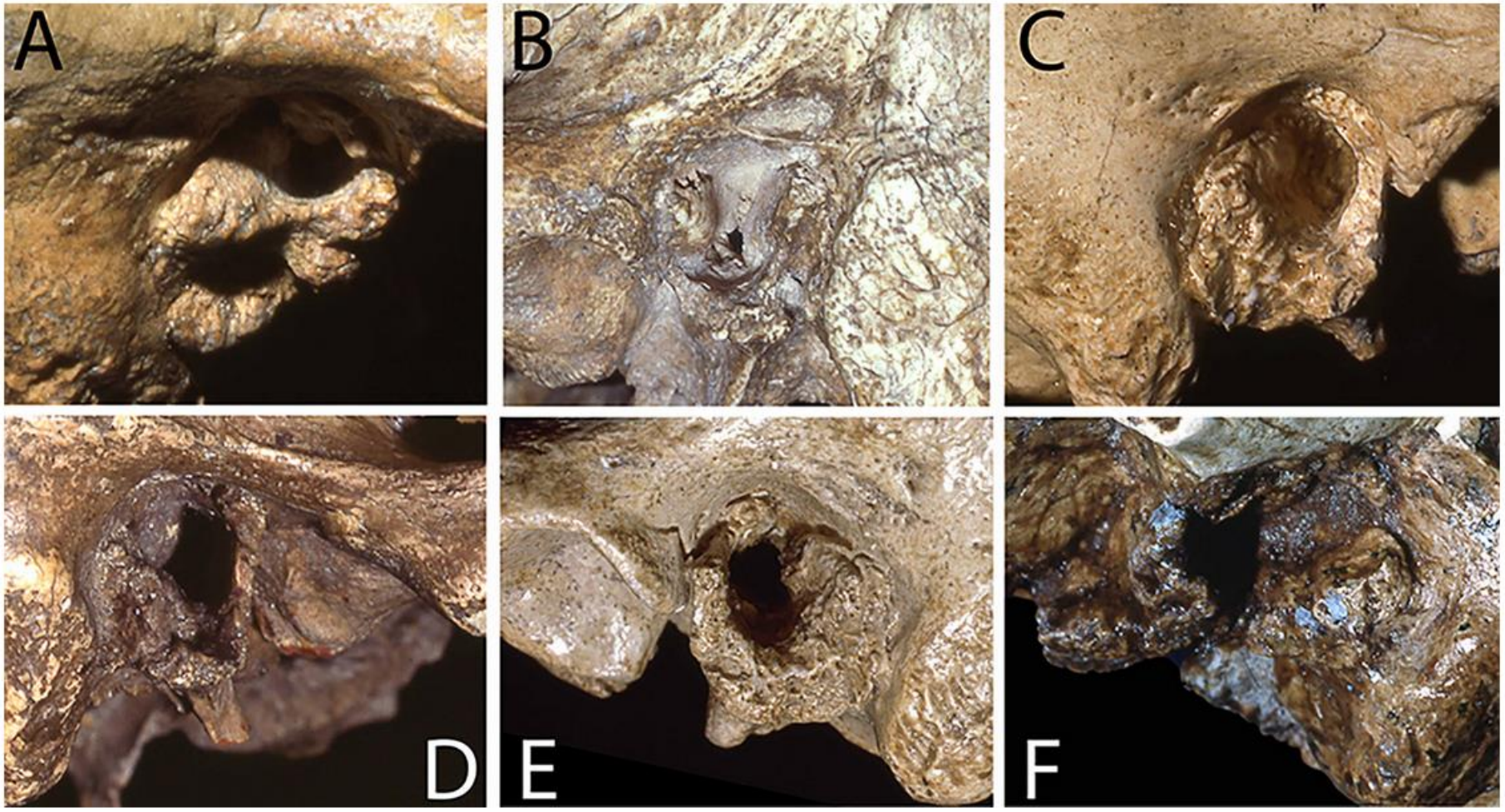
- Eric Trinkaus: ear remains of 23 Neanderthals; 48% had bony growths that suggested aquatic foraging was a prominent part of their lifestyle.

- These growths, known as external auditory canal exostoses, or "surfer's ear", are found today in surfers and those who spend time in wet and cold conditions. Twice as often as in MHs of same period.

- Typically caused by bacterial infections in the outer ear, as opposed to the inner ear, and can cause pain, itching, and muffled hearing.

N surfer’s ear





Bony growths have been found on the outer ears of Neanderthal remains from A) Kurdistan, B) France, C) Croatia, D) Belgium, E) Croatia, and F) Israel. E. Trinkaus & H. Rougier /PLOS ONE

N ear problems

- But other possible explanations are possible.
- One is the simple fact that Neanderthals likely had poor hygiene.
- Neanderthals may have been more genetically susceptible to swimmer's ear than modern humans,

- Inner ear infections study: Neanderthal ear canals did not change angle with age but remained flat into adulthood, producing a higher potential for ear infections and accompanying complications, like pneumonia, respiratory infections, and even permanent hearing loss.
- Other study: Findings indicate that Neanderthal tubal morphology may have predisposed them to high rates of middle ear disease (otitis media [OM]).

Neanderthals: Bird experts

N ability to catch birds

- In older theories, Ns did not systematically and regularly take birds

- Mary Stiner: Europe
  - Middle Paleolithic (Ns) hunted slow-moving prey;
  - UP MHs were able to hunt fast moving birds, rabbits, and hares

- R. Klein: Africa
  - MSA in Africa hunted slow moving,
  - LSA did fast movers

The Smart Neanderthal – C. Finlayson, 2019

Golden Eagle

Cinerous Vulture

N’s favorite birds

Bearded vulture

Ns and birds

- Association of Ns and black feathers from Corvids and birds of prey

- Most N associated birds:
  - golden eagle;
  - cinerous, bearded, griffon vultures;
  - bearded vultures known for naturally covering themselves in ochre (an anti-microbial) pecked from red rocks

Hunting the Golden Eagle

- Eagle Hunt:
- A hundred thousand years ago on the Spanish coast, a Golden Eagle dove out of the sky and onto a deer carcass splayed out in the grass. The great bird crouched over the body, gripped the dead animal with heavy talons, and tore at its flesh with a curved beak.
- Suddenly, a brawny figure rose from behind the carcass and lunged toward the eagle; after heavy blows, the Neanderthal hunter stood with the dead eagle in his arms. For a moment he admired the hooked talons, running a thumb along their length; polished and strung into a necklace.
- They would make a fine symbol of his cleverness, and maybe even grant him some of the bird's ferocious power. Cradling its body in his thick hands, he set off for home.
- Recall Native Americans capturing eagles with bare hands from pits

Birds and Ns

- At Krapina, eagle talon pendants at 130 Ka

- In Gibraltar: Neanderthals extracted the feathers of certain birds — only dark feathers

- Cave sites from Italy, France and Spain yielded evidence of intentional extraction of feathers or terminal pedal phalanges of large raptors, corvids and other birds.

- Finlayson conclusion: Use of long bird feathers for personal adornment by Ns

Golden Eagle and Ns

Raptor talons and bird bones: intentional hunting of the powerful birds, likely for decorative and symbolic use—perhaps as religious totems, perhaps as icons of personal strength.

The Golden Eagle was the most frequently caught raptor by Neanderthals.

- caught for their feathers and talons.
- probably ambushed by Neanderthals at carcasses.

•• Neanderthals are the first humans known to practice eagle-catching.

Stewart Finlayson, et al., 2019

Neandertal sites with raptor talons

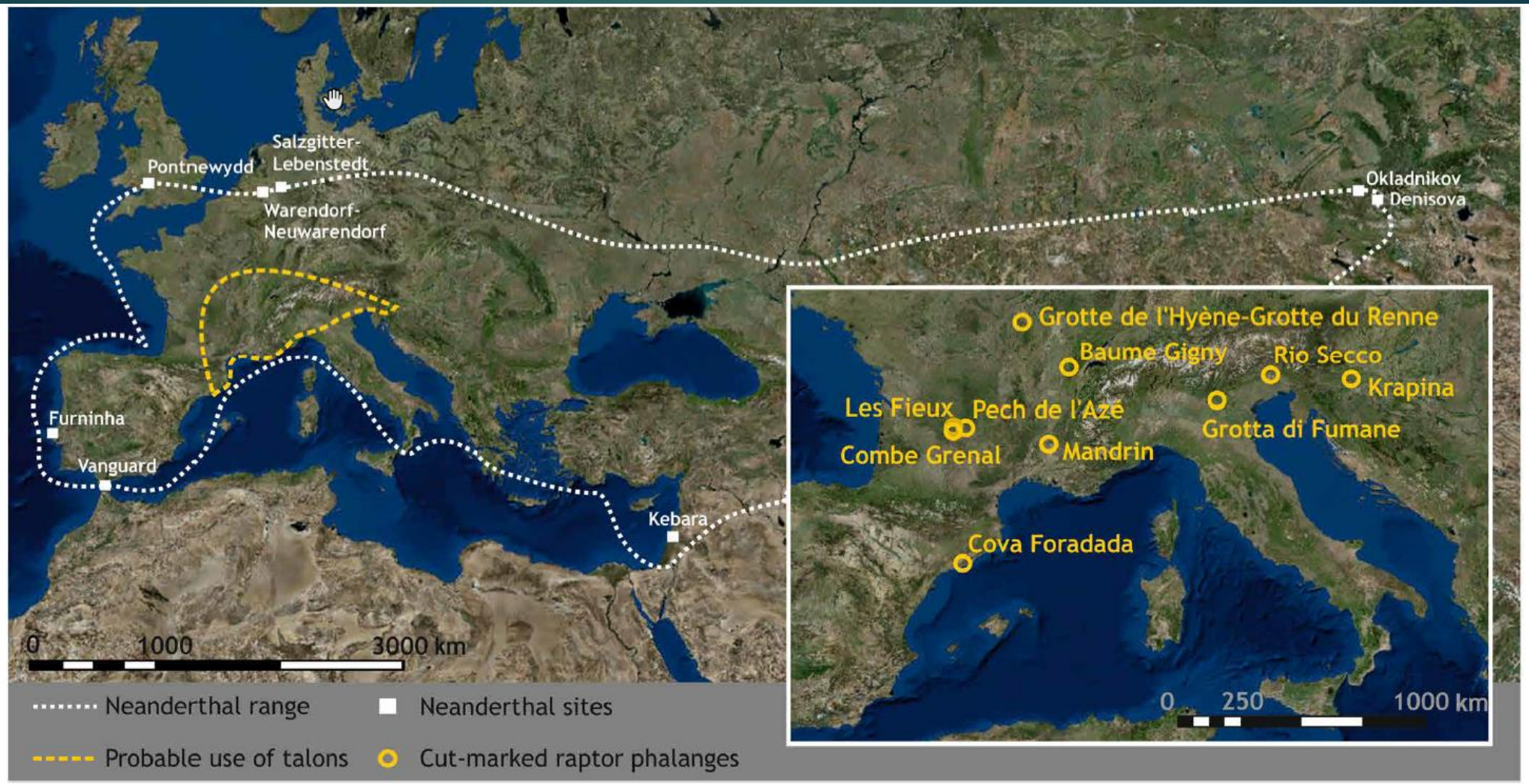


Fig. 1. Pre-UP symbolic use of raptor talons. Geographical range of Neanderthal populations and sites with raptor cut-marked phalanges. The line of white dots roughly marks the probable range of Neanderthals in Eurasia, based on paleogenetic data and fossil remains. The yellow dotted line suggests the common cultural territory for the use of raptor talons before the arrival of the UP. The extended map indicates the location of all MP/CP sites, with raptor phalanges interpreted as symbolic elements, including Cova Foradada. Baume Gigny is included for the sake of clarity.

N and birds

- Finlayson research: 161 bird species found in Gibraltar Caves
- There is evidence of cut marks made by their tools on wing and other bones, of roasting the birds for eating, and even Neanderthal tooth imprints on some bird bones
- Finlaysons reviewed the bird remains from some 154 Neanderthal sites, they found large-bodied raptors—largely Golden Eagles— at 75 (or nearly half) of those sites.

N and birds

- They were systematically using large raptors such as vultures and eagles and large falcons; but not ducks

- The eagle remains: wing bones and talons, which are far from the most appetizing parts of the bird.

Neandertals: Naturalists and use of carcass sites

- Neandertals were great naturalists who understood their environments because their lives depended on it.
- Understood behavior and different activities of species they hunted.
- Understood seasonality behavior of their prey.
- Example: swarming of ravens/crows, vultures, and golden eagles at carcass sites: all carrion eaters

Birds of a Feather: Neanderthal Exploitation of Raptors & Corvids

- Finlayson: Database of 1699 Pleistocene Palearctic sites based on fossil bird sites.
- Clear and widespread association between Neanderthals, raptors and corvids.
- Direct intervention of Neanderthals on the bones of these birds, which indicates extraction of large flight feathers.

Finlayson, et al., 2012

Birds of Feather

- This was a systematic, geographically and temporally broad, activity that the Neanderthals undertook. 18 species of corvids & raptors; 56% wing bones; over 25 K years at Gibraltar

- Other locales: Ns and eagle talons over 100 K at Combe Grenal, Pech de l'Azé, Krapina

Clive Finlayson: The Smart Neanderthal: Ns and Birds

- Importance of Birds and Ns: Finlayson helps dismantle the old ideas about Ns, and N and MH differences or similarities;
- Finlayson: counters idea that Ns could not catch fast flying, difficult to catch, animals

- 4 Gibraltar Caves,
  - Ns from 127 to 32 Ka:
  - 161 species of birds, 30% of all European species
  - Corvid cloughs (~chafs) most frequent;
  - Quail in 75% of N sites (transfixed by modern bone whistles that sound like male/female call)

Ns and Birds

- Corvids were ever present in N sites:
  - They are often first birds at carrion, then vultures; they act as early warning system of presence of nearby kill; Ns obviously learned this pattern
- Evidence that Ns could plan seasonal cycles of activities relying on knowledge of animal and bird behavior and movements: ibexes on cliffs at Zafarraya in spring & summer and seabird nests

Ns and birds

- Finlayson: N eye orbit size: did N's focus hunting in twilight and perhaps nighttime, times of lower light condition; dawn and dusk when prey are most active

- Many of N associated birds shared features: ground dwelling and nesting, cryptic plumage, twilight and nocturnal activity, conspicuous breeding activity; with patience, you can handfeed wild vultures

Birds of a Feather

- The wing bones, low in meat but anchors for the large flight feathers, which were processed.

- The overrepresentation of raptor and corvid wing bones in Neanderthal sites cannot thus be interpreted in any way other than for the use of their feathers.

- Raptors and corvids are not regularly eaten in any culture. The most parsimonious explanation for feather use by Neanderthals would be the same as for tribal Modern Humans:
  - ornaments on their heads and bodies.

Ns and Birds

- 1950s, Solecki at Shanidar Cave: Ns and griffon vultures & white tailed eagle bones, covered in ochre
- All evidence for feathers and talons are Eurasian starting from 130 Ka; none from Africa; Ns were not copying MHs, or being acculturated; perhaps MHs learned practice from Ns?
- Raptor migration: At Gibraltar, can now count 10 K raptors migrating from Africa in 1 day, twice a year, gliding on thermals; 21 km distance; often flap last km; land exhausted
- Ns also roasted rock pigeons and choughs

Birds of a Feather: Neanderthals & black Corvid feathers

Clive Finlayson models griffon plumage. The ulna was removed from the carcass with a flint tool and the feathers left intact. Most of the birds Neandertals used were smaller and thus perhaps better suited to headdresses. Image: Kate Wong

- 1699 fossil sites in Eurasia and north Africa spanning the Pleistocene epoch.
- evidence of intentional extraction of feathers or terminal pedal phalanges of large raptors and other birds.
- Neanderthals exploited birds for the use of their feathers or claws as personal ornaments in symbolic behavior

Clive Finlayson, et al., PLOS One, 2012

Single long cut can create a vulture cape

Credit: BBC Earth

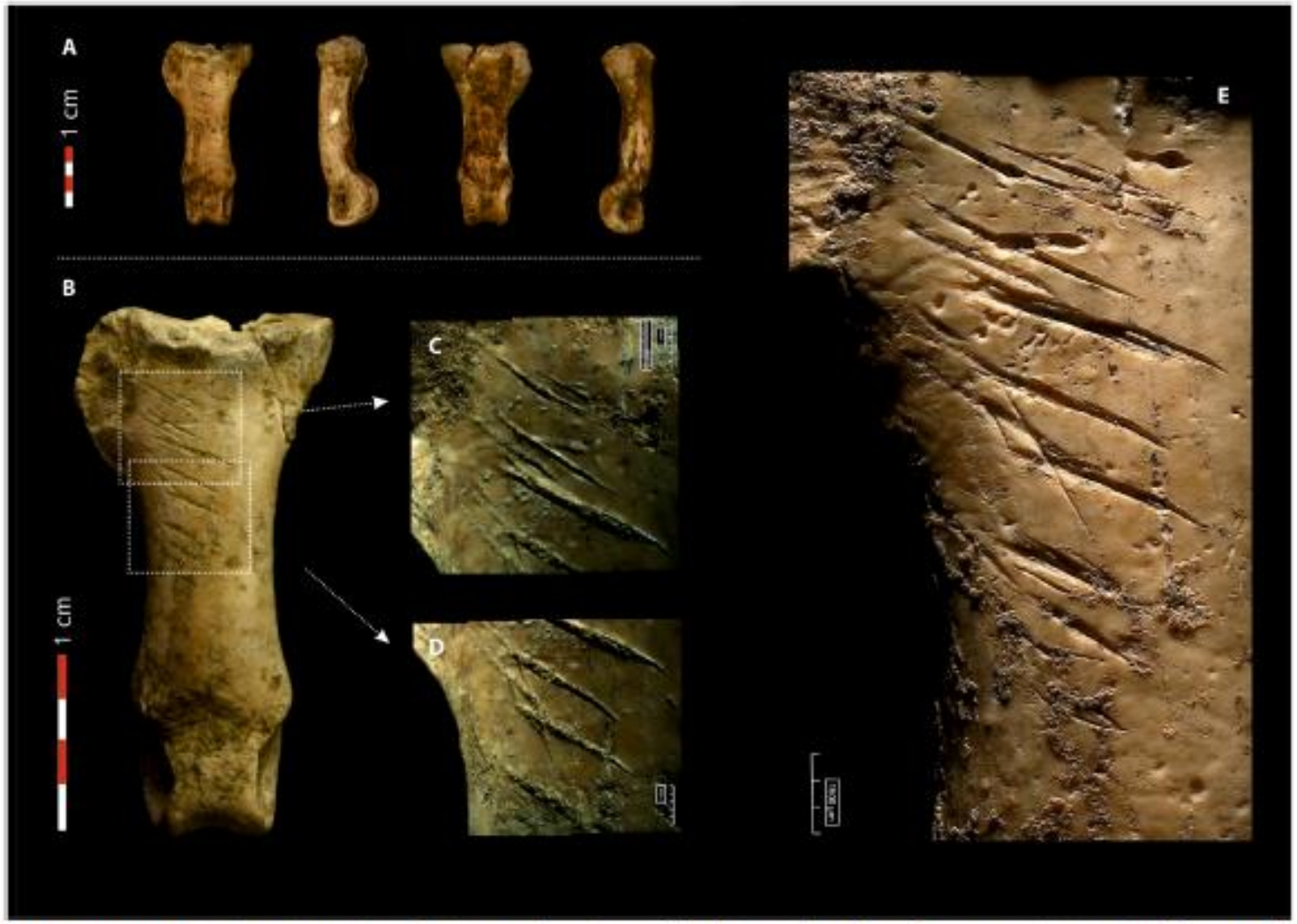


Fig. 2. FO15/IV1/E6/1339 specimen. (**A**) Dorsal, medial, plantar, and lateral views of the phalange (from left to right, respectively). (**B**) Detail of the cut marks in the dorsal view and dotted-line squares with the area amplified in photos (**C**) and (**D**). (**E**) Detailed photo of all the cut marks after cleaning and restoration. Photo credit: Antonio Rodríguez-Hidalgo, IDEA.

First Iberian eagle talons:
Cova Foradada (Tarragona), Spain:

consists of a phalanx of the left leg of an imperial eagle (*Aquila Adalberti*);

large, with 12 cut marks suggesting that they were treated to form part of a necklace.

Dated: 39 Ka

Neanderthal adaptability:
G’Me Shelter

Adaptability

- Ns lived 400,000 years or more in the harshest climates experienced by primates, not just humans.
- They inhabited a climatic range (from Arctic to Mediterranean) requiring the extended ability to use culture as a buffer for environmental adaptation,
- Most N habitation sites and fossils are associated with faunas from temperate woodland and steppe habitats
- Neanderthal sites differ from those of their H. heidelbergensis predecessors in showing abundant evidence of controlled use of fire

Ns were adaptable

- Neanderthals once covered a vast and climatically and ecologically diverse range. 10 Million square Kms. They adapted their diet and technology to local conditions.

- In northern latitudes, they were
  - predominantly carnivorous,
  - had advanced leather processing technology (using lissoirs, probably later borrowed by AMH),
  - modeling studies suggesting advanced winter clothing using stone and bone awls (such as found in the Grotte du Renne) as sewing aids,
  - Flexibly adapted to their ecologies: their diet was very flexible and adapted to the local environment, including both meat and plant foods to varying proportions.

Shelters

- Ns did not just occupy caves and overhangs; they lived in the open and constructed shelters.
- Holes for wooden pegs and posts for lean-tos have been found at two sites in France
- Numerous hearths dating from 60 Ka indicate that Ns also controlled fire

Neandertal Shelter

- The Neandertal lifestyle was mobile:
- suggested by the spatial distribution of their stone tools borne out by multiple archeological sites,
  - where only very little investment in site furniture, i.e., archeologically visible remains of dwelling structures or stone-lined fire-places, has been documented
  - But so was the case for their African MSA contemporaries.

- If Neandertals built structures, they were generally not significant enough to leave clear archeological traces, i.e. lean tos
- But remember preservation bias

2019: Persistent Neanderthal occupation of the open-air site of ‘Ein Qashish, Israel

- 71-54 Ka Neanderthal bones in northern Israel at Ein Qashish; found in an open-air site—the first such discovery in the Levant region

- Locale was used as a generalized residential site rather than specialized task-specific one. The finds from Ein Qashish show that Neanderthals inhabited sites in diverse topographic and ecological contexts

- In addition to the Neanderthal bones, flint tools, animal bones and other items were discovered at the archaeological site.

Ravid Ekshtain, et al., 2019

‘Ein Qashish, Israel: N out in the open

The lower limbs of a Neanderthal exposed at the open-air site of Ein Qashish, on the banks of the Kishon River in northern Israel (Erella Hovers, courtesy of the Hebrew University of Jerusalem)

Neandertal Mammoth bone shelter, ~44 Ka

- Found in eastern Ukraine, believed to be the oldest known structure built of mammoth bones, near Molodova:
- The home was apparently built in two parts.
  - The lower part, or base, was made by assembling large mammoth bones to support the whole structure, which was circularly arranged, 26 feet across at its widest; 116 large bones including mammoth skulls, jaws, 14 tusks and leg bones. 3000 mammal bones found.
  - topped by wood or other material
- The Neanderthals who built the structure also obviously lived in it for quite some time as 25 different hearths were found inside.
- Some of the bones used to build the house had decorative carvings and added pigments; a home?

Laëtitia Demay, et al., 2012

Uses of Mammoth Bones:

Mammoth bone shelter

Lissoirs

Skin: Clothing, tents, ...

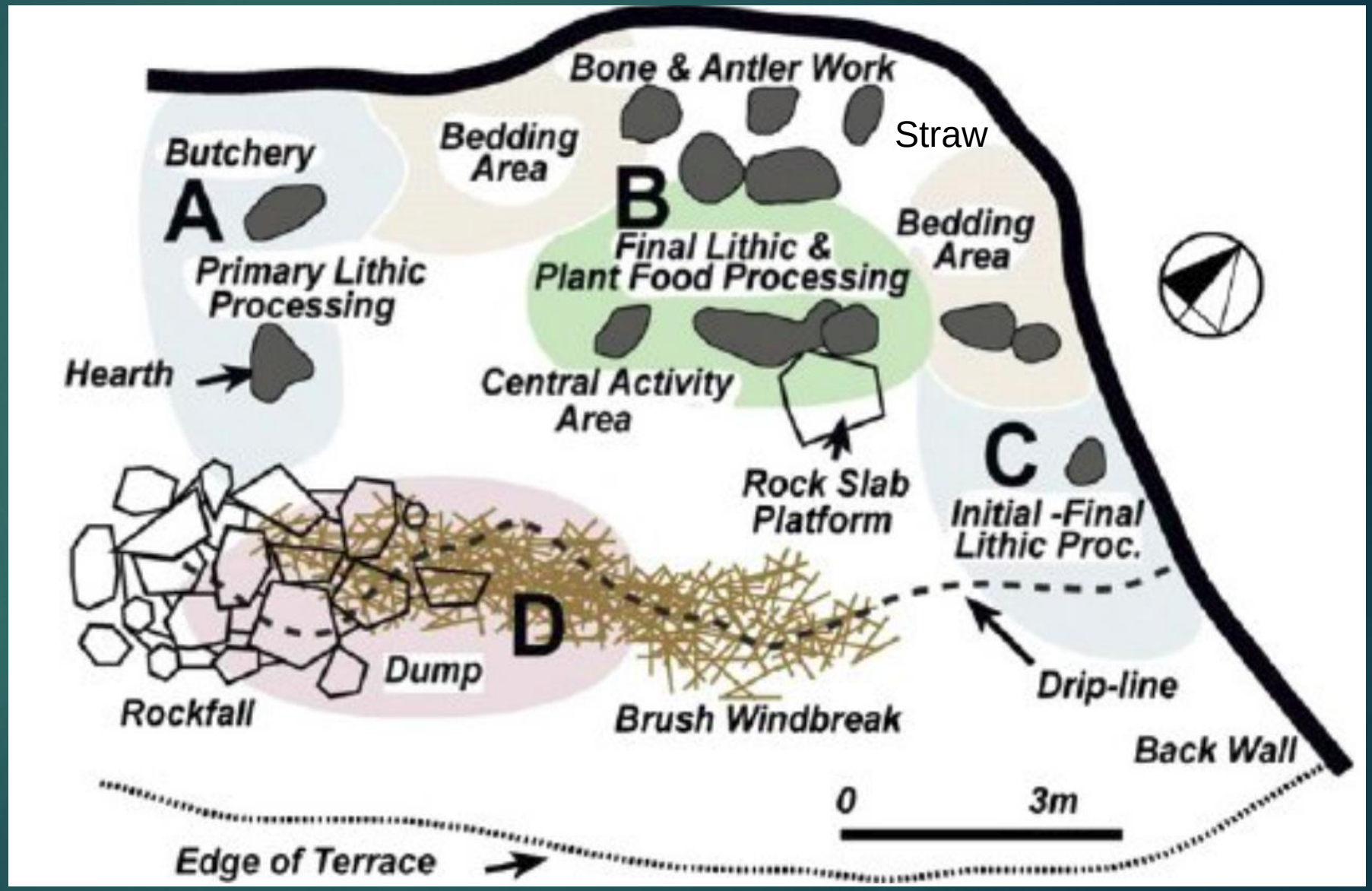
Spatial organization

- Spatially organized activities and well delimited activity areas have been documented in N living areas.
- Had spatially segregated task-specific areas.
- Good evidence for well-delimited activity areas at Neandertal sites such as Kebara, Amud (Israel) and Tor Faraj (Jordan) as well as from several European sites where the task-specific areas are documented by refitting.
- Data revealing systematic collecting and even storing of fuel sources (twigs and small branches for lighting, large branches and trunks.

N Site utilization

Tor Faraj, Jordan: N functionally divided their living spaces

Same as MSA sites in Africa



N Shelters

- At the 70,000-year-old site of Tor Faraj in southern Jordan, they piled up stones and wood to create windbreaks inside the shelter.
- Later, they began building windbreaks in the open, using wood and even mammoth bones.
- At La Folie, a 60 Ka site near Poitiers in France, post holes preserved in sediment point to some kind of circular wooden structure, perhaps covered with skins or brush.
- By lighting a fire inside a tent, raise the temperature from -20˚C to 20˚C and endured a cold winter night.

N Homes: Abric Romani -- hearths

- Above all it was fire – the hearth – that structured the space.
- Abric Romaní: Neanderthal rock shelter near Barcelona in Spain; for over 70 K, until about 40 Ka, probably by family groups of 10 to 20 individuals each time; 17 levels that represent different temporal periods of occupation.
- One level, dated to 58 Ka, contains more than 40 hearths
- At each level, the arrangement of hearths is the same: small ones (50 cms) in diameter, around the outside, and much larger ones in the center.
- The small hearths are located between 1 and 2 meters from the walls, and the inhabitants probably slept in that gap.

N social networks

N social networks & long-distance transfer

- Negative N hypothesis: - Modern humans had larger social networks (based on long-distance exchange networks- obsidian, shells). which acted as a buffer against environmental downturns, thus fostering long term survival based on distances over which artifacts were transported)

- Evidence: Such inferences are
  - based on the translation of distances over which artifacts were transported in the deep past
  - into statements about sizes of social networks.

Size of Social Networks

- Old idea that Neandertals groups were “limiting themselves to a single river valley and only occasionally did they venture farther afield” has been refuted by abundant evidence for transport of raw materials across major river valleys in the Middle Paleolithic of western and central Europe

- As far as the archaeological record for raw material transfer distances is concerned, the MSA and the Middle Paleolithic record are not significantly different.

N population sizes

- Negative N hypothesis: Modern human populations were 10x larger than Neandertal populations
  - Mellars & French study -- conclusion based on archeological remnants that MH populations were larger than late Neandertal populations
  - Dogandžić and McPherron extensive review show in detail that the Mellars and French analysis was severely flawed
    - only used data from caves not open sites;
    - high residential mobility typical of Neandertals probably resulted in brief periods of occupation and low densities of artifacts
  - MHs did not have larger populations at time of Ns in Eurasia

Mellars and French, 2011

- From the differential distribution of well-documented archaeological remains in the Perigordian region— between the Châtelperronian, 45-40 Ka, and the Aurignacian 40-35 Ka, attributed respectively to Neanderthals and to MHs

- Mellars and French (2011) have estimated vestige quantity as 10 times larger for the modern human population.

- Their conclusions: MHs estimated at 795–12,980 individuals vs local Neanderthal population of 80–1,300

N peak and decline in Germany

- 2016 study of Ns in Germany: Neanderthals reached their population peak right before their population rapidly declined and they eventually became extinct.

- German N peak in 60 to 43 Ka: 50 percent of the known Neanderthal settlement sites in Germany can be dated to this period

- N population in Germany was subject to extreme demographic fluctuations.

J. Richter, 2016

German Ns

- Between 110 to 70 Ka: only 4 known settlement sites,
- From 70 to 43 Ka, there are 94.
- In less than 1,000 years after this demographic peak, however, there was a rapid decline and the Neanderthal disappeared from the scene.

Demographics

- By and large Neandertal populations were small
- Small populations go extinct all the time for stochastic (random) reasons:
  - N had small group sizes
  - Lower birth rates: If low fertility rate, population will crash
  - Higher mortality rates
  - Increased family interbreeding; decline in genetic diversity

How many Ns were there? Archeology vs genetics

- The archaeological record suggested that ~150 K Ns spanned Europe and Asia, living in small groups of 15 to 25 — and that their total numbers fluctuated greatly during the several climate cycles (which included harsh glacial periods) that occurred during their 500 K years, before going extinct ~40 Ka.
- In population genetics, effective population size is not a direct measure of the total number of people that lived at a given time. It is rather a measure of genetic diversity.
- Essentially, genetics estimate how many generations of relatedness separate the maternal copy of a gene from the paternal copy. If a population is small, they can expect to reach the common ancestor relatively quickly; if it is larger, it takes longer.

How many Ns? Genetic answer

- Longstanding impression has been that Neanderthals had low levels of genetic diversity.
- In African individuals today, ~11 of every 10,000 nucleotides are heterozygous, (2 SNPs differ; loci with alleles that differ at a single base,)
- In non-African individuals, only 8 of every 10,000 sites are different.
- For Ns, 2 of 10,000, as well as for their sister species, the Denisovans.
- Population genetics theory tells us that means a small N population size, 2,000 to 3,000 individuals

How many?

- Rogers, et al., 2017 study: Neanderthals numbered ~10,000
- Assumption that Neanderthals had a much more diverse gene pool, but that it was divided into small, isolated, inbred groups of genetically similar individuals.
- This kind of fragmentation would have
  - skewed the earlier genetic results: Prüfer et al. estimate that the Neanderthal population was very small—declining toward extinction)
  - Estimates like that 2-in-10,000 number described the local populations and their regional histories
  - but missed the big picture.
- Instead of analyzing a single individual's genome, Rogers compared genetic variants shared by modern Africans, modern Eurasians, Neanderthals and Denisovans.

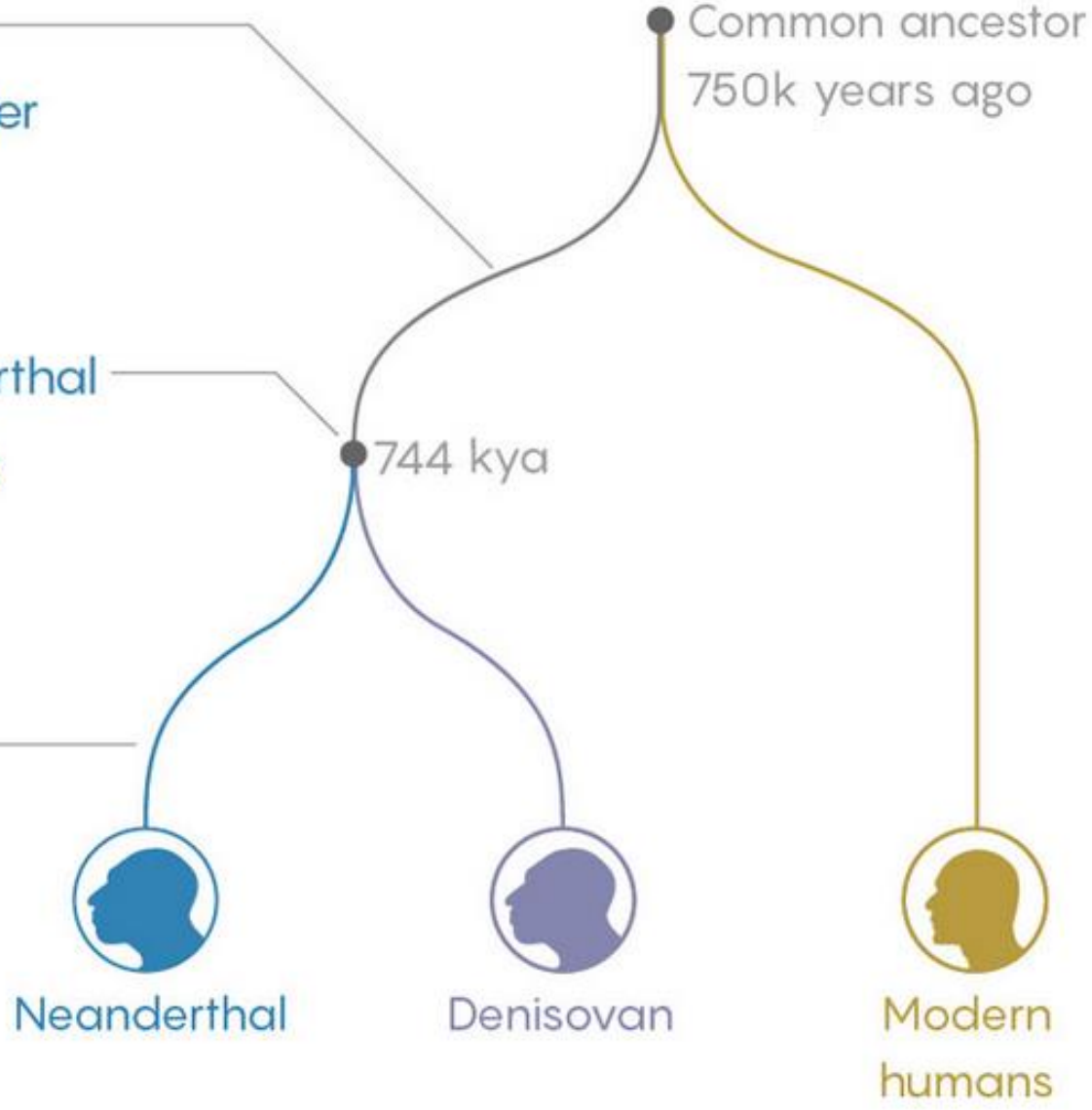
Rogers, et al., 2017 study

- The increase in genetic diversity that Rogers and his colleagues found corresponds to a roughly tenfold increase in effective population size. Closer to archeological record numbers.
- After separating from MHs ca 750 Ka, genetic data shows the N population passed through a severe bottleneck.
- By 744 Ka — they separated into two separate lineages, the Neanderthals and the Denisovans.
- The Ns then split further into the smaller regional groups

The Neanderthal-Denisovan population plummeted shortly after leaving other humans in Africa ...

... and split into separate Neanderthal and Denisovan lines almost 200k years earlier than was thought.

Tens of thousands of Neanderthals lived in distinct, isolated groups scattered across Europe and Asia.



Neanderthals: Diverse But Isolated

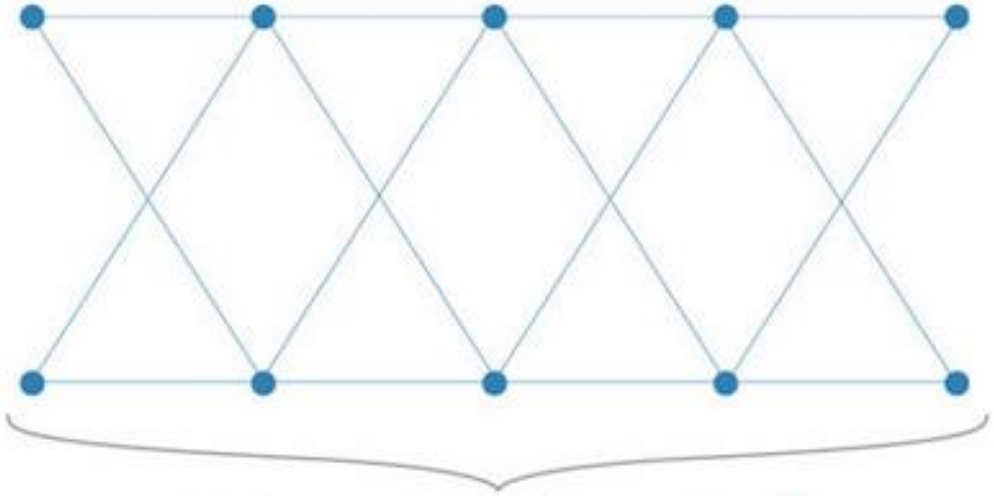
Rogers, 2017

Their full genetic diversity may have been obscured because so many of them lived in small inbred groups rather than sharing a gene pool.

PREVIOUS MODELS

Effective population: ~1,000

Spread-out but genetically connected

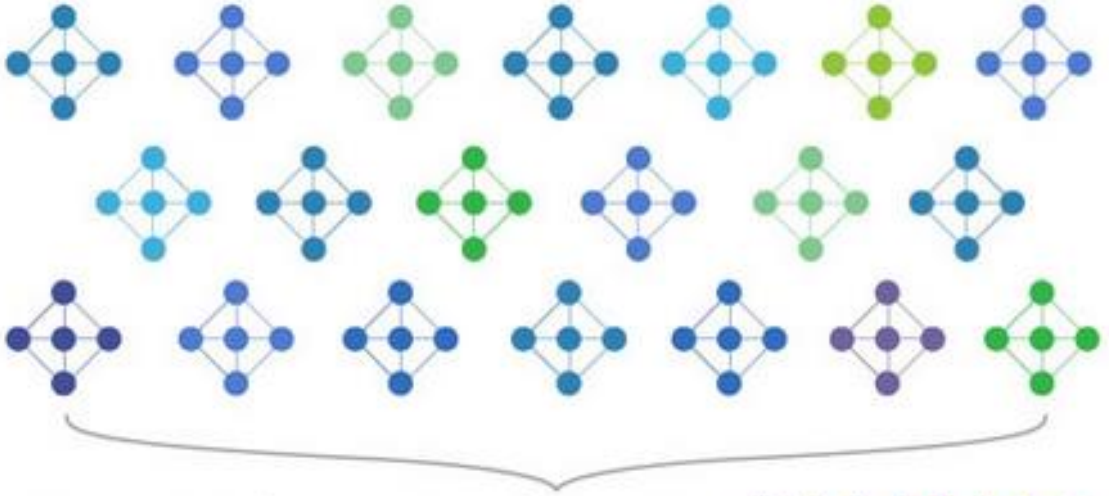


Little genetic diversity

NEW STATISTICAL ANALYSIS

Effective population: ~10,000

Isolated, inbred regional groups



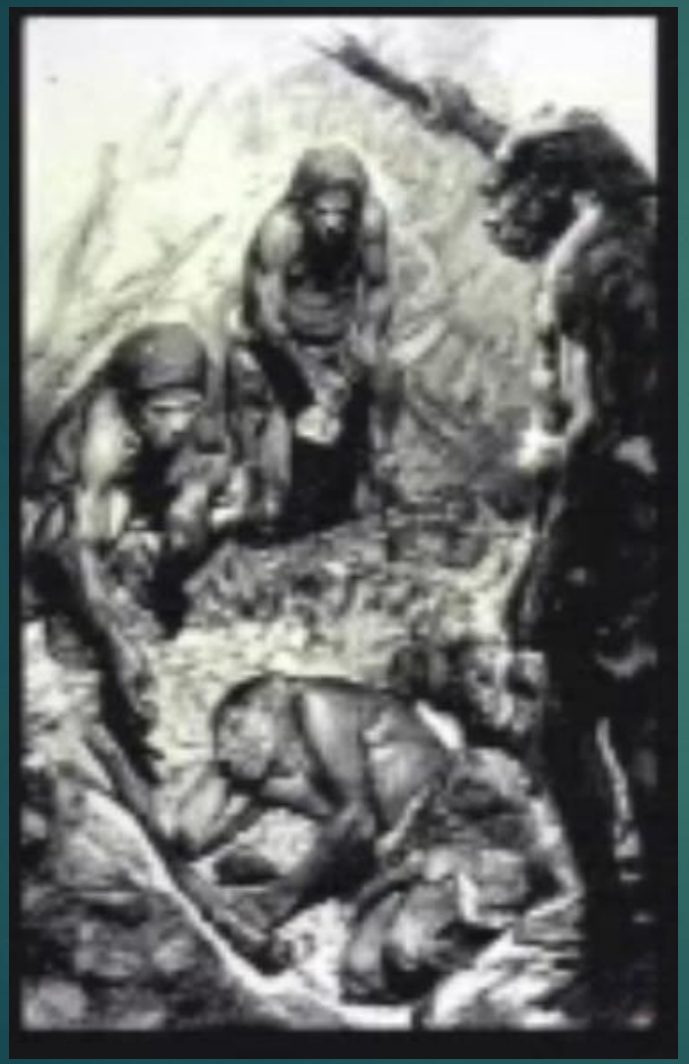
More total genetic diversity

Rogers, 2020: Smaller N population size = ~1000

- New 2020 Rogers study: results on Neanderthal population size differ from those published in 2017.
- New estimates are more in line with earlier studies published by others.
- Based on our 2017 analysis of the Altai N genome, we got a larger N population estimate (≈ 11,000);
- Once we included the Vindija Neanderthal genome, we get estimate closer to ~1000.
- Around 700 ka ago, Neandersovans expanded from Africa into Eurasia, endured a bottleneck of population size, interbred with indigenous Eurasians, largely replaced them, and separated into eastern and western subpopulations—Denisovans and Neanderthals

Burials

Reconstruction of Neandertal Burial

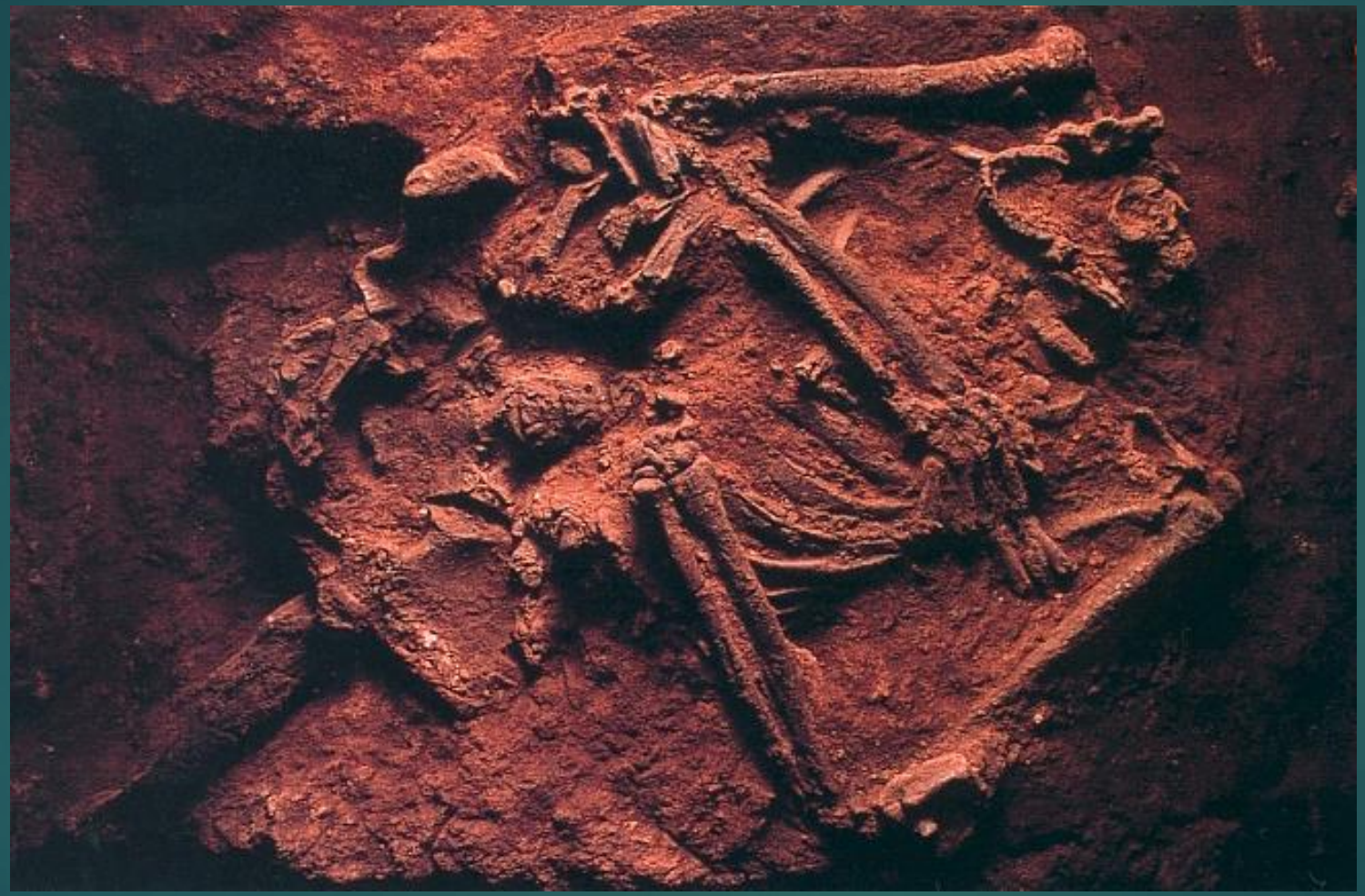


Czech artist: more archaic

N Burials

- Ns were the first people to have buried their dead. We have more fossils of N than of any other fossil hominin species.
- There has never been solid evidence that they included symbolic objects in graves; Their burials included simple grave goods like animal bones and stone tools.
- It is clear that they did not just dump their dead with the rest of the trash to be picked over by hyenas
- They placed the bodies of their dead in a flexed position.

Neandertal Burial



N at Kebara, Israel

Kebara 2.

Type of deposit: cave
Unit XII

7.80 m deep Adult subject:

Skeleton sub-complete but without box cranial or upper limb left

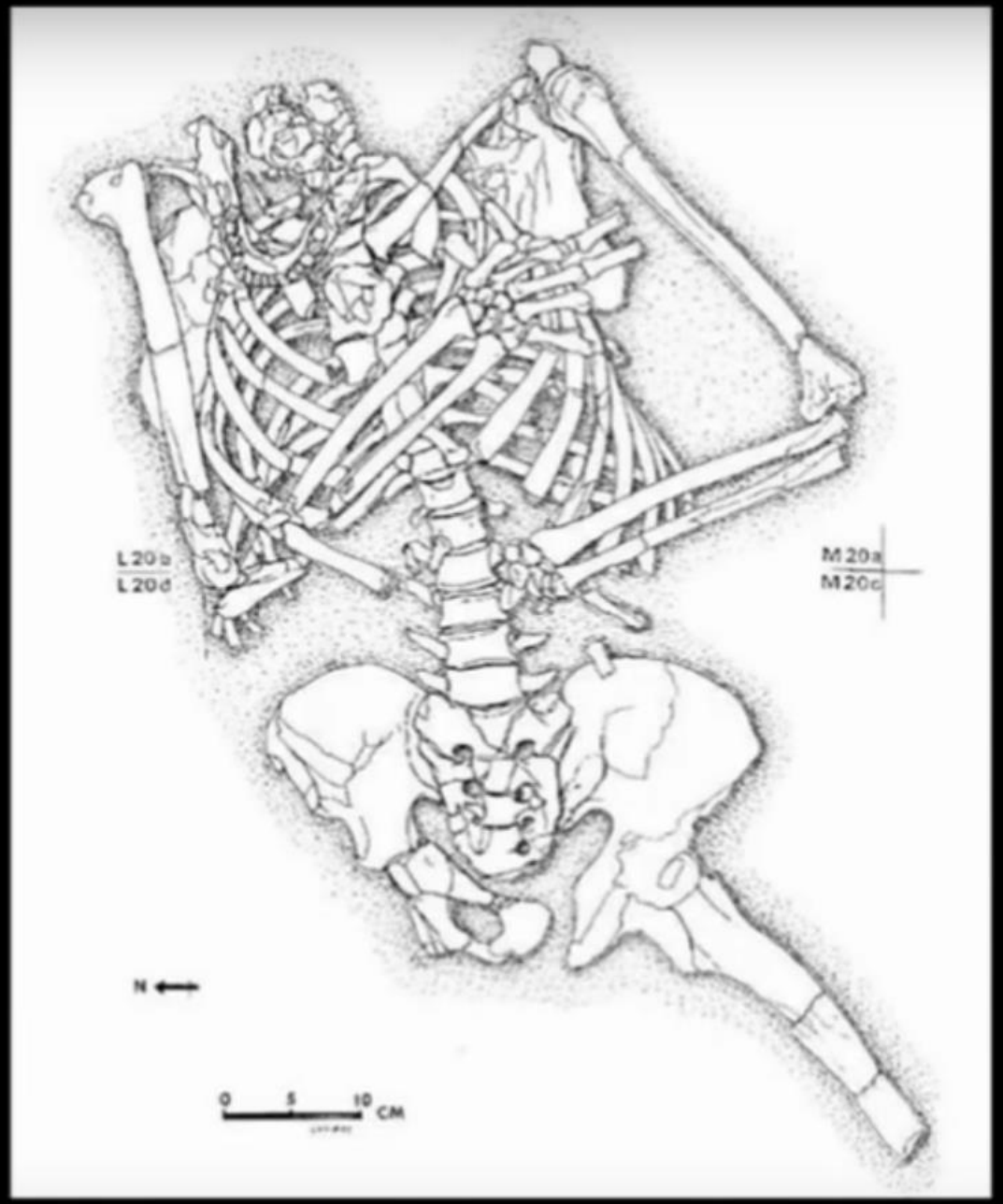
Square: L20 Primary burial Young adult Sub-complete skeleton In a protected area and pit

Supine Cephalic extremity removed with caution

59.900 ± 3500 BP

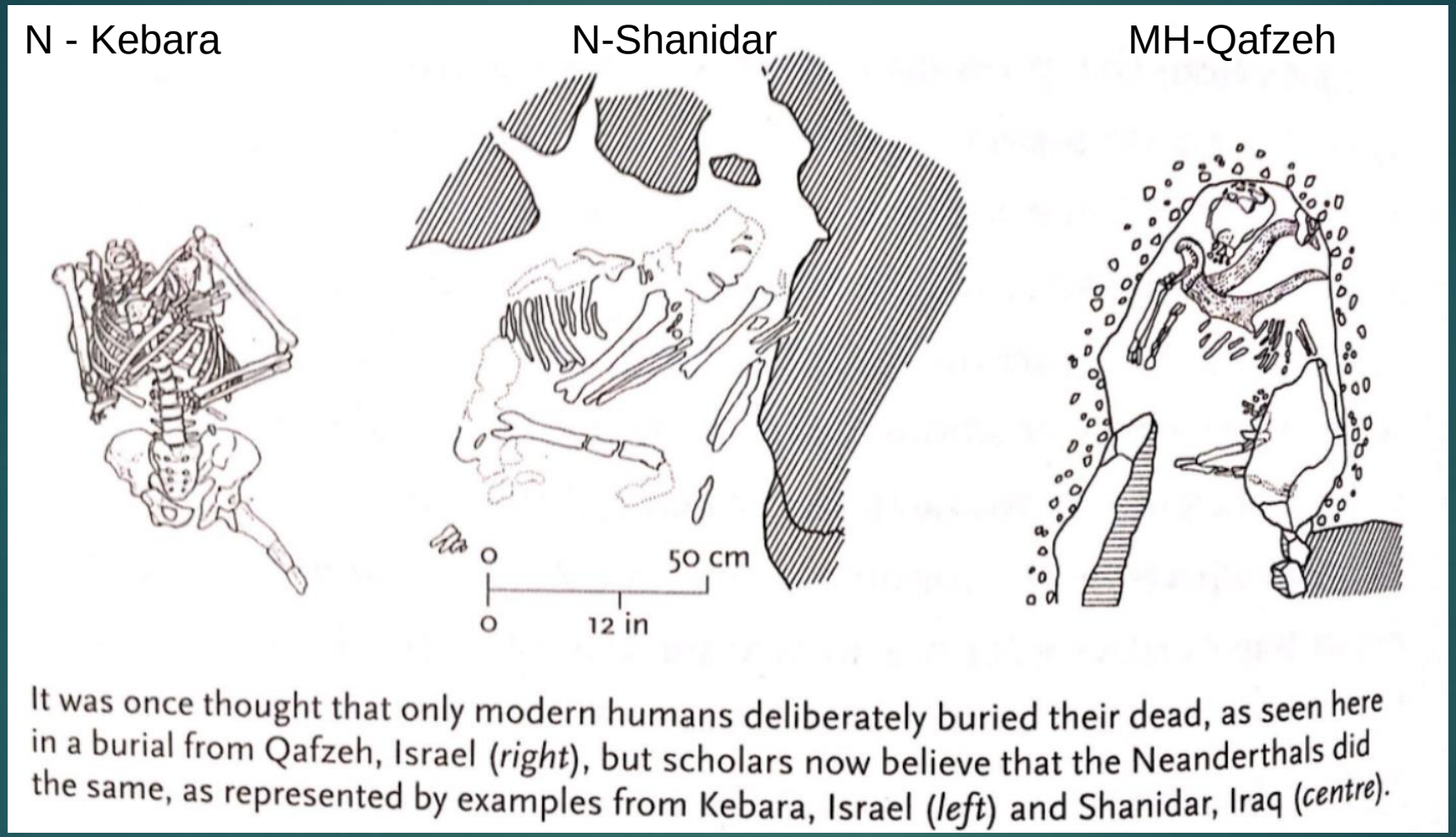
Type de gisement : grotte
Unité XII
7,80 m de profondeur
Sujet adulte : Kébara 2, squelette sub-complet mais sans bolte crânienne ni membre supérieur gauche
Carré : L20
Sépulture primaire
Adulte jeune
Squelette sub-complet
Dans un espace protégé et fosse
Décubitus dorsal

Extrémité céphalique prélevée avec précaution



(D'après Tillier et al., 1991) Dessin D. Lariday

Both N and MH buried their dead



It was once thought that only modern humans deliberately buried their dead, as seen here in a burial from Qafzeh, Israel (*right*), but scholars now believe that the Neanderthals did the same, as represented by examples from Kebara, Israel (*left*) and Shanidar, Iraq (*centre*).

Some animal bones found in N burials; but much more at MH burials: shell beads, red ocher

Papagianni & Morse, 2015

Homo neanderthalensis: Burials

- At least 36 Neanderthal sites show evidence of intentional internment of the dead, and in some graves there were remains of offerings: stone tools, the pigment red ocher, and the bones of large game animals are known

- Original idea that some graves at Shanidar, Iran, were adorned with offerings such as flowers, has been reinterpreted (due to Persian Jird intrusions)

12 European burial sites with 20 graves

- Feldhofer
- Betche-al-Rotche
- Le Moustier lower rock-shelter
- Chapelle-aux-Saints (7 graves)
- La Ferrassie grand abri
- La Quina amont
- Grotte du Loup
- Le Regourdou
- Le Roc-de Marsal
- Le Mas Veil
- La Roche-à-Pierrot
- Sima de las Palomas

Burials

- Burials of adults and children in and outside Europe are often considered the most striking evidence supporting the idea that intentional symbolic acts were part of Neandertal cultures.

- Grave goods in the form of faunal remains, stone and bone tools, engraved bone, and rock slab engraved with cupules are reported at Neandertal primary burials Neanderthal burials such as La Ferrassie, La Chapelle-aux-Saint, Le Moustier in France, Amud and Dederiyeh in the Middle East.

La Chapelle-aux-Saints

Research question: burial vs funeral

- The presence of a number of fully articulated Neandertal skeletons suggests that some Neandertals covered their dead with sediments, i.e., that they buried their dead.

- There is no way to differentiate between
  - a burial—a body covered with sediment—and
  - a funeral, which denotes a symbolic ritual possibly based on spiritual beliefs.
- In the absence of unambiguous grave goods associated with Neandertal skeletons, we have no evidence for funerals in the Neandertal record.

UP Burials

- Recent review of the Upper Paleolithic burials in Eurasia concludes
  - (i) that for the whole of the Eurasian Upper Paleolithic, there is only a small number of burials (3 per 1,000 y)
  - (ii) the earliest UP burials postdate the arrival of modern humans in Europe by ~10,000 y (start ~16 Ka).
  - (iii) UP burials differ widely in terms of elaborateness
  - (iv) evidence for UP funerary rituals is very thin
  - Authors suggest that most of the items traditionally considered as UP grave goods are probably personal ornaments worn in life.
  - Except for a few, most UP burials were not as different from the Neandertal record as commonly thought

N Burials

- Although it is possible that early humans buried their dead for purely hygienic reasons or to discourage scavengers, many anthropologists view intentional burial as a kind of symbolic behavior.

- 3 camps of opinions:
  - 1 - all evidence for Neandertal burials can be explained by natural processes
  - 2 - buried their dead occasionally and sporadically; motives behind Neandertal burials were different from those of modern human burials (for example, practical vs. symbolic);
  - 3 - characteristics of, and motivation behind, Ns & MH burials were the same, suggesting that the cognitive capacities of the two groups were similar, if not identical.

N burials 1: Intentional burials

- Different standards used to identify a burial.
- For some, good preservation may be enough to conclude that an individual was intentionally buried.
- Others require more rigorous criteria, such as the position of the body (flexed), evidence of a burial pit, grave markers, and/or inclusion of grave goods.
- Some claim that one must completely disprove the role of natural processes in order to properly interpret a skeleton as a burial.

N burials 2: Intentional burials

- When present, the burial pits associated with Neandertal skeletons are shallow, and some clearly have a natural origin.
- Only 50% of the N burials include possible grave goods (for example, stone tools, animal bones, and/or pigment).
- Because these grave goods are not very different from the items found in the surrounding deposit, it is difficult to rule out the possibility that the items were accidentally included in the grave fill.

N burials

- The most convincing evidence that Neandertals occasionally buried their dead is that many of the skeletons, especially those of juveniles and infants, are well preserved.

- If use looser criteria, there are 33 N sites for which there is probable or certain evidence for one or more intentional burials; 50% with stone tools or animal bones,

Grave controversy: La Chapelle

- The first N discovery: in 1908 at La Chapelle-aux-Saints in southwestern France. However, skeptics argued that the burial may not have been intentional.

- Neanderthals were known to bury their dead in the Middle East. However, these burials dated to a time when contact with modern humans (*Homo sapiens)* might have occurred.

- Between 1999 and 2012, excavation of seven graves at La Chapelle-aux-Saints, where the first known potential Neanderthal burial was discovered.

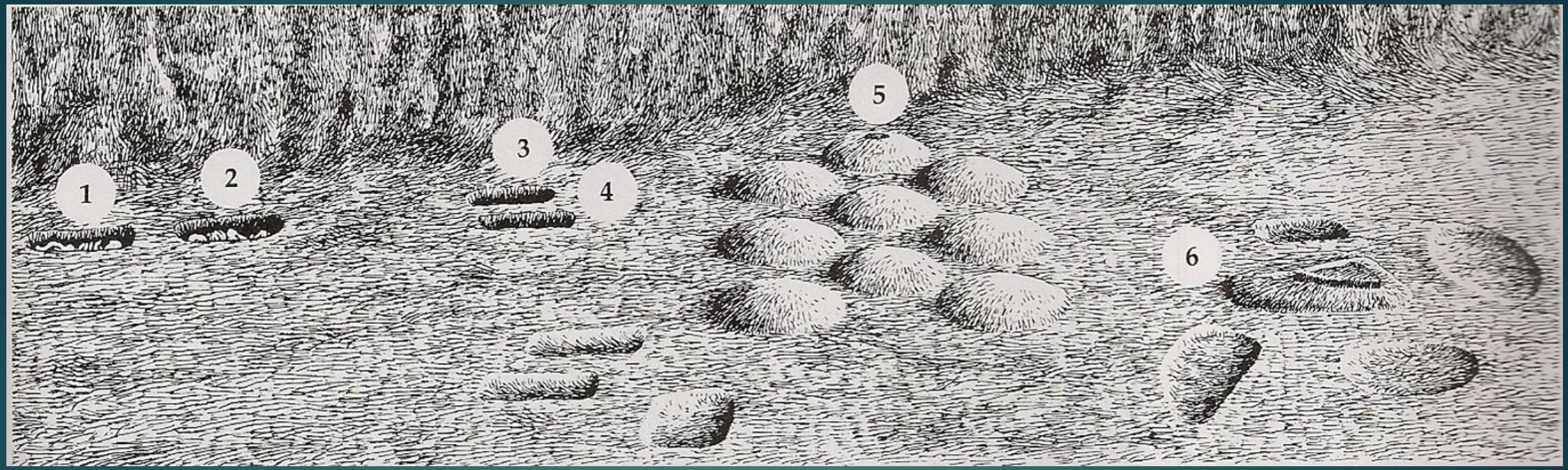
Grave controversy: La Chapelle

- More Neanderthal remains were found — two children and one adult — as well as some bison and reindeer bones.

- 15-inch-deep pit where the remains were found suggested it was not a natural feature of the cave floor.

- Neanderthal remains found at the site in 1908, they discovered that unlike the bison and reindeer bones, the Neanderthal fossils had few cracks, no smoothing related to natural erosion from the environment and no signs of disturbance by animals.
- These traits suggest the Neanderthal was buried rapidly, and perhaps intentionally, to protect the bones.

La Ferrassie Burials, 70 Ka: 2 adults & 4 children



The care that Neandertals sometimes lavished on their dead seems clear at La Ferrassie, in France. There, archaeologists discovered what may be a 70,000-year-old family cemetery, containing the skeletons of two adults and 4 children. The drawing here shows a site about 85 feet (26 meters) long. The presumed parents were buried head to head (at locations 7 and 2 in the drawing); two skeletons (3 and 4), possibly of their children, each about five years old, were neatly interred near their father's feet. The significance of the nine small mounds is not clear, but one contained the bones of a newborn infant and three flint tools (5). The triangular stone (6) covered the grave of another child.

Shanidar 4, the “flower burial”

- The skeleton of Shanidar 4, an adult male aged 30–45 years, was discovered by Solecki in 1960, positioned on his left side in a partial fetal position.

- For many years, Shanidar 4 was thought to provide strong evidence for a Neanderthal burial ritual. In 1968, pollen analysis was done.

- In two of the soil samples, whole clumps of pollen were discovered, suggesting that entire flowering plants (or at least heads of plants) had been part of the grave deposit.

Shanidar

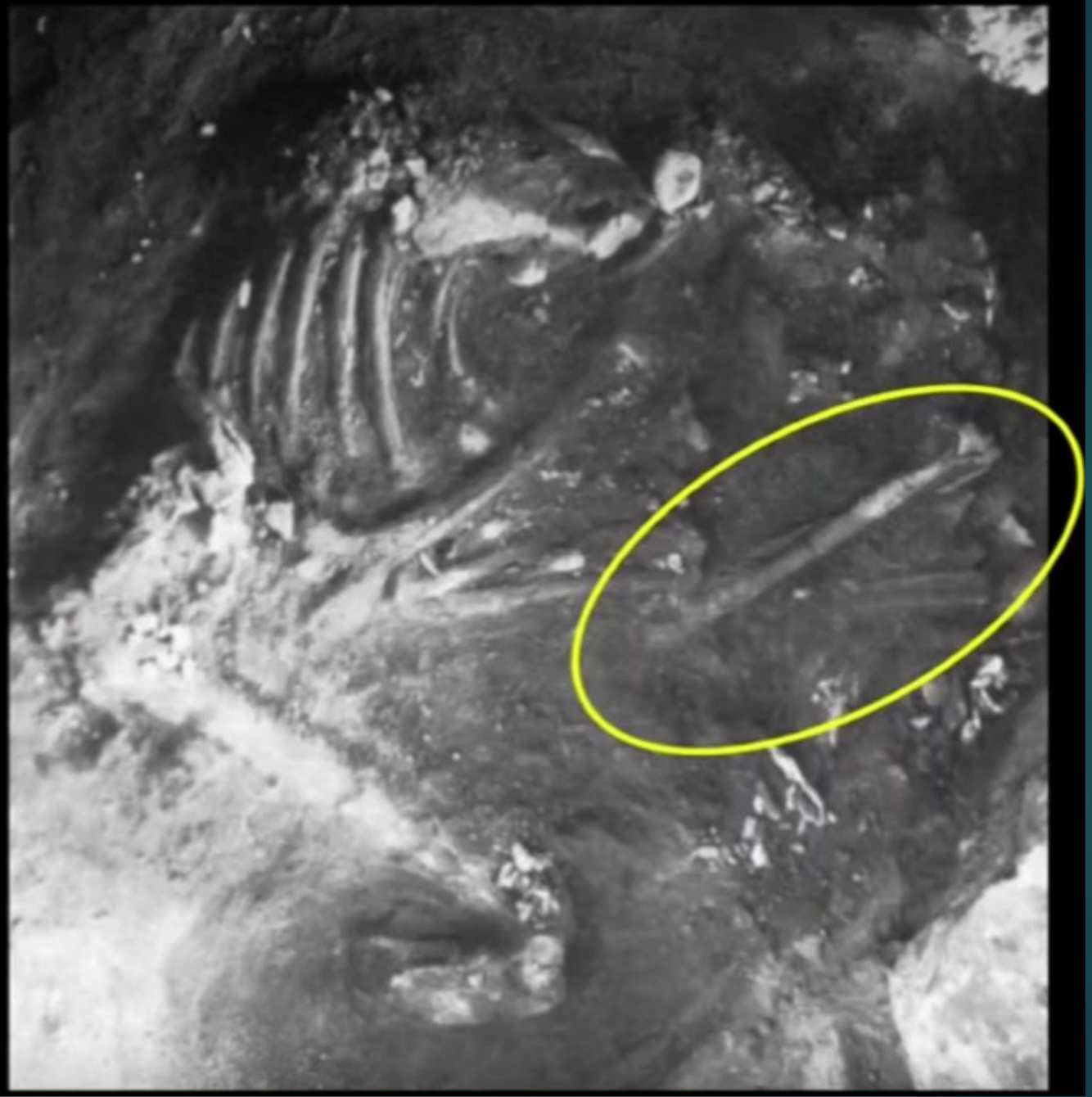
- Study of the particular flower types suggested that the flowers may have been chosen for their specific medicinal properties.

- Included Yarrow, Cornflower, Bachelor's Button, St. Barnaby's Thistle, Ragwort, Grape Hyacinth, Joint Pine or Woody Horsetail and Hollyhock,

- This led to the idea that the man could possibly have had shamanic powers, perhaps acting as medicine man to the Shanidar Neandertals.

Iraq

Shanidar 4 (1960)
&
Shanidar 6,
Shanidar 8,
&
Shanidar 9



Shanidar 4, the “flower burial”

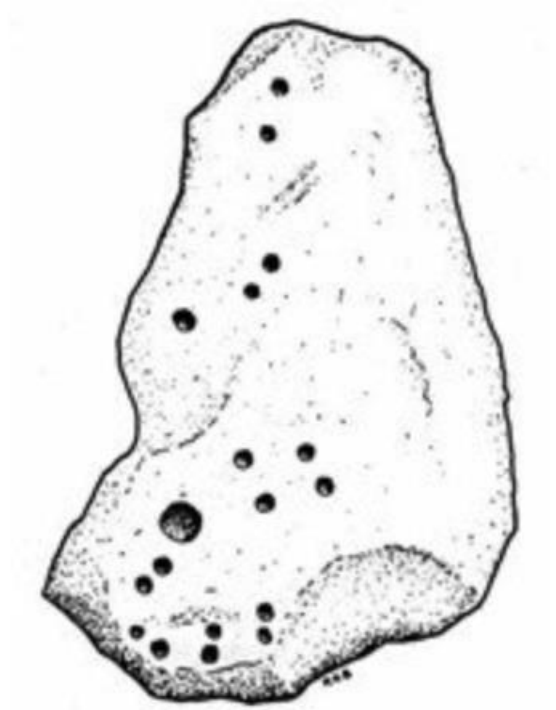
- Now: pollen was introduced to the burial by animal action, as several burrows of a gerbil-like rodent known as the Persian jird were found nearby.
- The jird is known to store large numbers of seeds and flowers at certain points in their burrows
- Paul B. Pettitt has stated that the "deliberate placement of flowers has now been convincingly eliminated", noting that "pollen was deposited by the burrowing rodent *Meriones persicus (*Persian jird)
- Petitt concludes that the Shanidar burials, because they happened over so many years, represent a deliberate mortuary practice by Neanderthals

N burials

- Neanderthal burials in the Levant are as old or might be even older than those of moderns, if one accepts the most ancient date for the Tabun C1 burial, at 120 Ka

- Neanderthal burials in Europe are numerous but concentrated in a few areas, suggesting that Neanderthals, as modern humans in Africa, may have engaged in funerary practices that left no traces in the archaeological record.

La Ferrassie Cave Neandertal: slab covering with Cupules (~ 60 Ka)



Sketch of Cupules found on slab over tomb at La Ferrassie Cave

Series of cupules - a primitive form of rock art - dating back to Mousterian culture (c 60,000 BCE), which makes it among the oldest prehistoric art in Europe.
At *La Ferrassie burial 6*, a large limestone slab was found covering the grave of a Neanderthal child. On its underside was found an arrangement of cupule-art, consisting of 2 larger hollows and eight pairs of smaller holes.

1909

La Chapelle aux Saints, 1909

2012

La Chapelle aux Saints, septembre 2012

Fig. 3. The bouffia Bonneval in 1909 and September 2012. The 1909 picture comes from the Fonds Bouyssonie-Ecole Bossuet.

La Chapelle aux Saints

La Chapelle-aux-Saints

Bouyssonie, Bouyssonie, and Bardon. 1908. “Découverte d'un squelette humain moustérien à la bouffia de La Chapelle-aux-Saints (Corrèze).” *L'Anthropologie* 19:513-518.

This is a reconstruction of a Neanderthal burial at La Chapelle-aux-Saints, France. The original discovery at the site in 1908 remains one of the most famous and highly debated Neanderthal finds of all time. Dea/A. Dagli Orti/De Agostini/Getty Images

La Chapelle-aux-Saints:
where the hypothesis of a Neandertal burial was raised for the first time.

2014 project has concluded that the Neandertal of La Chapelle-aux-Saints was deposit in a pit dug by other members of its group and protected by a rapid covering from any disturbance.
These discoveries attest the existence of West European Neandertal burial and of the Neandertal cognitive capacity to produce it.

William Rendu, et al., 2014

Roc de Marsal near Les Eyzies, France: 75 K, Neandertal site; burial of 3 year old N child; earliest European burial

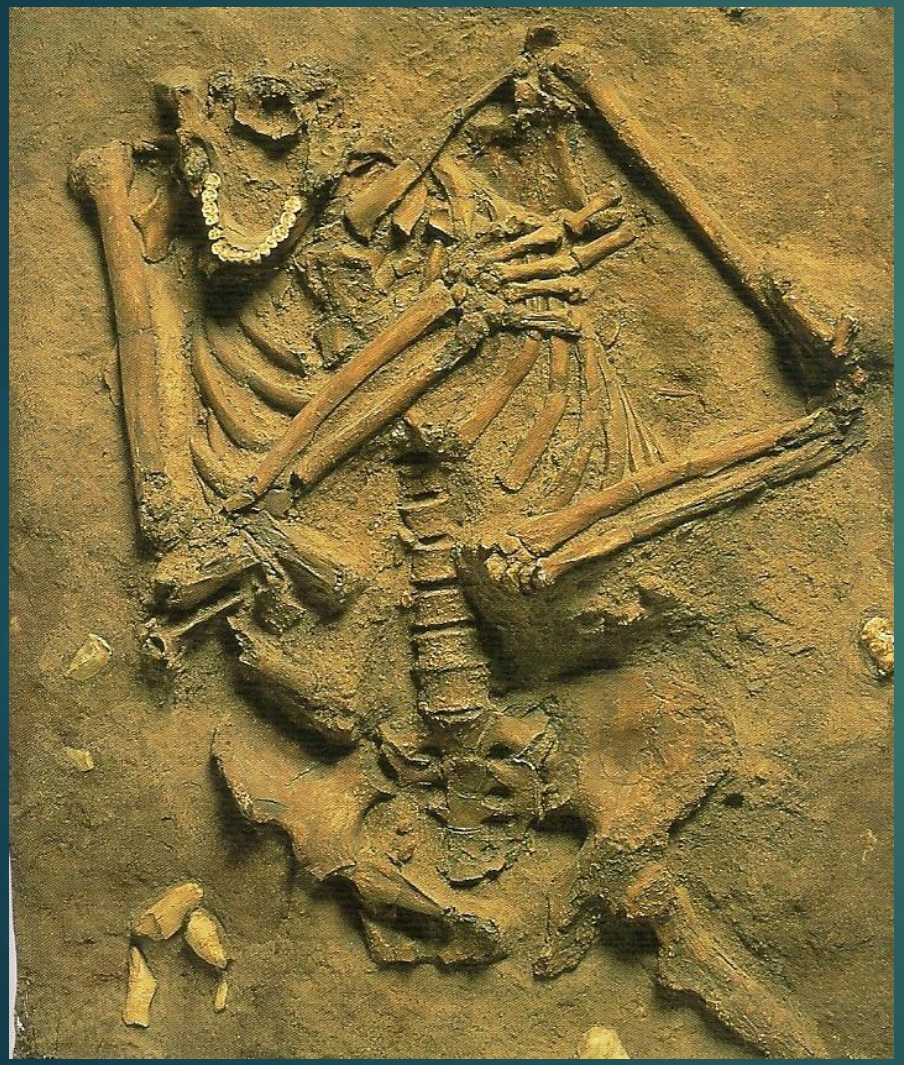
Capital of prehistory because of number of Paleolithic sites

Found by Jean Lafille in 1961

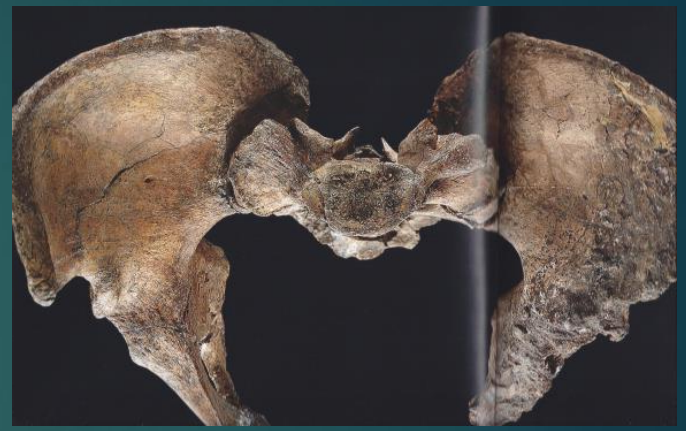
60Ka, Metmann, Germany: 2nd oldest European burial site

1983: *Homo neanderthalensis*, at Kebara, Israel, 60K

Most complete extracted Neandertal specimen & hyoid bone



Homo neanderthalensis
(Kebara 2)
Discoverer: Lynne Schepartz
Locality: Kebara Cave, Israel



Pelvis

Hyoid bone

N burials

La Ferrassie child

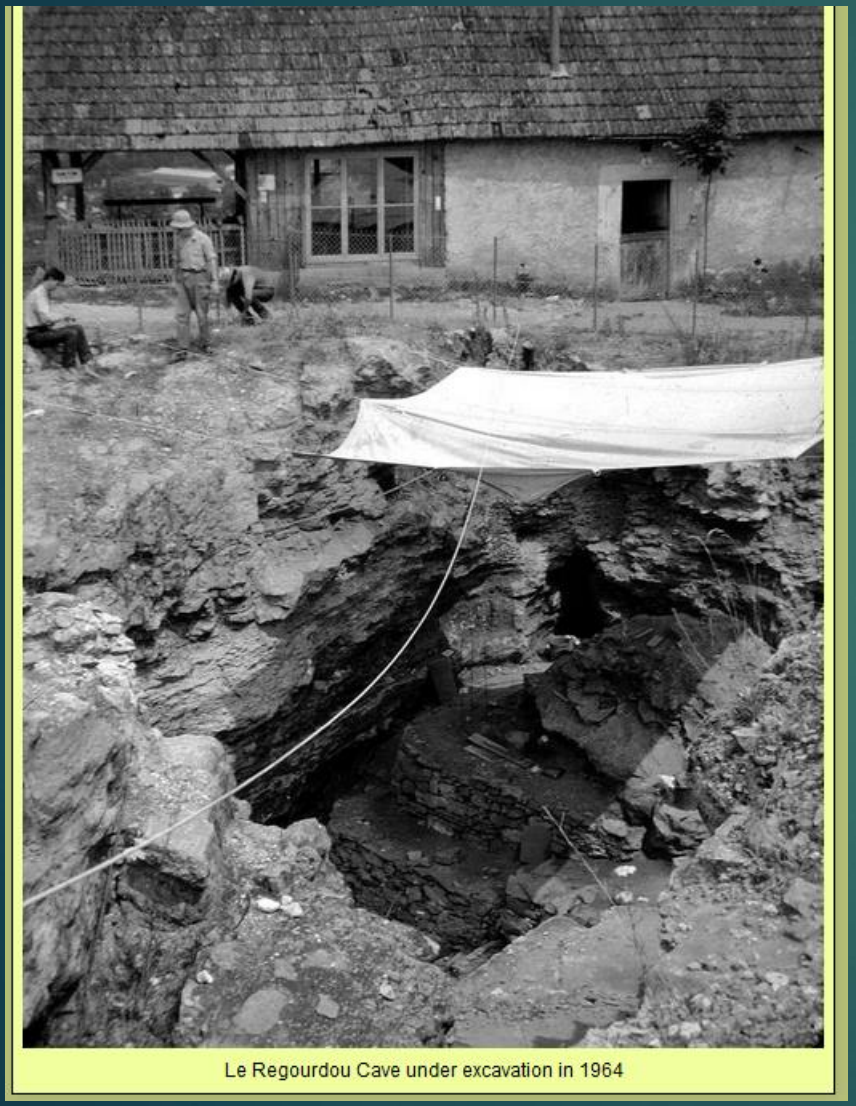
Burial: child burials

- The treatment of Neanderthal children in death also offers a picture of considerable care, far from previous views of infants simply being ‘dumped’ (e.g. Pettitt 2000, 359).
- The 10-month-old infant recovered from Amud Cave in Israel for example, was found laid on its right side and buried within a small niche in the cave wall, with a red deer maxilla on its pelvis (Hovers et al. 1995).
- Several of the five children buried at La Ferrassie in France were also laid into depressions, including an infant less than one year old, possibly associated with three flint scrapers (Heim 1976a).
- Two infants at Dederiyeh cave, one of which had a small flint placed upon its chest and a stone slab possibly laid under its head (Akazawa and Muhesen 2002).

Burials: Homo naledi

- Homo naledi is a whole different story.
- Its brain was less than half the size of a modern human's brain.
- Naledi makes the connection between burial and symbolism increasingly dubious: It is easier to imagine that these creatures disposed of their dead for practical reasons than for symbolic ones.
- But why, then, would naledi go through all the effort of bringing the fossils through the darkness, so far into the cave?
- The practice of defining uniquely human features is colored by value judgments about what matters to us in the present

Le Regourdou cave, France, 90 Ka: a N tomb



Le Regourdou Cave under excavation in 1964

- At Le Regourdou, France, a Neanderthal was buried (around 90 Ka) surrounded by stone points and brown bear bones. This burial has some of the best evidence for *grave goods*, the stone points were possibly weapons.
- On top of the grave is a giant (850 kg/1870 lbs) limestone slab, a *true funeral slab*. Built on the slab was a tumulus /burial mound of large stones, and on top of *that* was a layer of burnt sand and various artifacts including more brown bear bones. Regourdou is the first *tomb*.
- Around the grave are about 20 man-made ditches. These are either lined, filled, or covered with stones, and their purpose is unknown.

Madelaine, S., et al., 2008

Regourdou 1 Skeleton: no cranium

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