Neandertals 2.0
Part 4

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by
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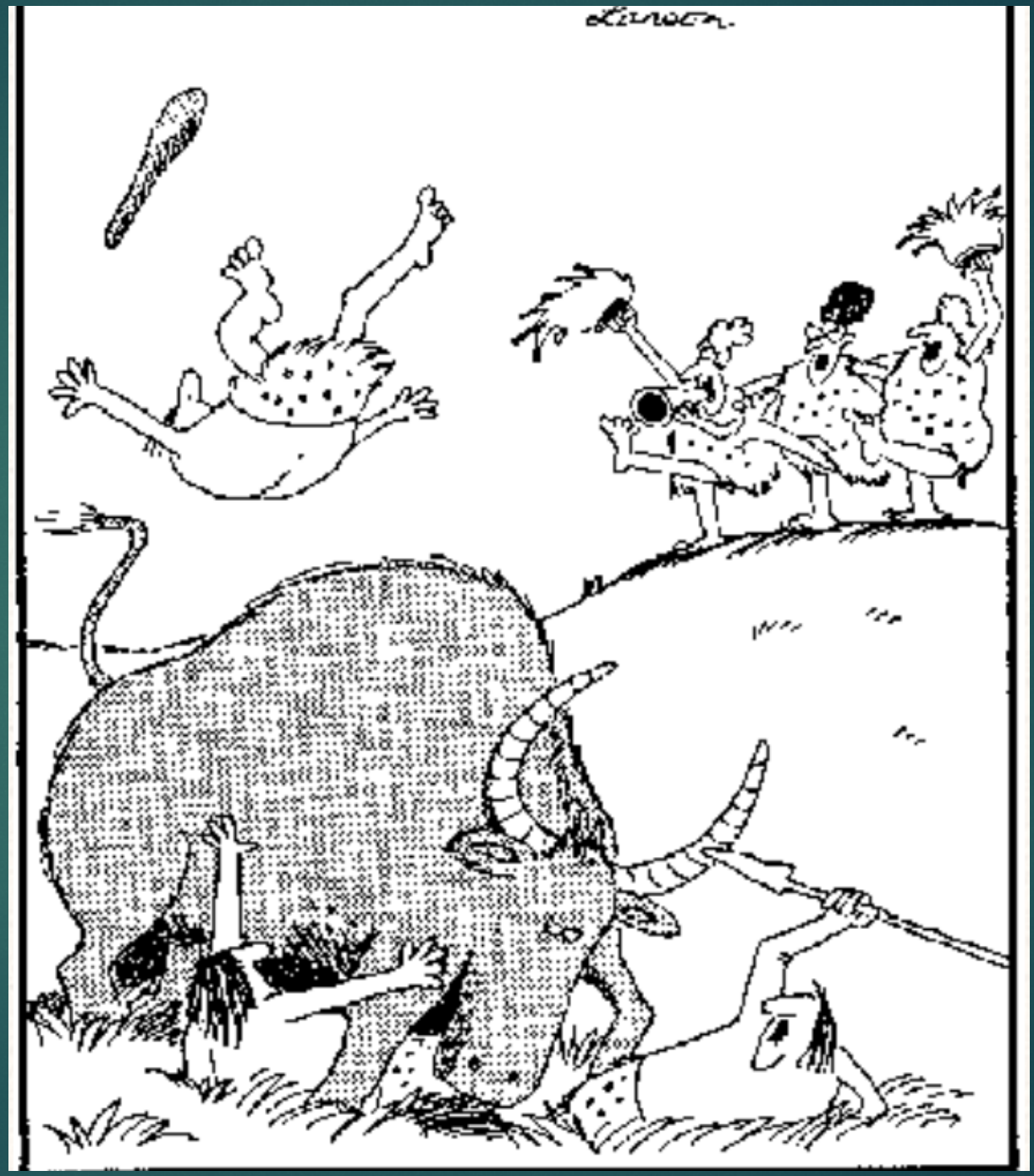
++ Neandertal Healthcare

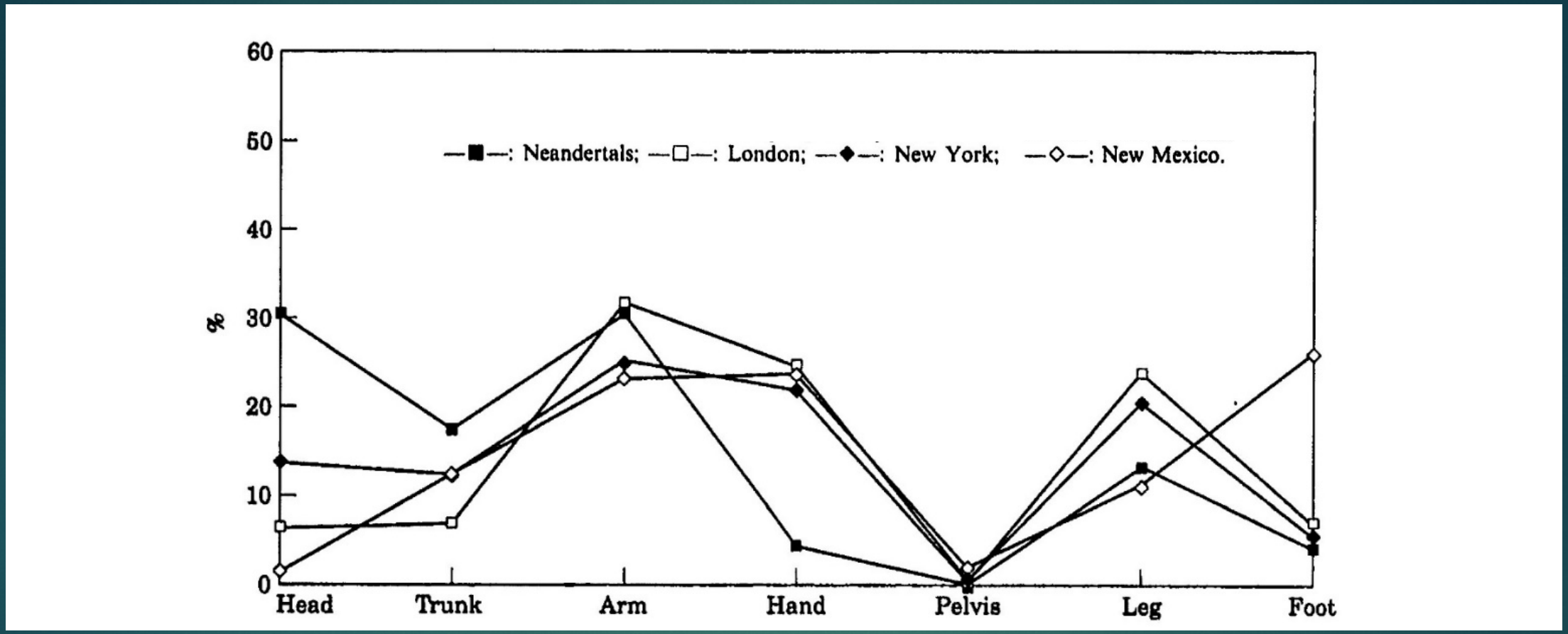
Rodeo Neandertals

Of 500 fossil skeletons, all of the adult fossils have broken mended bones in upper torso (like American rodeo rider injuries); no gender difference



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

Trauma evidence: upper body injuries



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

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.

- The "Rodeo rider" hypothesis: In 1995 Berger and Trinkaus proposed that the anatomical distribution of Neandertal trauma, with a predominance of upper body lesions reflected close-quarter ambush hunting.

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 contemporary 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.

2009: No evidence for idea that Neandertals are more frequently traumatized than modern populations

- No evidence for idea that Neandertals are more frequently traumatized than modern populations
- Some of the Neandertals with trauma are female, but less than males;
  - No division of labor reflected in trauma pattern.
- Wu, et al., 2011: similar injury profiles also characterize pathologies in skeletal remains throughout the Pleistocene suggesting that differential preservation may be a more likely explanation for the rodeo rider pattern.
- 2012 study: no difference in trauma patterns relative to ancient MHs, and recent hunter gatherers

Virginia Hutton Estabrook, 2009

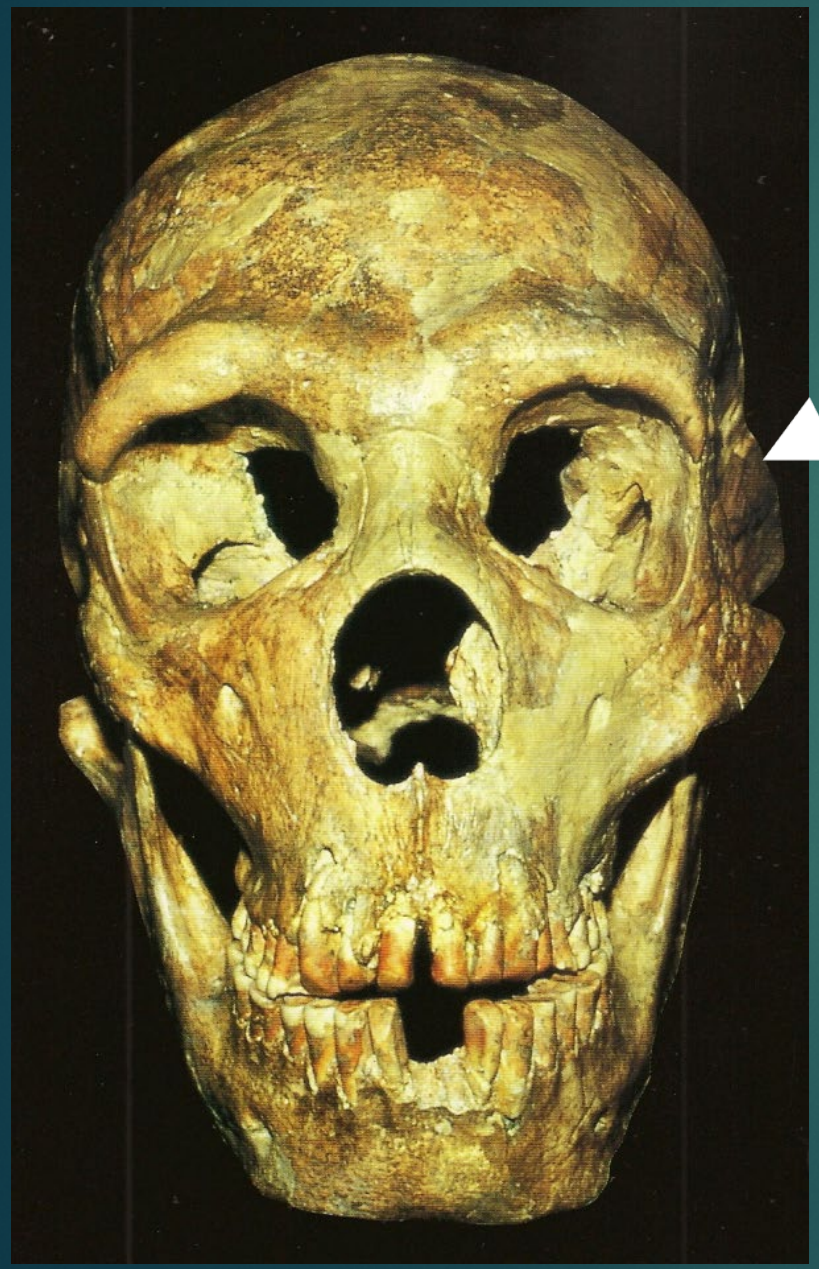
MHs also were traumatized

- Early H. sapiens sites: Nearly all had poor health indicators, whether severe growth interruption lines on teeth, hearing impairment/deafness, infections, a benign tumor, bone degeneration, gum disease and potentially scurvy or meningitis.
- A MH single male skull known as Mladeč 1, In addition to a broken arm, bore three injuries, very likely from assault.
- Farther east and a few thousand years later, at Sunghir, Russia, there's even a cut-and-dried *H. sapiens* murder case. The throat of a richly buried adult skeleton had been violently gashed, very probably fatally.
- Much more evidence for interpersonal violence among MHs.
- 2018 - J. Beier et al. study: 4 to 33 percent of Neanderthals and 2 to 34 percent of ancient humans had traumatic cranial injuries

N Healthcare = Medicare for All

- Neandertals lead a hard life: There are no adult Neanderthal skeletons that don't have at least one fracture.
- In adults in their 30s, it's common to see multiple healed fractures.
- Few lived to an old age of 45 (but beware of preservation bias).
- Practiced Medicare for All: Ns cared for their own sick and injured.
- Used plant based medications

Shanidar 1: adult male, 40-45 years, old & injured



- Eye socket crushed-
  Blinded in that eye

Left arm amputated
above the elbow;
Also 1 at Krapina

N Medicare for All: Shanidar I

- "A one-armed, partially blind, possibly deaf, crippled man could have made no pretense of hunting or gathering his own food. That he survived for years after his trauma was a testament to Neandertal compassion and humanity" *(Trinkaus and Shipman 1993)*.

- Perhaps the most famous individual benefitting from N compassion and care, Shanidar I, survived for at least a decade despite a withered arm, damaged leg, probable blindness in one eye and probable hearing loss through what is likely to have been daily care and provisioning from others

(Crubézy and Trinkaus 1992; Trinkaus and Zimmerman 1982; Trinkaus 2014; Trinkaus and Villotte 2017).

Shanidar 1: the most battered Neanderthal known

- Shanidar 1, was probably well into middle age and had overcome an astonishing number of physical difficulties.— Some time before adulthood his right upper arm suffered a terrible multiple fracture, and shriveled after healing badly. Incredibly, it looks as if the lower part was amputated, presumably by someone else. There is also a N amputation at Krapina.

- While he survived and coped with these injuries, his right shoulder blade was malformed, and it may also have led to his collarbone being both unusually small and developing a serious bacterial infection, perhaps also damaged during the original injury.

- This individual was immortalized as the shaman Creb in Jean Auel's novel *Clan of the Cave Bear*, (1980) which inspired a generation to become prehistorians.

Shanidar 1

Left facial trauma; probably blind in right eye

Deaf in left ear – bony growths

Right humerus broken in 2 places

Lost right arm

Fracture and osteoarthritis of right foot

Severe degenerative disease

All his traumas had healed before his death

Required caregiving

Shanidar 1

- He also survived multiple head injuries. A horrendous wound crushed the upper left side of his face, distorting the bone all around his eye and cheek. It probably also caused him to be partially sighted - if not blind - in that eye.

- His partial deafness was caused by benign growths inside the ear; in medical literature they're known as 'surfer's ear' from being associated with swimming in cool water, but in fact they can be caused by infection, injury or even prolonged cold wind exposure.

Shanidar 1

- In spite of living with chronic pain and his many challenges, Shanidar 1 adapted to daily life in the group. He continued to use his dominant arm despite missing a hand, perhaps even knapping using an altered technique.

- Though by death he displayed a marked limp from advanced arthritis, well-developed leg bones point to an adulthood just as mobile as other Neanderthals.

- After coming through so much, however, slower reactions may have been his ultimate downfall, since some evidence points to him being caught in a rockfall.

Neandertal Healthcare

- A social perspective on Neanderthal healthcare contributes to our understanding of Neanderthals
  - as living in groups with deep investments in each other's wellbeing and
  - with a competence to apply knowledgeable approaches to preserve health. 300 K years of survival experience leads to how to care for each other

- Neanderthal care for illness and injury, and support of impairments, was widespread, and motivated by similar close social bonds to those in our own species.

Healthcare

- Neanderthals were capable of caring for individuals who were ill or injured, from the provisioning of food, water and protection to active treatment for injuries

- Neanderthals appear to share a common human emotional and practical response to vulnerability and suffering of those that they were close to, attitudes also reflected in care of children, attitudes to the body at death through burial practice.

(Hublin 2009; Thorpe 2016; Trinkaus and Villotte 2017).

Living to fight another day: The ecological and evolutionary significance of Neanderthal healthcare

- 2019: Penny Spikins concluded that Neanderthals' medical skills were remarkably similar to our own ancestors' methods, and included
  - wound dressing,
  - fever management,
  - midwifery, and a
  - budding pharmacopeia of herbal remedies.

Penny Spikins, et al., 2019

Caregiving

- N caregiving: A few really beat-up Neanderthals are hard to explain without something like this.
- The dreadful head injury suffered by the Saint-Cesaire woman would probably have caused confusion and certainly massive blood loss, and she must have been helped at least temporarily.
- Similarly, Shanidar 3 might have been lucky and avoided a collapsed lung after their chest was stabbed, but they may have struggled with breathing and walking.
- They hung on for more than two weeks before death, and given the increased calorie needs of Neanderthal bodies, this seems a long time to survive if nobody was bringing them food.

Care for the injured at Krapina

- At Krapina, remains of 11 individuals exhibited signs of injuries that healed during their lifetimes, which wouldn't have been possible without the care of the community.
- Krapina 4, 5, 20 and 31 show evidence of small blunt trauma, which would have resulted in short term pain and blood loss, and would have required cleaning.
- Krapina 34 shows evidence of a significant depressed parietal skull fracture. It would have resulted in significant pain, blood loss and inflammation of the wound.
- Krapina 106 and adult Krapina 110 show a high degree of degeneration to the C4 and C7 cervical spinal nerves. It would have limited the mobility of the individuals, as well as their range of motion.

Care for the injured at Krapina

- Krapina 120 had a fragmented rib with signs of fibrous dysplasia.; a symptomatic neoplasm would have required a high level of care.

- Krapina 149 showed evidence of a fractured, and well-healed, right clavicle.

- Krapina 180 showed evidence of fracture of the right ulnar bone, that might have later resulted in an amputation.
- Krapina 188 had a fracture and bowing of the left ulnar bone. The injury would have required splinting and care for several weeks.

Use of medicinal plants

- There's also growing evidence that Neandertals ingested or chewed plants for medicinal reasons.
- That evidence began with Shanidar, where the Shanidar 4 burial included flower pollen from yarrow, ephedra, ragwort, and knapweed, all plants with medicinal uses.
- That evidence has been controversial, with the suggestion that rodents may have accumulated the flower material instead of the Neandertals themselves.

Use of medicinal plants

- Yet in recent years other kinds of evidence have provided a more direct record of ingestion.

- Karen Hardy and coworkers examined the chemical contents of Neandertal dental calculus from El Sidrón, Spain, finding evidence of compounds that are found in yarrow and chamomile.

- The argument that such plants were medicinal for Neandertals is based on their use in recent human groups for medicinal purposes; however it is also possible that they were also added to foods as flavoring.

Use of plants for medication

- There's no clear-cut evidence of herbalism in Neanderthals, but their deep knowledge of plants means it's not entirely unfeasible.
- An important cue to plants' medicinal characteristics can be distinct, often bitter tastes, which Neanderthals could detect and tolerate.
- When probable yarrow and chamomile were identified as being consumed at El Sidrón, claims that these herbs were used as medicines attracted attention.

Use of plants for medication

- But they're both also used as flavorings, so the use purpose is unclear.
- Really the proof of self-medication is indirect, from healing and lack of infection in horrific wounds like those of Shanidar 1, the Saint-Cesaire woman or the giant skull wound and another potential amputation at Krapina.
- Note that every hunter gatherer society in history have used medicinal plants for healing.

Neanderthal self medication: Fossilized El Sidrón Neandertal adolescent with dental abscess

L. Weyrich, et al., 2017

Neanderthal medicine: The upper jaw of male Neanderthal, found in El Sidròn, Spain

- DNA preserved within dental calculus on teethed reveal possible use of medicinal plant use 50,000 years ago by Ns:
- 1 - Methanobrevibacter oralis - This bacteria suggest presence of an abscess
- 2 - Populus trichocarpa (Poplar tree) - Contains salicylic acid, related to the active ingredient of aspirin; Acts as a natural pain killer that would have helped sooth pain from an abscess
- 3 - Enterocytozoon bieneusi - Evidence of an intestinal parasite that would have caused diarrhea
- 4 - Pénicillium rubens - Food fungus and source of medical penicillin - Natural antibiotic that could have been effective against a gut parasite

Any old Ns? Issues of preservation?

- Very small populations of Neanderthals, combined with a high percentage of skeletons being young adult males, makes it seem on the surface like lifespans must have been pretty short.

- But all this rests on assuming that the currently discovered N fossils accurately reflect the age range of the living. One indicator that this is not the case is a drastic under-representation of female bodies, and cadavers were sometimes ending up in the archaeological record after Neanderthals had been doing things to them.

- Given all this, the fact that there are relatively few identifiable elderly – (60+ years old) - individuals can't really be taken as proof Neanderthals were dying well before their biological time.

Chez Neandertal:

N Food Choices

Chez Neandertal:

What Ns ate was as diverse as the landscapes they lived in.

Not just carnivores: enormous range of plant and animal food

Deli at Stockton On Tees, England

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

Preservation issues and diet

- Sampling matters: there are fewer than 25 analyzed N individuals and because of issues around preservation, they're younger than 100 ka and come from colder climates.

- Neanderthals who lived in warmer, plant-rich times and places are missing from the picture.

- Yet even if we did have such samples, carbon and nitrogen stable isotopes only reflect protein, not carbs. Meat effectively swamps any plant protein in these methods, meaning that even if half of a Neanderthal's protein was vegetable in origin, isotopically they'd still look more like meat eating hyenas than grass eating horses.

N plant consumption

- If Neanderthals nibbling roots and shoots feels unlikely, remember that other archaeological evidence points to their being herbaceous connoisseurs.
- If they were well aware of plants' material properties, whether for tools, hafting adhesive or other uses, why shouldn't this knowledge have also been nutritional?
- On top of that, the existence of digging sticks is strong supporting evidence.
- Europe today has over 1,000 edible species, though they've mostly fallen off our cultural radar. Indigenous tundra-living societies have long known at least 20 to 40 species that are good to eat, many of which would have grown farther south during colder climates. They include fireweed (or rosebay willowherb), sorrels/docks, berries, fungi, roots and tubers, seaweeds and even some lichen.

Meat and plants

- The Krapina Neandertals show that they were eating significant amounts of unprocessed grasses, tubers, and other plants – and Neandertals living in mixed and wooded habitats ate more plants than those dwelling in open country.

- But, in general, the evidence suggests that Neandertals obtained most of their protein, and a lot of their calories as well, by eating meat.

'What the crap?', 'Poop scoop'

- N Coprolites: among mostly animal-based compounds, there was indisputable plant matter, probably from roots or tubers.
- We're only seeing a fraction of the plants Neanderthals were really eating. That's especially true for cooked foods, which break down faster.
- Amino acids still show animal proteins as dominant, but are now coming up with evidence of plants too.
- For the Belgium Spy Neanderthals, up to a fifth of protein was potentially coming from non-animal sources.

Diet

- At the famous North German site of Lehringen, there is evidence of an elephant (Paleoloxodon antiquus) carcass associated with a wooden spear (embedded in the rib cage) and several flint flakes.

- There is widespread evidence of Neandertal exploitation of a wide range of smaller prey. They collected and ate fish and shellfish in Italy, Portugal, France, and Gibraltar.

- Other sea resources also were exploited at numerous sites, as were birds.

N Toothpick use

- Toothpicks: N were their own dental hygienists. Distinctive grooves show that some practiced habitual tooth-picking, especially on sore areas.

- At El Sidrón, a conifer wood fragment was embedded in calculus right next to a tooth with pick-grooves.

- Sima de los Huesos, Atapuerca (Spain): 430 Ka
- Krapina (Croatia): 130 Ka
- El Sidrón (Spain): 49 Ka
- Cova Foradà (Spain): 17 Ka

N cuisine

- Ns required 3500-5000 calories per day (= 6.5 lbs of game); twice today's caloric recommendation

- To feed a group of 10 Neanderthals for a week, you're looking at 300,000 kcal. Three reindeer every seven days would hit that target, but it's almost 50 per cent more than managed by typical wolf packs.

N Diet – Meat from ungulates

- In multiple sites throughout Eurasia, remains of medium and large ungulates (deer, horse, goat, aurochs) have been identified as the most common food in the Neanderthal diet.

- But they also hunted larger animals: in Neumark-Nord (Germany) 70 elephantis of the species Palaeoloxodon antiquus, the largest terrestrial mammal in the Pleistocene (between 6 and 13 ton weight, up to 4 m in height).

Meat and plants

- Another example of an elephant is that of Preresa, Spain: an Elephas antiquus associated with the flint and quartzite tools used to process it.

- The Neanderthals of Spy (Belgium) had a diet heavily based on the meat of the fauna typical of their environment: woolly rhinoceros, goat... But up to 20 % of their protein source came from fungi and plants.

N diet: meat

- Small carnivores: very little evidence of consumption of them by Neanderthals.
  - In Abric Romaní (Spain) the consumption of wild cat (*Felis silvestris*) has been observed, apart from other animals mentioned above (deer, aurochs and horse).
- In Gabasa, Spain, a Neanderthal tooth shows a high consumption of meat and also marrow. The Neanderthals there were an "extreme" carnivore, more so than wolves, lynxes and foxes.
- In different sites in Europe, they have also been seen consuming choughs (*Pyrrhocorax)*, a species of bird with black plumage and similar in size to pigeons, which they would capture at night in the caves.

Neandertal Cuisine

- Mammals: Varied by region: Cave bear, deer, woolly rhinoceros, mammoth, wild cattle, reindeer, horse, wild ass, saiga; bison in colder periods; hippos, deer, ibex in warmer; but also rabbits, marmots, beavers, porcupines

- Neandertals were capable of capturing “fast” prey:
- At Terra Amata & 49 other sites, small game exploitation has been identified; 50% rabbits, 50% birds

Be careful of lean meat

- And since human nutritional requirements aren't the same as wolves or hyaenas, living largely on lean meat quickly leads to starvation.

- To get enough vital micronutrients - fats, vitamins, minerals - you need fat, brain, tongue, eyes and marrow, implying need for double the number of animals

- Protein poisoning: too much protein from excessive lean meat with not enough fat and carbohydrate for a long period of time.

Rabbit starvation

- Called “rabbit starvation” or “mal de caribou.” Produces malnourishment.

- Liver & kidney effects: When excessive amounts are consumed, it can put the body at risk for increased levels of ammonia, urea, and amino acids in the blood. Although very rare, protein poisoning can be fatal because of these increased levels.

- Ns hunted prime herd animals; preference for prime cuts – not just lean meat, but fat (brain, offal, marrow)

Insects

- Insects: Perhaps the most overlooked of protein groups that possibly contributed to Neanderthals' diets.

- Eurasia doesn't have many massive, fat grubs and larvae, but like ours, Neanderthals' summer days would have hummed with the background sound of bees. Even chimps love honey.

N Cuisine

- Used boiling – using bark, skulls, animal stomachs, stone bowls?
- Used fire: many, many hearths
- The gnawing and the biting marks from hyena teeth are always underneath the cut marks from Neanderthal stone tools. Not always but 90% of the time, you can tell that it's Neanderthals who had those carcasses first.
- Also teeth evidence of periods of severe starvation were not uncommon

Regional cuisine: Diet DNA Data from N teeth plaque

- A. Spy cave, Belgium, Northern Neanderthal diet was heavily meat based and included woolly rhinoceros and wild sheep (mouflon), 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. Cut marks on Neanderthal bones from the site suggest many members of the group were cannibalized after death

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

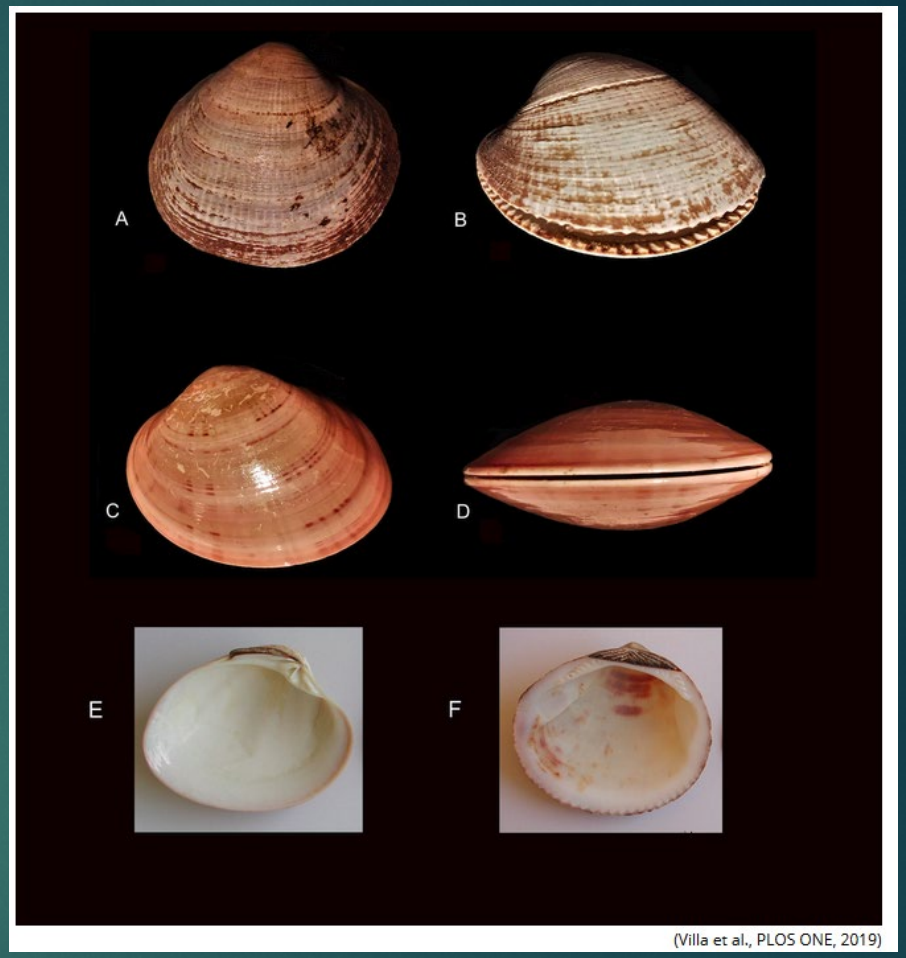
N swimming

- Ns could fish and dive
- 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.
- Excavated in 1949, Grotta dei Moscerini, 71 to 130 Ka is one of two Italian Neandertal sites with a large assemblage of retouched shell tools
- The shell tools are made of valves of the smooth clam *Callista chione*.

Neandertals at the beach: *Callista chione*

Shiny = Required 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

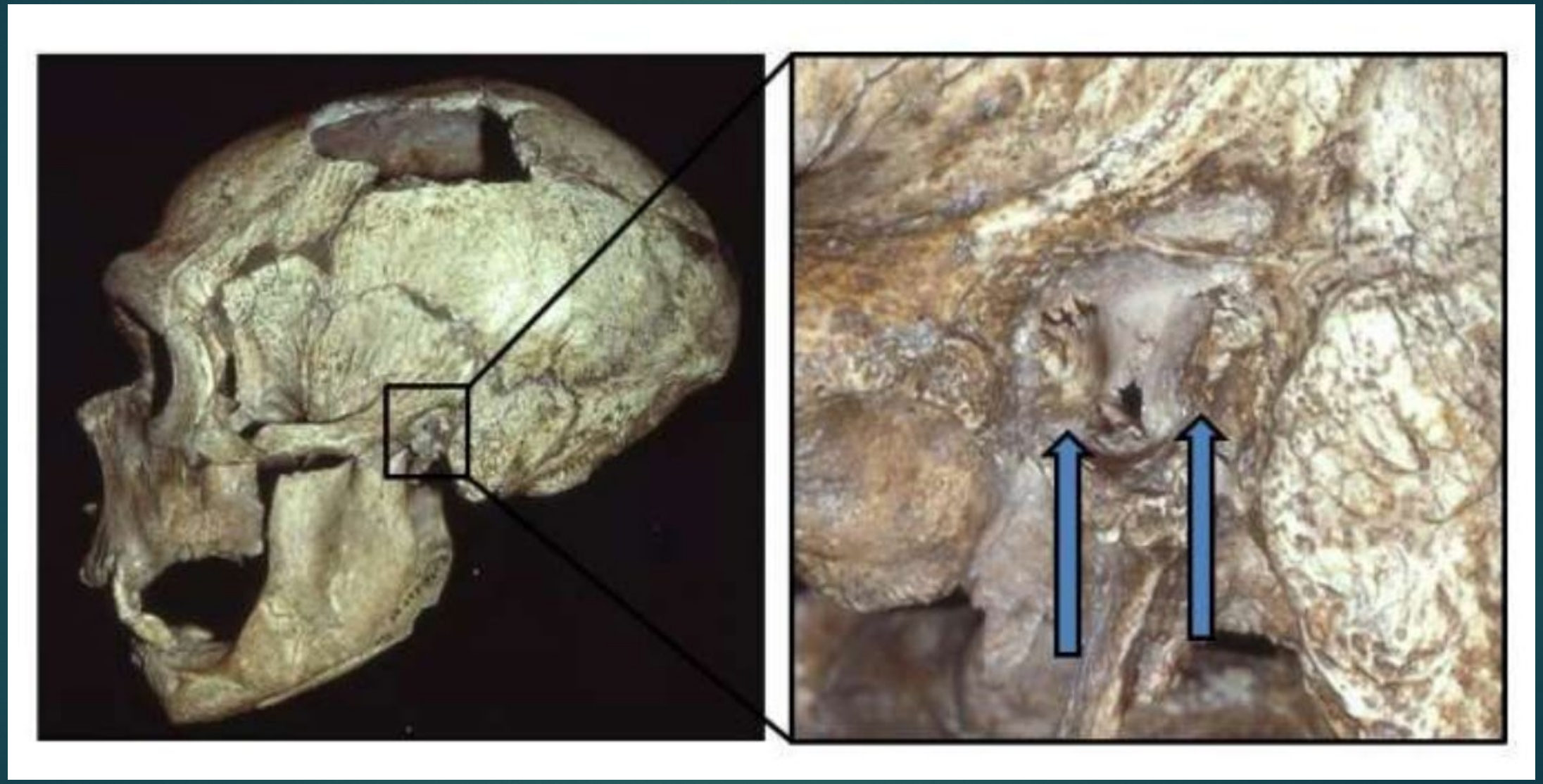
N could swim: Ns had surfer's ear

- 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.

- Such growths were first noted by French paleontologist Marcellin Boule in a classic 1911 monograph on the Neanderthal skeleton.

N surfer’s ear



Gibraltar: Gorham's and Vanguard caves: today & then

Credit Jaap Scheeren for The New York Times

Marine resources

- Evidence for continuous use of coastal resources between ~150 and 40 ka

- At Gibraltar: monk seals, dolphins, shark, clams, shellfish, (mussels, limpets, cockles), tortoises, turtles

- But not much evidence of freshwater fish – but growing, i. e. 2023 study of Northern Italy N site

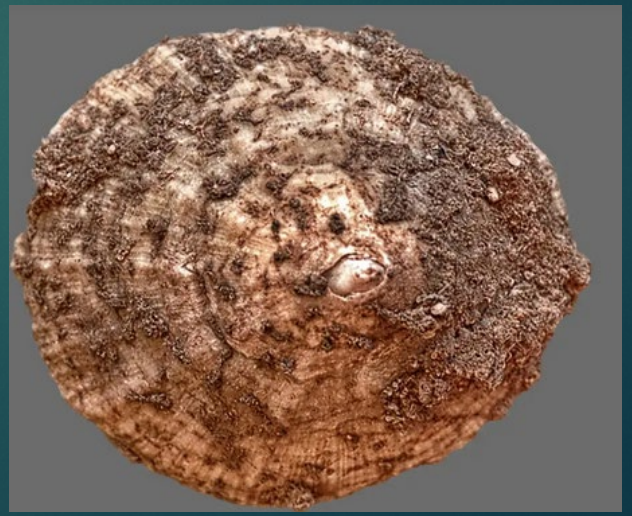
Marine resources

- In the Figueira Brava cave (Portugal) they ate mollusks (limpets, mussels and clams), crustaceans (brown crab and spider crab), fish (shark, eel, sea bream, mullet), birds (mallard, scoter, goose, cormorant, gannet, common puffin, egret, grebe) and aquatic mammals (dolphin, seals).

Meat

- The consumption of brown crab stands out: 33 specimens
- Marine resources accounted for approximately 50% of the Neanderthal diet at this site, with the remainder coming from land animals such as deer, goats, horses, aurochs, and turtles.
- Seafood consumption has been documented in at least 24 other European sites in Greece, Italy, Spain, Portugal, Gibraltar, etc.

Neandertals roasted crab and limpets at Gruta da Figueira Brava cave: another challenge to popular image of Neanderthals as just meat-eaters.

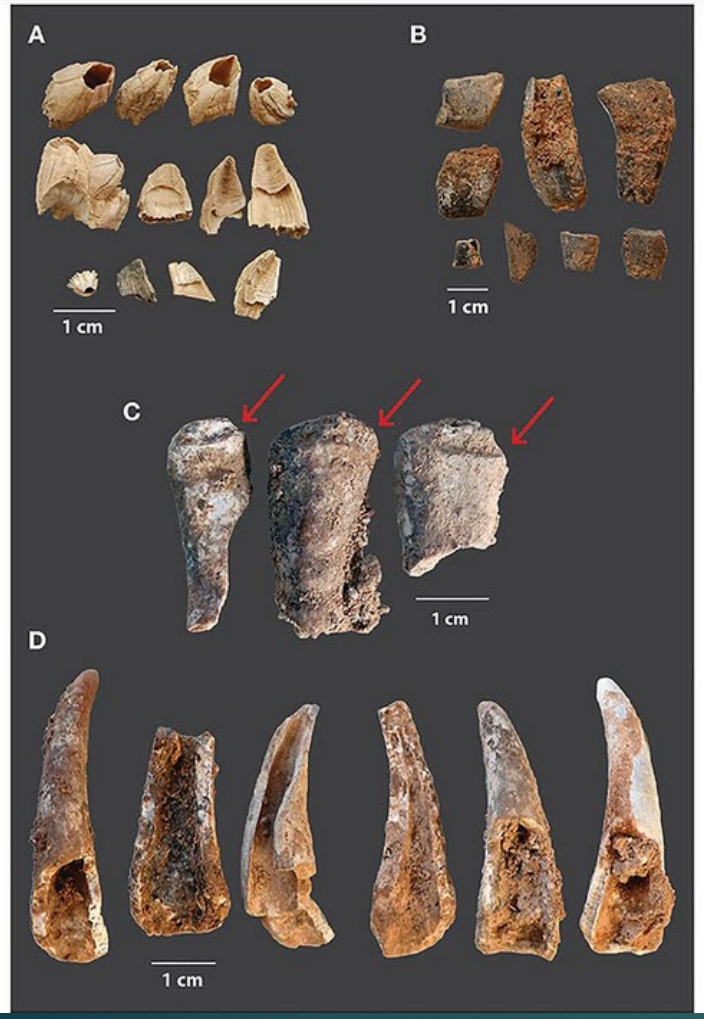


Neandertals liked crustaceans and sea urchins

- In a cave less than 20 miles from Lisbon, researchers discovered charred remnants of shells and claws: evidence that Neanderthals were cooking and eating crab 95,000 years ago.

- The cave site, Gruta da Figueira Brava, was about a mile from the coast when Neanderthals lived there.

- Aquatic feast: Found 560 fish bones, as well as remains from clams, mussels, crabs, waterfowl, seabirds (11%), seals and dolphins. As well as eels, morays, conger, mullet and sea bream.



Pieces of crustaceans from Gruta da Figueira Brava including from a barnacle, Perforatus perforatus (A); brown crab (B) with black burns; brown crab showing impact flakes (C); and pincers with longitudinal breaks (D).

Mariana Nabais/Catherine Dupont/João Zilhão, Frontiers in Environmental Archaeology, 2023

Neanderthals actively ate shellfish:

Found 635 bits of crab shells, representing a bare minimum of 33 individuals, along with remnants of barnacles and sea urchins.

M. Nabais, et al., 2023

Surf and turf dinners

- The analysis of crab remains reveals that complete animals were brought to the site, where they were roasted on coals and then cracked open to access the flesh.

- Don't know what was caught directly from the sea or scavenged from creatures that washed ashore or got trapped in tide pools

- In addition to the "surf," they found plenty of "turf," such as remains from red deer (20%), rabbits (17%), ibex (17%), aurochs(13%), horses (5%), cave hyena (4%) porcupine and tortoise. Plants included pine nuts.

The exploitation of crabs by Last Interglacial Iberian Neanderthals: The evidence from Gruta da Figueira Brava (Portugal)

- Neanderthal Crab Roast Leftovers Are Found in a Portuguese Cave

- There is growing evidence for the Neanderthals' subsistence exploitation of small terrestrial animals. This has been demonstrated by several studies rabbits, birds, and tortoises, from southern France and the Iberian Peninsula.

- Fish and shellfish harvesting played a significant role in the subsistence economy of Last Interglacial Iberian Neanderthals

Gibraltar Ns: Diet – Marine and Birds

- At Gibraltar: 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 dolphins on a seasonal basis.

- 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)

- Preservation bias: Both leporids and fish are more likely not to be preserved or recovered due to their small size and fragility

Cuisine

- Elephants:
  - 70 butchered in Neumark, Germany (28K lbs),
  - And at Jersey,
  - 11 in Linford, Eng (submerged?)

- 50 huge horses at Schöningen, Germ. Lakeshore (remains both on shore and in water); fermentation in water?

- A range of recent studies suggest that starch-rich foods were already important before the split between the Neanderthal and modern human lineages and document consumption of a similarly wide range of plant species by Neanderthals across their geographical range

Shoots to Roots

- Preserved Pleistocene vegetation is extraordinarily rare and this, together with visions of barren arctic tundra, led to assumptions that plants weren't eaten; or in such tiny amounts that they are undetectable. Initially, stable isotope analysis appeared to back this up.

- While Neanderthals' reputation as primarily big game fans is looking less prominent, they're never going to be just vegans.

- Nonetheless, it's plants that underlie the most dramatic U-turn in our understanding of their diet.

Plants and legumes

- The tartar particles of the Neanderthal group from El Sidrón (Spain) show remains of vegetables and medicinal plants.

- A high presence of pine nuts, moss and mushrooms from its wooded environment has been detected. The absence of meat in the tartar is interpreted as a much less frequent consumption than in other places further north in Europe.

- There is also a notable proportion of plants of various species in the Neanderthal tooth tartar from Vindija (Croatia), Grotta Guattari (Italy), Grotta Fossellone (Italy), Sima de las Palomas del Cabezo Gordo (Spain) and Kalamakia (Greece), including starchy plants.

- Remains of date palms, legumes and grass seeds have been found in the teeth of Shanidar (Iraq) and Spy (Belgium)

Plants

- In particular, the Neanderthals of Shanidar (Iraq) had a complex and diverse plant diet, including some that were possibly used to influence flavor.
- Ns understood concept of mixing materials; nuts in food for spice
- For example, nuts and wild herbs were often combined with legumes, such as lentils, and wild mustard.
- Legumes (beans, lentils, and peas) have a naturally bitter taste due to the tannins and alkaloids in their seed coats, so preparation techniques such as soaking and leaching, followed by pounding or coarse grinding, removed much of the bitter taste.

N plant usage

- Back in the Figueira Brava cave , they also ate a variety of plants and fruits there, including pine nuts, which were picked from the pine trees and could be opened with the help of fire.

- In El Salt (Spain), fecal biomarkers were used for the first time to study the Neanderthal diet, thus detecting compounds related to both a carnivorous diet and an herbivorous diet

N used 61 different plants

- Neanderthals across the entire range probably consumed as many plant species as did modern humans

- 2016 Study: sources included plant remains (e.g., starch, pollen, phytoliths, and seeds) in soil and dental calculus, dental and tool wear, coprolites, and genetics, for Neanderthal's nutritional, medicinal, and ritual use of plants
- 61 different taxa from 26 different plant families; found at 17 different archaeological sites.

- Fairly efficient seasonal gatherers: Berries, greens, roots – plants with limited seasonal time frame (few weeks)

Gerhard P. Shipley and Kelly Kindscher, 2016

Broad N diet

- Neandertal diet was more diverse than generally acknowledged, and varied according to season and to different 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 in Levant at Kebara, Misliya, & Amud.

- Diet included small prey, such as wild rabbits, tortoise, birds, ducks

Ns were masters of processing and cooking plants

- Plants – date palms, vetch, water lily roots
- Vegetables: parsnip and burdock, mushrooms, tubers
- Species closely related to modern wheat and barley, grinding them, cooking them to make them palatable; starch from grass seeds that was boiled; N grindstones have been found
- Including bitter plants (flavor enhancing, medicinal?)
- Cooking implies containers

Plant diet

- Find preserved morsels of figs, olives, pistachios and date palm in caves across the Mediterranean and West Asia.

- In archaeological sediments and on stone tools, remnants of tubers (wild radish, water lily) and seeds (wild cereal, peas and lentils) have also been discovered.

- All this tells us that Neanderthals were very likely chowing down on cooked food more diverse than meat.

Neanderthals and early modern humans spiced up their foods with a variety of plants and seeds.

- Spicing up food: Analysis of the oldest charred food remains ever found show that jazzing up your dinner is a human habit dating back at least 70 Ka.

- 2022 study showed both Neanderthals and *Homo sapiens* had complex diets involving several steps of preparation and took effort with seasoning and using plants with bitter and sharp flavors.

Ceren Kabukcu, et al., 2022

Spicing food

- Earliest-prior known plant food remains in Southwest Asia were from a hunter-gatherer site in Jordan roughly dating to 14,400 years ago, reported in 2018.

- Examined food remains from two late Paleolithic sites, which cover a span of nearly 60,000 years, to look at the diets of early hunter-gatherers.

- Evidence was based on fragments of prepared plant foods (think burnt pieces of bread, patties, and porridge lumps) found in two caves. To the naked eye, or under a low-power microscope, they look like carbonized crumbs or chunks, with fragments of fused seeds.

Charred remains of Plants

- Kebara Cave, Israel: This recovered thousands of charred remains from nearly 50 plant species, a good number edible.

- Combined with other warmer sites like Amud and Gibraltar, the range of vegetable scraps in Neanderthals' hearths is impressive: nuts (acorn, pistachio, walnut, hazel and pine), fruits (palm, fig, date, wild olive and grape), tubers (wild radish, bulbous barley and nut grass) and seeds (grasses, peas and lentils).

- Even Eemian Northern Europe was full of options: at Neumark-Nord and Rabutz in Germany, charred hazelnuts, acorns, lime tree seeds and stones from sloe and cornel berries indicate that these may have been eaten.

Plant variability

- In contrast, teeth from Neanderthals like the Tabun 1 woman who lived in warmer and more lush landscapes had wear from chewing tough, abrasive stuff extremely likely to be plants.

- Krapina: the micro-wear from these Neanderthals most closely matches later prehistoric agricultural peoples who ate a lot of fibrous plants.

- And a clear picture of individual variability exists: woven through large-scale climate-connected patterns, Neanderthals from the same site and even the same layer aren't always identical, showing that not everyone was eating the same stuff.

Plants

- Out of some 40 sampled individuals so far, the prize winner for most diverse grot in their teeth is Shanidar 3, who we met earlier having been stabbed in the chest. Before this individual's death, date palms, plants from the pea/lentil/vetch family and unidentified roots/ tubers were all eaten.

- These latter also show up as residue samples on lithics from the same level, They include evidence of seeds, nuts, leafy plants/fruit, pea family plants, unidentified roots/ tubers, fungi and grasses.

- Grasses are especially intriguing because collecting and processing the seeds is very time-consuming. Seed starches from wild grass relatives of barley or wheat are also in some calculus samples including Shanidar 3.

Water Plants

- At Spy around 100 ka; definitely cooling weather, yet both Neanderthal adults had traces of grasses and, startlingly, waterlily root starches.

- These certainly imply that Neanderthals were actively foraging for plant foods, and were quite comfortable wading about in water.

- The individual from Spy with meaty-looking wear on her teeth had calculus DNA that matched rhino as well as wild sheep; sheep aren't really represented in the faunal assemblage, could this be food eaten before arriving at Spy?

Fuliginochronology: dating by soot analysis

- Pioneered at Mandrin Cave, south-east France, an ingenious method known as fuliginochronology- a method of dating based on the analysis of patterns of soot deposits
- Close inspection of odd black smudges within lumps of carbonate - a mineral deposit growing on walls and ceilings - revealed nanoscale stripes.
- Essentially tiny stratigraphies written in soot, they formed when the fires of Neanderthals in residence 'smoked' the roof and walls, leaving thin soot films. If nobody was there, plain carbonate sealed them over, then the cycle repeated and layers built up.
- Just like barcodes, they're unique, allowing pattern matching between different chunks within and between layers.

Soil layers reveal number of stays

- This sooty archive provides the only known means of counting the minimum number of times Neanderthals stayed during reasonably thick archaeological layers, and the results are startling.
- One 20 in.-thick level at Mandrin Cave covers at least eight periods of occupation.
- But the level below - of about equal thickness - represents up to 80 occupations.
- It's a stark warning that the appearance of layers can be deceptive, and a reminder that more than 99 per cent of all the assemblages archaeologists study aren't from single occupations but represent patterns of behavior over at least one if not many generations.

Cooking stews

- Roasting megafauna is an old caveman cliché but it's actually inefficient and fuel-hungry.

- Stews are better, cooking flesh while providing marrow-rich broths to sup. Then there's grease: study after study show that Neanderthals were consistently organizing hunting around marrow and fat: the animals they targeted, the extent of butchery and what was brought back.

- Moreover, the spongy, grease-rich ends of long bones are nearly always missing. Neanderthals methodically processed them. This would be either boiling to render the grease, or pulverizing them into an oily bone paste. All this matches modern hunter-gatherer cuisines in cooler climates, which are often similarly focused on extracting juicy fats.

Plant processing: ground, boiled

- What about plants? Grass seeds need soaking or charring and grinding, and though acorns are highly nutritious they also require soaking to remove bitter tannins.

- Calculus studies back this up: some at El Sidrón contained heat-cracked starches, and 40 per cent of the starches from the Shanidar 3 individual appeared to have been boiled.

5 Grindstones from 39 to 43 Ka: cereals into flour

- Italian-led study of five ancient grindstones and 1 pestle from around 39,000 to 43,000 years ago shows that milling for food dates back to the transitional period between Neanderthals and Homo sapiens.

- Pushes back by several thousand years the earliest evidence of plant processing and flour production

- The grindstones come from two Paleolithic sites some 1,000 km apart on the Tyrrhenian Sea side of the peninsula: Riparo Bombrini, in the Balzi Rossi archaeological area of Liguria, and Grotta di Castelcivita, at the foot of the Alburni Massif, in Campania.

M. Lippi et al., 2023

Neandertals ground starches

- Starch granules with different morphologies were found on the surface of grindstones at both sites, testifying to the use of different plants, including wild cereals, by humans who inhabited the areas at that time.

- These show certain technological knowledge and eating habits were widespread in both populations

Neandertal Grindstones

- The grindstone from the Mousterian levels of the Riparo Bombrini constitutes the oldest European examples of the processing and transformation of plant products in Europe and shows Neanderthals engaged in this practice.

- Transforming cereals into flour is an important innovation because it allowed Paleolithic foragers to store and transport food more easily.

- The recovery of starch grains associated with use-wear on Palaeolithic grinding tools offers proof of a specific technology for making flour among Pleistocene hunter-gatherers.

Grindstones

- Analyzed five grindstones from two Italian sites, Riparo Bombrini and Grotta di Castelcivita, both inhabited during a crucial phase spanning the decline of the Neanderthals and the establishment of Sapiens.

- The recovery of starch grains on a Mousterian grindstone at Bombrini suggests that the last Neanderthals not only consumed and processed plants but also made flour at 43–41 Ka.

- These new data suggest a profound knowledge of available plant resources in both human groups.

Flour production via grinding stones

- Grinding was of particular importance, offering new possibilities for the consumption of underground storage organs, fruits, and seeds. Flour is a high calorie food that can be used for varied carbohydrate-rich recipes such as gruel, biscuits etc.

- Flour production calls for a multistep procedure, from harvesting to cooking, to obtain a suitable, digestible, and high-energy food

- First direct evidence – starch grains in association with use-wear traces – of the use of this technology by Neanderthals

Cooking

- In general, when the type of plant is identifiable, it's often those with hard seeds that benefit from cooking.

- But how did a culture with no ceramic or metal containers do this? It's possible to boil liquid by putting red-hot cobbles into any vessel, but heat-cracked stones are very rare in Neanderthal sites.

Cooking

- However, there's more than one way to stew a mammoth.
- You can simply hold the container over a fire as long as the liquid level remains high. It could be a large skull, a naturally hollow stone or even a bark box, but one of the most obvious natural 'pots' would be the stomach or skin of the animal you've just killed.
- Another option is smoking. Calculus from two individuals at El Sidrón contained chemical markers for woodsmoke showing that some Neanderthals were living alongside shouldering fires, but there may be other explanations.

Storing food

- And preserving this way is perhaps more likely outside caves: another way to view the burning at Mauran is as involved with conserving meat and marrow.
- But the simplest way to store meat (and the hardest to detect archaeologically) is by making jerky - it requires only drying, and can be either kept or further processed by mashing up with fat and marrow into something like pemmican (dried beef & fat).
- At some exceptionally preserved sites there are microscopic traces of pulverized bone fragments and cooked fats around hearths that might reflect this kind of processing.
- Storing plant-based foods would require quite similar processes; leaves, grains or roots could be dried or ground.

Fermentation

- A few sites do have enigmatic stone blocks with abraded surfaces, and at La Quina some lithics have cracked grass starches that could relate to grinding or dry heating preparation.

- A whole other range of options exist with fermentation. By storing in low-oxygen conditions, meat, fat, fish or plants can all be allowed to go some way along the path to putrefaction yet still be edible.

- In a way this is like predigesting food, and it's especially useful for things such as brains, which are prone to going bad. Unlike cooking, this also preserves some key nutrients, especially vitamin C.

Fermentation

- In many ethnographic accounts fermented foods aren't emergency fallbacks or delicacies, but built into the normal diet.

- Keeping food underwater is one simple method, raising intriguing possibilities for places where we know animal carcasses were submerged.

- This includes horses at Schöningen or the mammoth at Lynford. Whatever the method, fermentation takes so long that if Neanderthals used it, it may well have been something they left and only returned to after travelling elsewhere.

Butchery practices

- Neanderthals carried forward their collective action from kill through methodical butchery to moving the richest parts onwards, sometimes delaying feasting over three or more stages of processing.

- Salzgitter-Lebenstedt shows this in practice. At least 44 and potentially twice that many reindeer were killed here in autumn, likely during different hunts as herds moved down from summer grazing in the Harz Mountains.

- Animals of all ages were skinned and filleted but only the fattest - prime-aged males ready for breeding - were more intensively butchered.

Butchery practices

- Neanderthals were after the richest parts of these chosen animals, going for marrow, fat and organs, but less so lean meat.

- Such an obviously selective pattern couldn't emerge in a selfish free-for-all, but from groups with common purpose. The same thing is mirrored hundreds of times over in other Neanderthal sites.

- At Schöningen marrow smashing was happening away from the butchered horse bodies.

2021: Neandertals & Starch: The evolution and changing ecology of the African hominid oral microbiome

- Analysis of 124 dental biofilm genomes from humans, Neanderthals and Late Pleistocene to present-day MHs, chimps, gorillas, & New World howler monkeys (89 well preserved dental calculus datasets consist of samples ranging from the present day up to 100 ka.)
- Reconstructing oral metagenomes from up to 100 thousand years ago, show that the microbial profiles of both Neanderthals and modern humans are highly similar, sharing functional adaptations in nutrient metabolism.
- These include an apparent Homo-specific acquisition of salivary amylase-binding (starch digestion) capability by oral streptococci, suggesting microbial coadaptation with host diet.

J. Fellows Yates, et al., 2021

Streptococci and Starch

- Streptococci: amylase-binding capability by oral streptococci.

- Found that amylase binding is an apparent *Homo*-specific trait, suggestive of microbial coadaptation to starch-rich diets early in human evolution.

- These *Streptococcus* groups are a general feature of Homo, suggesting that
  - starch-rich foods, possibly modified by cooking, first became important early in Homo evolution prior to the split between Neanderthal and modern human lineages more than 600 ka,
  - a finding with potential implications for the energetics of *Homo*-associated encephalization

Microbial archeology: Oral biome and starch digestion

- Study reconstructed the 100,000-year-old oral microbiome of a Neanderthal from Pešturina Cave in Serbia

- Identified a core group of 10 bacterial species within the African hominin primate oral microbiome that are also shared with howler monkeys.

- Identified 27 genus-level members of the *Homo* core oral microbiome, and these include many well-known and clinically relevant species, such as *Streptococcus* and the pathogens *Porphyromonas gingivalis*, *Tannerella forsythia*, and *Treponema denticola*.

Microbial archeology

- Found major taxonomic and functional differences between the oral microbiomes of *Homo* and chimpanzees but a high degree of similarity between Neanderthals and modern humans, including a *Homo*-specific acquisition of starch digestion capability in oral *Streptococcus* bacteria.

- Found that ancient African sapiens living in Ice Age Europe shared some bacterial strains with Neanderthals.

- Because the oral microbiome is typically acquired in early childhood from caregivers, this sharing may reflect earlier human-Neanderthal pairings and child rearing.

Oral biome: starch by 600 Ka in MHs and Ns

- Found that Neanderthal-like bacterial strains were no longer found in humans after 14,000 years ago, a period during which there was substantial population turnover in Europe at the end of the last Ice Age.

- Found that a subgroup of *Streptococcus* bacteria present in both modern humans and Neanderthals appears to have specially adapted to consume starch early in *Homo* evolution.

- This suggests that starchy foods became important in the human diet prior to the split between Neanderthal and modern human lineages more than 600,000 years ago.

Homo-Specific Shifts in Oral Biofilm Are Linked to Dietary Starch Availability

- The biggest surprise from the study was the presence of particular strains of oral bacteria that are specially adapted to break down starch. These strains, which are members of the genus *Streptococcus*, have a unique ability to capture starch-digesting enzymes from human saliva, which they then use to feed themselves.
-
- This bacteria is only active when starch is part of the regular diet.

- Both the Neanderthals and the ancient humans had these starch-adapted strains in their dental plaque while most of the primates, who eat exclusively on non-starchy plant parts, like fruits, stems, and leaves, had almost no streptococci that could break down starch.

Starch

- Oral microbiomes of Neanderthals and today's humans were almost indistinguishable.
- The findings also push back on the idea that Neanderthals were just top carnivores, given that the "brain requires glucose as a nutrient source and meat alone is not a sufficient source."
- Reinforces view that Neanderthals diets were the same as *H. sapiens:* starch-rich and cooked.

Starch

- For human ancestors to efficiently grow a bigger brain, they needed energy dense foods containing glucose. Meat is not a good source of glucose. The starchy plants are an excellent source of glucose

- Dental plaque of 124 individuals. The one Neanderthal microbiome, dated to 100 Ka, is the oldest oral microbiome genome reconstructed to date.

- The microbiome of bacteria in the mouths of preagricultural humans and Neanderthals strongly resembled each other.

Starch

- Humans and Neanderthals harbored an unusual group of *Streptococcus* bacteria in their mouths. These microbes had a special ability to bind to an abundant enzyme in human saliva called amylase, which frees sugars from starchy foods.

- The presence of the strep bacteria that consume sugar on the teeth of Neanderthals and ancient modern humans, but not chimps, shows they were eating more starchy foods

Neanderthals carbo loaded, helping grow their big brains

- Shows that Ns ate so many roots, nuts, or other starchy foods that they dramatically altered the type of bacteria in their mouths.

- MHs & Ns had adapted to eating lots of starch by at least 600,000 years ago—about the same time as they needed more sugars to fuel a big expansion of their brains.

- And they had already adapted to eating more starchy plants long before the invention of agriculture 10,000 years ago.

The Gathering in Hunting and Gathering

- Although earlier studies found evidence that Neanderthals ate grasses and tubers and cooked barley, the new study indicates they ate so much starch that it dramatically altered the composition of their oral microbiomes.

- Because the amylase enzyme is much more efficient at digesting cooked rather than raw starch, the finding also suggests cooking, too, was common by 600,000 years ago.

- Reveals how much Ns depended on plants.

N diet

- Therefore, although they were predominantly hunters, it is observed that the exploitation of plants was a very widespread and entrenched Neanderthal subsistence strategy.

- The Neanderthal diet differed little across time and space, both in the exploitation of plant and animal foods.

- The consumption of vegetables seems a characteristic of a widespread and stable N dietary niche.

++ Homes & Hearths

Ns were fundamentally nomadic

- For all the spectacular, intimate details we have about individual sites, Neanderthals were fundamentally nomadic.

- Their world was the land, and moving in it was their life. Like everything else they did, this was far from random.

- Sites were not simply destinations, but intersections, nodes within networks stretching hundreds of kilometers. The blood-stained, fur-tufted muds at a kill site were nevertheless linked to caves or rockshelters through the animal bodies taken there to be further divided.

- Hunting moving animals was their life. Therefore movement was routine.

Neandertal social group organization

- Fluidity of N group size: never lived in large densities; no villages; but occasional gatherings, i.e. Neumark-Nord

- Sites: used a variety of different functional sites; home, killing, animal processing sites.

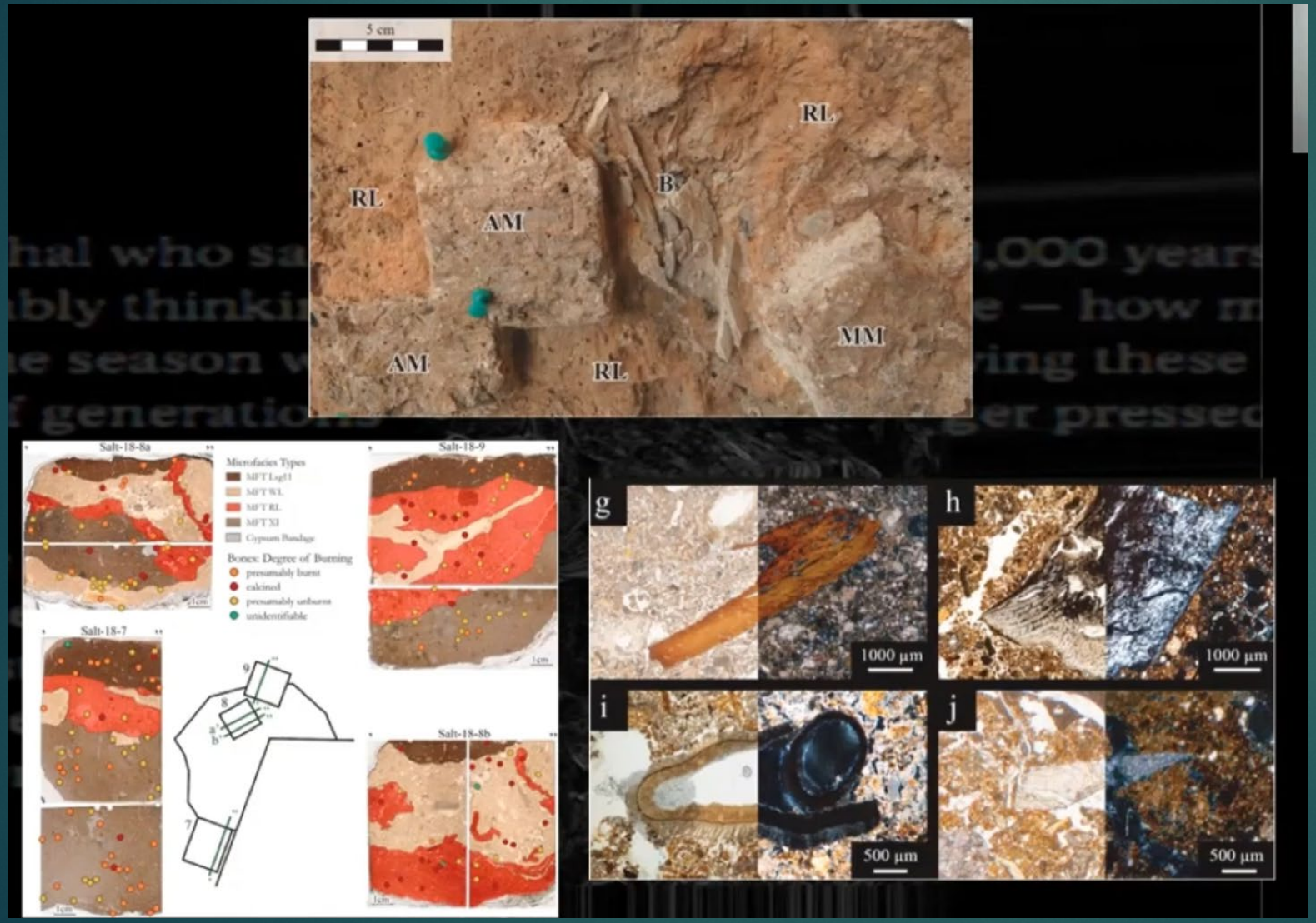
- Some were repeatedly visited home sites = 60-70 meters square, i. e. Abric Romani, Spain. It was inhabited on and off for at least 70,000 years, until about 40,000 years ago = 3 D analysis of 60 layers of hearths – horse, rhino bones

- Other sites: a single hearth - short visit

Home is where the Hearth is: N fire use

- Core of N life – N living spaces were totally unlike hyena dens; N spaces were intentionally designed; centered on fire places, hearths
- N did not do stone encircled fireplaces
- Can now do microlayer analysis & experimental analysis – thin sections; bone changes color with heat level; can identify different historical temperatures; different patterns of fire usage
- Can now identify hearth base, ash; ash dumps in other areas
- Ns used manganese dioxide as firestarter

Modern hearth analysis



Thin slice analysis = length of occupation

Microscopic analysis = was ash removed, fat analysis

Hearths

- Hearths at center of N life – complex division & use of space

- New archeological ability to micro evaluate hearths – micro layers; use of water, black layer is oldest, ash above; sediment sample thin sections – periods of use of that fire = layers; ash dumps elsewhere; rubbish middens; bone will change color at diff temperatures; a low fire for sleeping; vs bigger hotter for cooking; chemical analysis- animal fat; patterns of choice – creating, placing, fueling and maintaining fire

- Burning pine in north; different tree species in south; 1 site burned brown coal/lignite despite trees; also used it in warmer periods

Repeat use of same hearth at Kebara, 70 Ka

N and hearths

- Despite advances in identifying hearths, Neanderthal pyrotechnical skills remain hotly contested.

- Nobody today denies they used fire (as hominins have for over a million years), and hearths undeniably become more common through the course of the Middle Palaeolithic.

- From about 120 Ka fire was obviously part of everyday life. But the question of whether Neanderthals simply scavenged it or could produce it is, perhaps surprisingly, still debated.

- The problem is that some sites exist with relatively rich archaeology but the presence of fire is barely detectable.

N fire: outside the cave?

- What's more, the most often cited cases are Roc de Marsal and Pech de l'Azé IV, south-west France, where Quina layers really stick out as lacking hearths or even much charcoal, despite their presence in earlier periods. Given that the layers date to the MIS 4 glacial, the apparent lack of fire right when it was coldest is puzzling.

- There's another explanation for all this. Maybe Neanderthals were perfectly able to make fire at will, but simply changed how and where they used it according to different ways of living. If during the Quina phases they tended to make hearths just outside caves, there would be no trace inside except for a bit of charcoal and a few burned remains: exactly what's found.

New Discoveries of 2016

- 2016: 40 N sites have manganese dioxide. Neanderthals at Pech-de-l'Azé I used manganese dioxide in fire-making and produced fire on demand.

- Manganese dioxide reduces wood's auto-ignition temperature and substantially increases the rate of combustion

- Manganese dioxide is a deep-black-colored mineral naturally found in small concentrations at many sites. But some locales have exceptionally large amounts, for example up to 2.2 lbs worth across several layers at Pech de l'Azé I.

- It's also a great fire accelerant, especially when powdered, making wood catch alight faster and burn more efficiently. As yet there's no direct evidence that Neanderthals did use manganese this way, but it's an intriguing possibility.

Peter J. Heyes, et al., Nature, 2016

Fire starting

- Whether or not fire-on-demand was universal among all Neanderthals, birch tar technology strongly argues this was the case for many populations from at least 300 ka.

- Precisely what their blaze-starting skills consisted of is less certain, but being curious, inventive and surrounded by knapping, at least some Neanderthals must have noticed how struck flint gets hot and creates natural sparks. Bifaces found with strike marks.

Fire

- Once alight, Neanderthals were interested in carefully managing their fires. The majority appear like simple campfires: flat, circular deposits of charred material and ash, functioning well enough without surrounding stones.

- But sometimes Neanderthals invested in constructing hearth features. At Abric Romani and Roca dels Bous, another rocksheiter not far away, they chose to kindle fires within natural hollows, improving the heat retention.

- In some cases they deepened these first, and most impressively in Level O at Abric Romani Neanderthals were controlling airflow into pit hearths by digging small trenches

Fire

- It's probably no coincidence that in well-preserved sites like this, there's also more evidence that stone blocks or cobbles were placed by fires, probably helping to avoid draughts or direct heat.

- Being very abundant, pine is the most commonly burned wood, but sometimes it seems to have been selected despite other species being available.

- Naturally fallen or dead wood being the most common fuel, rather than freshly felled green wood. It's easier to collect, burns better - especially if resin-rich, like pine - and especially suits cooking.

Fire

- Used coal in some places. At Les Caneletes used it for centuries or millennia.
- Sometimes burned butchery waste, it's likely they noticed that bone could make the flames last longer.
- Across many hunter-gatherer societies there's a spectrum in how fire is used: big open-air blazes for protection, pit fires for roasting, small cooking fires, hide-smoking fires, sleeping hearths for warmth, even anti-insect 'smudge' (smoldering) fires. Neanderthal sites show a strikingly close match to the variety in ethnographic data.
- Some hearths only burnt below 300°C, while others blazed at over 750°C. Some of the lower-temperature examples look a lot like ethnographic sleeping fires: small and located close to back walls, their heat reflecting off stone to keep slumbering Neanderthals cozy.

Fire uses

- Burning leafy branches would certainly have boosted the hearth's smokiness: perfect for curing hides.

- Other fire uses: can drive animals and even manage the environment, since burning opens up vegetation, forcing new growth that's a magnet for herbivores.

Forest management via fire at Neumark-Nord

- Eemian forest-dwelling Neanderthals: In the Neumark-Nord sediments, just as Neanderthal lithics become visible, there's a sharp spike in charcoal particles: 10 times background levels. The pollen shows more sun-loving species too, like blackthorn and hazel; something was opening up the forest.

- What's difficult to tell is:
  - whether this was natural burning creating a landscape attractive to Neanderthals, or
  - if they were the fire starters.
  - It's clear, however, that there's a connection, since the pattern lasts for 2 to 3 millennia, then as their archaeology disappears, so the forest begins closing in again.

N hearths

- Hearths are both chronological and spatial anchors in our understanding of how Neanderthals used their sites.
- They were the nuclei around which life happened, with everyday tasks made manifest as artefacts.
- Hearth numbers and placements, number of bones, refittings, can indicate length of visit to a site, number of individuals
- N raked out ashes between uses

N use of space

- Claims that Neanderthal use of space was thoughtless or random - equal to that of hyenas - are now truly obsolete.

- On the contrary, Ns were among the first hominins to create complex, intentional divisions of space, with a surprisingly familiar layout. Hearths are the stable cores of N life.

- Mousterian sites like La Ferrassie (France), Abric Romaní (Spain), and Tor Faraj (Jordan) reveal complex patterns of space use, including distinct areas for tool making, plant and animal processing, bone and antler work, hearth areas, bedding areas, and other activity areas.

N use of space

- Evidence of ground was cleaned in-between phases when mats were used, perhaps at the start of occupations.
- Used hide floor mats
- Show that across the rocksheiter at Abric Romani, there was as much diversity in floors as seen in Neolithic houses.

Arranged living spaces

- Trampled layers were common, but not universal across the whole site surface.

- Areas with richer spreads of artefacts had evidence that pointed to more intensive use, and the converse was also true. This means that Neanderthals were using space in the same way over the long term.

- It was even possible to see how natural architecture such as large stalagmites and built features including alignments of limestone rocks seemed to define boundaries between 'cleaner' and messier areas.

Ns took out the garbage

- Far from being slovenly, Neanderthals were regularly disposing of their rubbish.
- Rubbish was most likely scraped up from inside and around fires, then dumped some distance away.
- Other rubbish samples were quite distinctive: masses of mostly unburned, crushed bone and animal fats, plus coprolite (fossilized dung) fragments (species unclear).
- Deposits surrounding particular hearths, and likely reflect Neanderthals tidying up especially messy butchery waste and other waste. Most interesting, this cleaning was systematic: some dump areas were multi-layered, clearly having been used repeatedly.
- Intentionally burned butchery and food debris; external ash dumps at some sites

N cleanups

- The most impressive evidence of Neanderthal housekeeping comes from Kebara. Along with a deep sequence of stacked hearths, it's famous for huge middens: trash heaps. Against the back wall was a pile of raked-out ash so large and thick it had to have built up over a long time period.

- It looks like Neanderthals had first made a fire when arriving, then swept the floor and burned the waste, which included old feces mixed with animal dung and plant material.

- This feels like a 'deep clean' on moving into a home, but there's also evidence from Abric Romani that bodily waste was routinely incinerated along with grass and potentially moss: most likely old bedding.

Engineered environments

- In general, Ns spurned the depths of caves as living spaces, staying close to the cave mouths. It is lighter there, but also draughtier.

- 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 60,000-year-old site near Poitiers in France, post holes preserved in sediment point to some kind of circular wooden structure, perhaps covered with skins or brush.

Campsite living at La Folie

- Neanderthals also wanted warmth and comfort when sleeping under the stars.

- Miraculously well-preserved campsite at the site of La Folie. Somewhere between 84 and 72 ka, Neanderthals stayed by a river, which shortly after flooded and left behind several meters of fine silts ensuring what lay beneath was protected.

- As well as hearths and lithic scatters, dark stains about a hand's breadth thick turned out to be decayed plant matter. Considering their thickness and location in a zone devoid of artefacts, the simplest interpretation is that this was a sleeping place.

Reconstruction of La Folie, France. The site features a circle of postholes and traces of activity within, showing that its Neanderthal inhabitants used the interior space in different ways.

La Folie: N built shelter

- Surrounding all of the archaeological features was a roughly circular series of small, slanted pits, each ringed by limestone blocks. They contained traces of organic material and had compacted walls, and were the first clear case of Neanderthal constructions.

- By piecing all the evidence together, it seems that large wooden poles had been rammed into the ground, then secured with stone blocks. It's even possible to see how the stones collapsed inwards slightly when the poles were removed (or rotted).

- This was clearly a built living space, providing both shelter - probably using hides lashed to the poles - and an enclosed 'home from home'. The area is so large that it wasn't likely to be roofed, but there was probably one main entrance marked by a gap in the circle, with a hearth adjacent.

La Folie campsite shelter

- Most interestingly, refitting shows that artefacts moved between different zones inside the structure: even during a relatively short stay, Neanderthals were dividing up space.

- Knapping was happening outside and around the inner edges, while the central area seems to have been for processing wood, vegetable matter and skins. And just like in a cave, the bedding was directly opposite the entrance, up against whatever barrier was used: the farthest point from danger.

- In the richest area four sizeable sandstone blocks were found. They must have been hauled in from nearby deposits, and were most likely useful surfaces; in other words, camp tables or chairs.

Abric Romani: 17 layers

- One level, dated to 58 Ka, contains more than 40 hearths. You can still smell the roasted deer.
- At each of the 17 levels, the arrangement of hearths is the same.
- There are small ones 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 and rested in that gap. Fossilized plant remains found there, possibly traces of grass they brought in for bedding.
- The larger hearths would have been reserved for daytime activities, including knapping of tools and processing the spoils of hunting, and may have been constructed specially for each function.

Abric Romani: 17 layers

- A third comprises a shallow depression in the ground that could have been filled with water into which hot stones were dropped to boil it for cooking, or to generate steam. It seems that Neanderthals were quite sophisticated cooks.

- Placed stone blocks or other large objects are known elsewhere. At Abric Romani, hearths have limestone blocks arranged around them, some acting as anvils for bone processing.

N living spaces

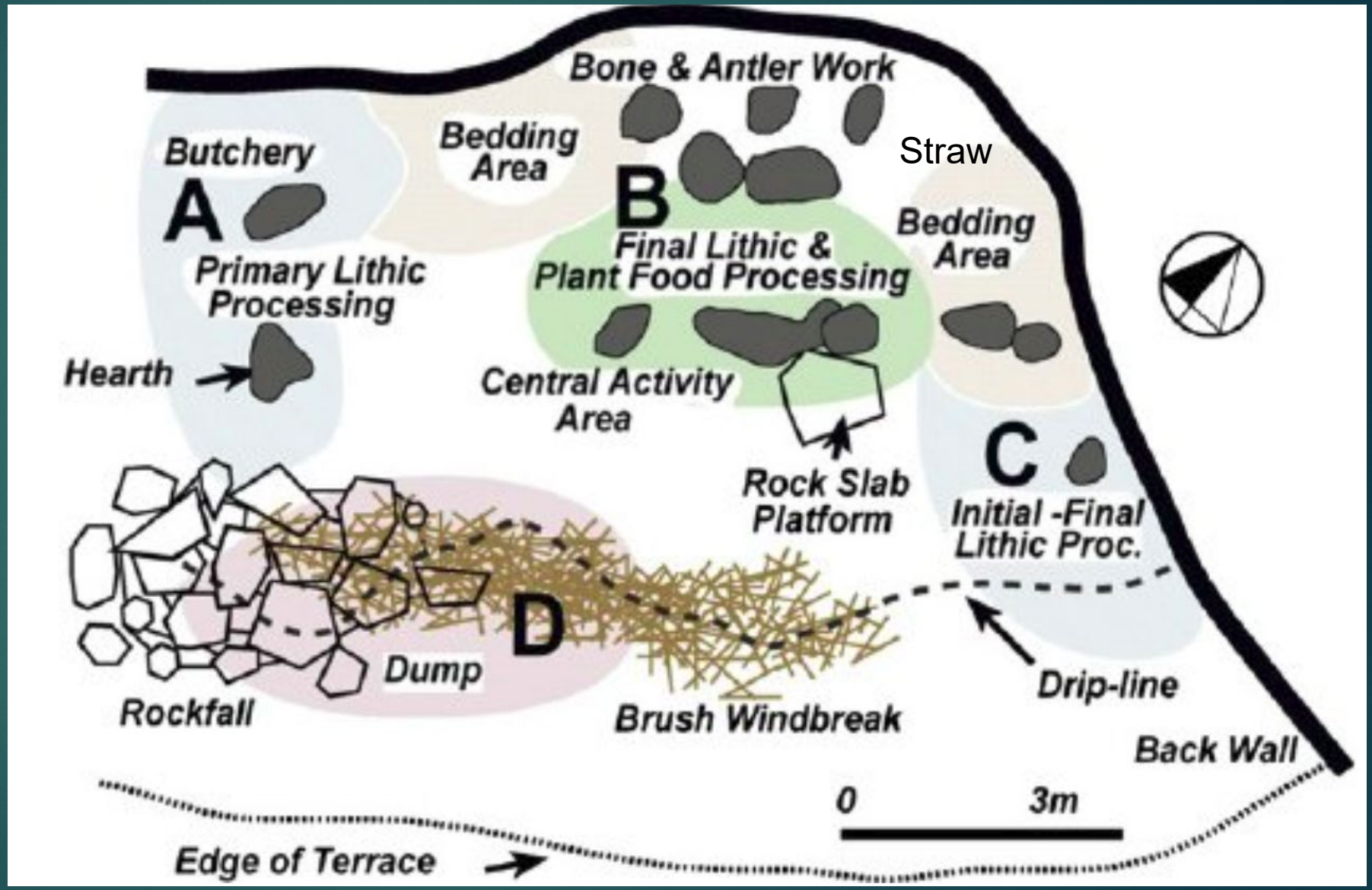
- Early N living spaces are being divided into separate activity areas right from the beginning.

- Rocks and animal bones were used to demarcate those proto-rooms, and though organic materials such as wood or hide have generally not survived, the rock alignments could have supported partitions made of these.
- Central to all of this was fire – the hearth – that structured the space, and this is seen most clearly at a Neanderthal rock shelter near Barcelona in Spain, known as the Abric Romaní.

N Site utilization

Tor Faraj, Jordan: N functionally divided their living spaces

Same as MSA sites in Africa



Identifying activity areas in a neanderthal hunting camp (the Navalmaíllo Rock Shelter, Spain) via spatial analysis

- Little is known about the distribution patterns at sites identified as hunting camps, i.e., places occupied over multiple short periods for the capture of animals later transported to a base camp.

- The present work examines a Neanderthal hunting camp (the Navalmaíllo Rock Shelter in Pinilla del Valle, Madrid, Spain) to determine whether different activities were undertaken in different areas of the site.

Navalmaíllo Rock Shelter

- A spatial pattern was detected with a main cluster of materials (lithic tools, faunal remains, and coprolites) clearly related to the presence of nearby hearths—the backbone of the utilized space.

- This main cluster appears to have been related to collaborative and repetitive activities undertaken by the hunting parties that used the site.

- Spatial analysis also detected a small, isolated area perhaps related to carcasses processing at some point in time and another slightly altered by water.

A neanderthal hunting camp

- The site was used in the same way in its different occupations. The activities undertaken in the area of this cluster were related to the presence of hearths.

- A small area of activity in the north of the site would appear to be an area associated with carcass processing or perhaps a disposal area.

- Carnivores also entered the site, as revealed by tooth marks on some faunal remains and by the presence of coprolites.

What Ns carried

- What did Ns carry on their nomadic hunting trips?

- Clothing is an obvious answer, but skin or leather bags also existed. We know from the archaeology that Neanderthals carried a lot of things between places: not only stone cores and tools, but birch tar, food, spears, digging sticks and, of course, babies.

- That implies they had some kind of container or means to transport gear and, as well as skin or leather, bags might have been made from other materials, perhaps plant fibers, which there is now some evidence for.

Use of 3 different sites for different activities

- Neanderthals routinely separated activities between different points in the landscape.
- They didn't set up a new camp each time they reached a rock source or opened up a steaming carcass.
- Initial knapping locales - where stone was found, tested and prepared - and animal kill sites are identifiable precisely because they lack the later-stage lithic products and the richest parts of hunted animals.
- Records of systematic butchery sites: For big game, the least fatty or meaty parts are all that remains: horse hips and still-articulated backbones, heavy woolly rhino jaws, mammoth teeth. For smaller species, heads and whole joints are also missing.

Different sites

- Where did the good stuff go?
- In many places we can make out an intermediate type of site, essentially hunting camps, where Neanderthals further processed either partial carcasses or selected joints.
- Some hunting camps like Les Pradelles were used over and over, hinting that they were connected to particular kill sites.
- Neanderthals returned many times to some sites, like Schöningen and Quindeux.

No permanent destinations

- The final destination for food - either directly from kill sites or coming via hunting camps - was to 'central locations', or more prosaically, homes.

- This includes big sites like Abric Romani, where masses of third-stage processing happened involving a lot of bone smashing and some cooking, plus presumably eating and sleeping. The richness of the archaeology, combined with concurrent use of different parts of the site following quite specific patterns of activity, is very good evidence that Neanderthals were spending more than a day at a time there.

- There's no evidence anywhere for truly long-term settlement, on the order of many months.

Always on the move – a never-ending odyssey with no Ithaca

- Even large open-air sites like La Folie with clear activity zones obviously weren't lived in for months.
- And at the other end of the spectrum are locales such as Abric del Pastor, visited very briefly and by no more than a handful of individuals at a time.
- Some were short stopping places, others homes for longer periods, but all were points on a cycle of movement.
- They usually stayed for short periods at any site.

Repetitive visiting of some sites

- Repetitive visiting: For sites where the length of occupation phases is measurable, it's something up to a few centuries.

- Successive generations grew up in these caves and rockshelters following the same routines and traditions, which became physically part of the site itself through hearths, waste dumps and well-trodden floors.

- But then things would change and nobody visited, sometimes for 1,000 years or more. Either groups relocated to entirely different areas, or the population itself died out.

Rock type info

- Rock types give you information about N travels.
- The more distant the rock type, the fewer artefacts made from it there will be; typically less than 10 per cent will come from far-flung sources over 40 mi. away.
- The very longest distances - more than 190 mi. - are found for the purest silica rock of all, obsidian, but even decent flint was sometimes carried over 60 mi.

N knowledge of geology

- Overall, what we see in Neanderthals matches how recent hunter-gatherers organized their use of stone in the landscape.

- Personal travel gear is selected based on multiple factors: the expected activities, the amount of travelling and, crucially, what kind of stone would be available en route.

- This last point is key, because it is yet more evidence of Neanderthals possessing detailed knowledge of geological resources, and thinking ahead.

N knowledge of geology

- Original estimates of N range size: Since the distances their artefacts moved were the only direct measure of mobility, they ended up being used as a proxy for range size.

- Because at any site almost everything came from within 40 miles. prehistorians proposed that Neanderthals mostly moved around in quite small areas; essentially about 40 mi. square.

Incorrect theory of ranges

- Range size isn't just about land, but about people.
- If Neanderthals lived in small areas - maybe just across a couple of valleys - then they'd rarely meet other groups. Moreover, without large territories and extended social relations, it was theorized that Neanderthals wouldn't need material expressions of shared cultural values, which can help maintain networks.
- H. sapiens in the Upper Palaeolithic were typified as more numerous, and their distances are greater. Predictably, this was presented as reflecting larger territories and stronger social networks.
- These earlier theories were wrong.

N range

- The real proof that Neanderthals cannot have been limited to geographically small ranges comes from the much farther-travelled artefacts sourced beyond 40 mi., and sometimes well over 60 mi. They were already there in the early Middle Palaeolithic. Fundamentally, they're the best data we have about the true extent of the landscapes Neanderthals moved over.

- But what do these distances mean in terms of mobility? Today's best ultra-marathoners can cover 620 mi. in a week, and even 'normal' athletes can manage up to 120 mi. in 24 hours. While Neanderthal bones bear witness to extremely physical lives, and they were probably more efficient striders than us, long-distance running was not a forte.

- Factoring that in together with shorter legs making them up to 10 per cent slower and the impact of realistic terrain, a day's trek drops well below 60 mi.

N range

- Add in the varying travel pace for entire groups including youngsters and those with added burdens, whether hauling stuff or simply from age, and it's obvious that artefacts from beyond 50 to 60 mi. cannot have been directly sourced.

- Furthermore, truly immense stone transport distances exist. For example at Mezmaiskaya, not only are there lithics from multiple points across a region extending out around 60 mi., but obsidian was also arriving from 120 to 150 mi. to the south-east, and flint from some 190 mi. north-west. That's at the extreme end of the spectrum, but transfers over 60 mi. are known throughout the Neanderthal world.

- Ns had impressive knowledge of resources across an enormous territory, and probably mentally scheduled when and where to be.

Isotope study in Portugal: Ns vs MHs patterns

- Through the study of isotopes in the dental crown, it has been possible to determine the diet of humans who lived in the Almonda cave system (Portugal) in the Middle Paleolithic and Magdalenian periods.

- About 100 ka ago, Neanderthals ate goats in summer and larger fauna in winter (horse, deer, rhinoceros), which they searched over long distances, covering about 600 km2.

- Magdalenian MHs moved seasonally, ate rabbits, deer, ibex, and freshwater fish, and covered a smaller territory (about 300 km2), possibly because the increase in population density in the Upper Paleolithic could reduce the available territory.

N group size = 10-20 people

- Somewhere between 4 to 10 humans can fit around a hearth, which are usually spaced between 1.6 and 2.2 yd apart. So synchronous activity areas, multiple fires and especially rubbish dumps in places like Abric Romani or La Folie point to between 10 and 20 individuals. In other words, the size of a typical HG band.

- Population density was probably lower than one individual per 0.4 square mile based on comparable densities of hunter-gatherers from similar environments.

Genetic isolation?

- Despite being very sparsely scattered across the land, not all Neanderthals were genetically inbred, and so the question is how they maintained DNA diversity.

- At least some individuals or whole groups crossed even mighty rivers like the Rhone, and high mountain passes in the Massif Central and Pyrenees.

- Perhaps some populations that became genetically isolated, like those in Iberia and the Altai, lived in rich environments without large, migratory game herds as an incentive to travel outside their normal range.

Genetic isolation?

- Fundamentally, there's no solid reason to assume all Neanderthals disliked strangers, they were open to intimate relations with other sorts of hominins.

- But what's interesting too is that over time, very long-distance transfers become more common.

- Something was changing in the way Neanderthals lived in the landscape after 150 ka, but working out what caused it is one of the hardest remaining problems.

Not stuck to 1 valley

- But by comparing the strontium values in teeth to the geology where they were found, it's possible to see movement from different geological areas.
- Entire N lives weren't spent in single valleys.
- The first sample was an adult from Lakonis, Greece, who lived for part of their childhood somewhere up to 12 mi. away. A more distant measure came from an Eemian tooth at the site of Moula-Guercy, France, pointing to a move from geology at least 30 mi. to the south, with matching lithics too.
- These measures may be underestimates.

N travels

- Even if the isotopes haven't yet given abundant evidence for Neanderthals travelling over hundreds of kilometers, when lithics are also considered it's inescapable something moved over very considerable distances, and in quite varied ways.

- For the stone sourcing, there are only two possibilities:
  - Neanderthals themselves were carrying artefacts, or
  - objects were being exchanged between groups from different regions.

- Either scenario would raise many questions about social organization, and imply some kind of territorial concept must be part of the answer.

HG travels

- Among recent hunter-gatherers, the size of regularly traversed land varies drastically, from 100 to 7700 mi.2.

- Huge ecological productivity in the tropics means people can get what they need from smaller areas of land, but the ranges for Neanderthals in higher latitudes were more likely towards the upper end.

N territory

- Is it possible to define a particular ancient territory?

- High-quality flint was being carried sometimes up to 60 mi., largely eastwards along the Lot and Dordogne valleys. But far less was being moved north or south, and equally stone from the north is only transferred a few tens of kilometers southwards, with virtually no overlap between the two regions.

- Dramatic changes after 150 ka - from full interglacial to deep glacial and everything in-between - were very likely part of the reason for Neanderthals' growing flexibility, as well as specialization.

Cultural transfer and population density

- Conversely, cultural traits tend to evaporate in small groups, getting lost by mere chance when bearers of techniques and traditions die without passing them on to the next generation – a process analogous to the loss of alleles through genetic drift.

- If the small groups are widely separated, the chances of picking up those lost techniques and traditions from neighboring groups are correspondingly reduced.

- Both mathematical modeling and ethnographic data lead us to expect that rates of both invention and preservation of cultural traits in human groups ought to vary directly with population density.

N had extended networks

- Rebecca Wragg-Sykes, 2020: Following recent evidence from the archaeological record, the European Late Middle Palaeolithic and therefore the Neanderthals must be considered as cognitively equivalent to early anatomically modern humans of the Middle Stone Age

- The extension of raw material transfers in the LMP must reflect extensive movements of individuals, exchange, or both and, together with evidence of symbolic artefacts probably utilized to communicate cultural affiliation, indicates links within ‘extended networks’ across social landscapes.

- The LMP therefore features characteristics that conflict with a model for Neanderthals of social networks restricted in scale to very local groups.

Stone technology as cultural group signs

- The contemporary MTA and Micoquian stone tool complexes of Europe represent distinct cultures of Neanderthals that were living within subpopulations internally connected through these extended networks.

- Material culture, in the form of distinctive artefacts capable of signaling identity facilitated such long-distance relations within stone complexes, maintaining their internal homogeneity but also creating boundaries when individuals preferred to stay within culturally similar groups.

Last Ns

- The material residues of the LMP in the form of discarded artefacts and living sites formed the first encultured landscapes, delineated by different cultural traditions, recognizable as such to Neanderthals.

- Yet so far we've sampled fewer than 40 complete Neanderthals – and have only 3 high-coverage genomes – from among the thousands of skeletal parts in museums, representing hundreds of individuals.

- What's clearer than ever before, though, is that the 'end' of the Neanderthals was a process involving bodily and probably cultural assimilation.

Social networks

- Social networks are required for human survival and reproduction: they allow the sharing of information, knowledge and resources, as well as aiding cooperation, for example in hunting and for collective childcare.

- An individual with a larger social network should be better able to cope with local resource failure than someone with a smaller network, due to the more numerous independent sources of help available to them.

- Furthermore, a larger network will provide more opportunities for mating and shared childrearing. Similarly, larger networks might be better able to conserve cultural knowledge.

Using obsidian transfer distances to explore social network maintenance in late Pleistocene hunter-gatherers

- Obsidian transfer distances: Within both the (sub)tropical African and Subarctic biomes, the maximum obsidian transfer distances for Pleistocene modern humans (~200 km and ~400 km respectively).

- Raw material transfer distances between archaeological sites and their geological source that exceed typical hunter-gatherer foraging radii have been taken to represent interaction between social groups

- Neanderthal obsidian transfer distances (300 km) indicate that although Neanderthal home ranges are larger than those of low latitude hominins, Neanderthals travelled shorter distances than modern humans living at the same high latitudes

Eiluned Pearce and Theodora Moutsiou, 2014

Another adhesive = animal hides

- Why did Neanderthals need substantial amounts of hides?

- One possibility hardly ever discussed is that boiling hide together with bones, tendons and hooves is a well-known method for making glue.

- The released collagen makes an adhesive that's been exploited since medieval times as not only strong, but good for delicate work, since it's self-sticking, shrinks as it dries and can be remolded by heating like birch tar.

Animal hides = N Clothing

- The obvious answer is of course clothing. Many reconstructions show Neanderthals draped in the barest tattered skins, implying they only wore loose capes.

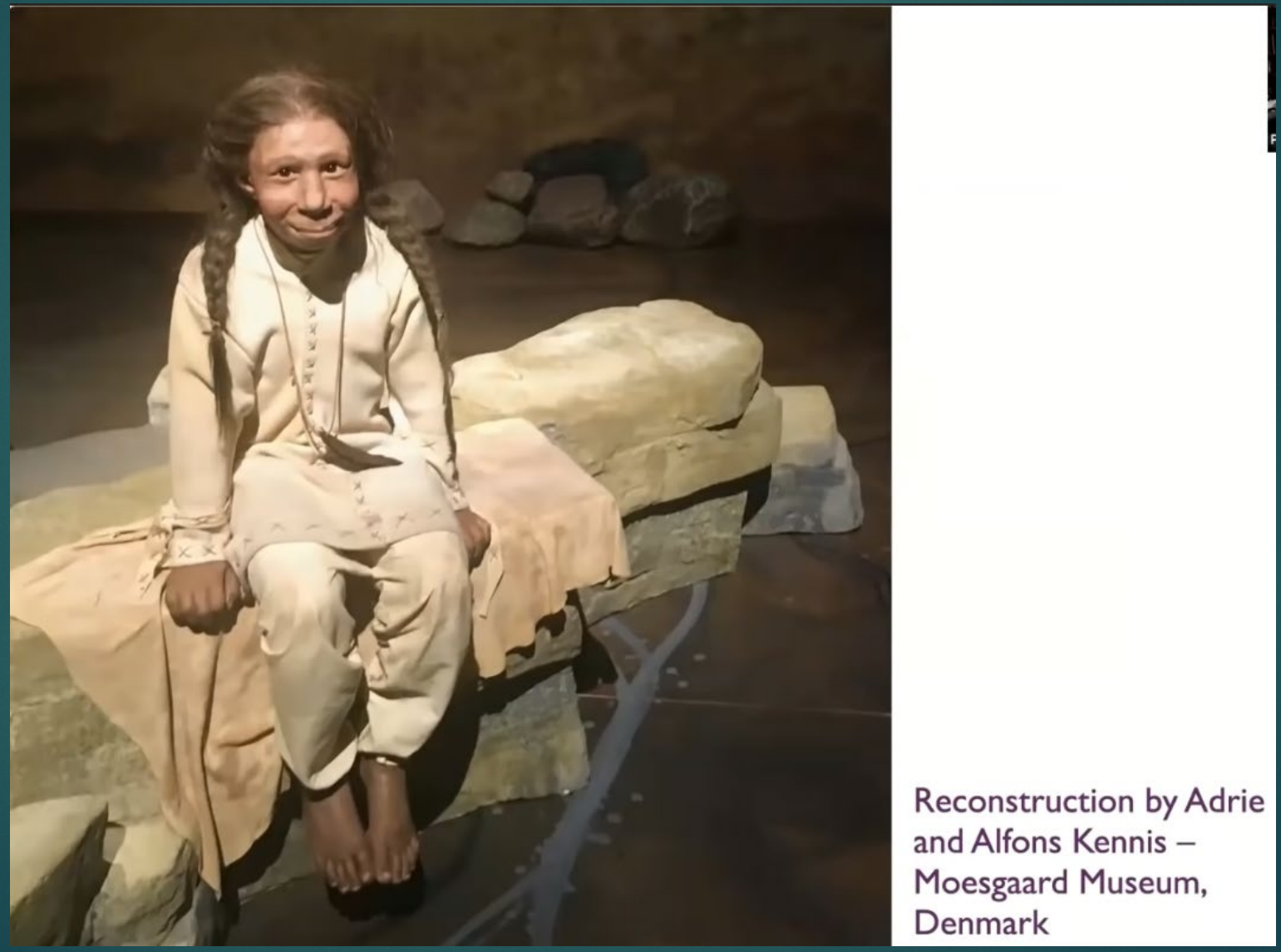
- But thermal modelling shows that unless they were super-fat and thickly furred like bears, fitted clothing of some sort was vital.

- Well-insulated clothing: Neanderthals could take their pick from reindeer, bison, bear or others. Moreover, eyed needles aren't necessary for tailored clothing, as hides can be pierced with stone, bone or even wooden awls that push thread through instead of pulling.

Atelier Manufaktur

Ns wore clothes. Neanderthals had originally physically adapted to periglacial conditions, but furs would have been essential for survival. They must have been adept at curing, cutting, and sewing pelts for warm clothing and footwear.

No evidence of clothes, but given climate…



Reconstruction by Adrie and Alfons Kennis – Moesgaard Museum, Denmark

Shoes

- What about shoes?

- There's no evidence of hard-soled shoes, but softer foot coverings wouldn't leave a trace. Production is relatively simple too: a deer's hind leg provides a readymade tube to slide onto the foot; if done while wet, it will shrink-wrap as it dries.

- What makes the production of clothing especially likely beyond Neanderthals' physiology is the multiple lines of evidence for massive processing to soften and stretch hides, notably seen in their clamping and probably also chewing tooth wear.

- It matches exactly that seen in hunter-gatherers who do this with skins and also sinews, and what's more is almost identical to early *H. sapiens* samples

Clothing

- So they wore clothes, and probably Quina Neanderthals in particular. But what kind of quantities of hides are we talking?

- Based on a fairly simple outfit with an upper-body garment and leggings or skirt, each adult would need at least five large hides. To make this from scratch would take somewhere between 20 and 80 solid hours of hide processing depending on species and the particularities of the process. This outfit would need replacing every few years, and then there's children's garments and coverings for infants.

- As well as the worn teeth, we can recall how Neanderthals' arms were thickened from huge pulling forces: much of it potentially from a lifetime where hide working was a never-ending task.

Bone awl: Pech de l'Azé, Dordogne, France: Circa 45- 40 Ka

Poinçon, a bone awl for making holes in soft materials such as leather.

N containers

- Hides can also produce things just as vital to hunter-gatherer life: bags.
- The average Neanderthal probably had a lot to carry: food, fresh skins, furs, perhaps bedding, not to mention stone. Natural 'bags' might be made from animal stomachs or bladders, but hides are especially useful because they're tough and big.
- Containers are also connected to food storage, perhaps especially important in the Quina.
- While there's no direct evidence Neanderthals stored food, but in a glacial setting where most meat was sourced during big seasonal hunts, it may have been necessary.

Tanning

- Little blob of tanned stuff found at Neumark in the Eemian = oak bark tannin for tanning leather

- Tanning to make leather isn't necessary when hide working, though it helps with preserving and waterproofing. But if you want to add color along a pink-orange-brown spectrum, it's perfect.

- Incredibly, an organic residue on a small stone flake at Neumark-Nord tells us Neanderthals did sometimes make leather. Moreover, the tannins at Neumark-Nord came from oak, which along with chestnut is the best tree species for tanning in an interglacial world: once more, Neanderthals were selecting for quality.

Neandertals and Birds

Ns used feathers for decoration

Ns and eagles

- In 2012, three studies indicated that Neandertals utilized elements of eagles and other birds in non-utilitarian ways.

- Cut-marked terminal phalanges of eagles were identified at the sites of Combe-Grenal, Les Fieux, Pech de l'Aze´ IV, and Grotta di Fumane.

- As eagles are rare birds and only eagle remains showed this modification, Morin and Laroulandie argued that this bias toward large and powerful raptors indicated that the claws were used in symbolically-oriented contexts by Neanderthals.

Ns and feathers

- At the Grotta di Fumane in northern Italy, 660 bones belonging to 22 species of birds were recovered with evidence of cut marks and scraping on wing bones. Since these parts of the birds would have little or no food value, it was concluded that feathers of various colors were being removed.

- Read Clive Finlayson: Director of Gibraltar Cave sites; master birder; major researcher of Ns and their relationship to birds
  - *The Smart Neanderthal*
  - *The Humans Who Became Extinct*

N and Birds

-
- Ns captured: duck, dove, swan, birds of prey, grouse, chough; also ate eggs

- At Gibraltar:
  - Butchered birds are found in five levels,
  - 100 bones from 12 species.
  - Unlike Fumane, though, it's all medium or small birds: partridge and rock dove but also kestrel, owl, chough, jay, magpie, crow, and roller.

Ns and Birds

- Catching birds has long been believed an advanced hunting technique, so how did Neanderthals do it?

- Many species lived alongside Ns, soaring over cliffs above caves, but woodcock, jay and roller at Cova Negra must've come from nearby woodlands.

- Special throwing sticks might work in wetland contexts at Schöningen.

Ns and birds

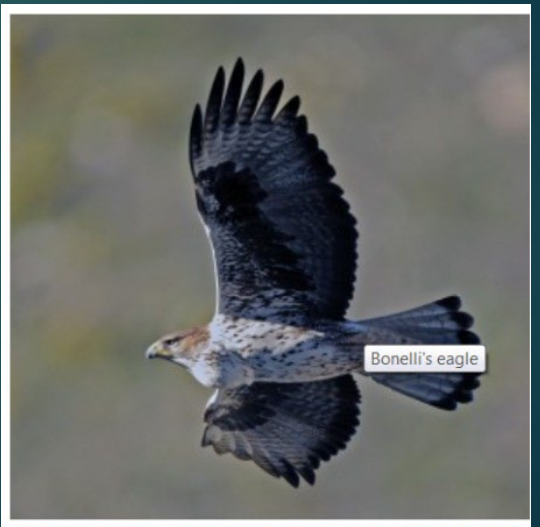
- Neanderthals collected sinews and tendons and may have had plant-based cord, we have no evidence of nets.

- Nobody has ever found preserved darts or bows, but the small bone point from Salzgitter and the tiny Levallois points or even bladelets could have been used as projectiles

Neanderthals & Corvids

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

- 2012 *PLOS ONE study:* review of 1699 fossil sites in Eurasia and north Africa spanning the Pleistocene epoch.
- Neandertals across western Eurasia were strongly associated with corvids and raptors (black vultures and their relatives)—more so than were the anatomically modern humans who succeeded them.



Bonelli's eagle is one of the raptor species Neandertals hunted, presumably for its dark feathers. Image: Clive Finlayson

Birds of a Feather: Neanderthals & black Corvid feathers

- 1699 fossil sites in Eurasia and north Africa spanning the Pleistocene epoch.
- Neandertals across western Eurasia were strongly associated with corvids and raptors (vultures and their relatives)
- Cave sites from Italy, France and Spain yielded 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

Birds of a Feather: Neanderthal Exploitation of Raptors & Corvids

- 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

N and birds

- C. Finlayson and colleagues (2012) followed with a broader analysis of the association between the fossil remains of Neandertals and raptors/corvids across the Palearctic region (Europe, northern Africa, and most of Asia) and found a convincing pattern of co-association.

- Their detailed analysis of three Gibraltar sites show that cut marks are generally found on bones supporting the flight feathers, and not on the meat-bearing elements.

- The use of raptors for non-utilitarian purposes is also hinted at by the modifications to eight eagle talons at the early Neandertal site of Krapina in Croatia, and by cut marks on an eagle phalanx from the Châtelperronian level at Cova Foradada (northern Spain) indicating removal of the talon.

Birds and Ns

- At Krapina, eagle talon pendants at 130 Ka

- In Gibraltar, there's evidence that 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

Cinerous Vulture

Neandertal's favorite raptors

Bearded vulture

Ns caught Golden Eagles

Raptor talons and bird bones collected from Neanderthal sites now point to 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; for their feathers and talons.

- Golden Eagles were probably ambushed by Neanderthals at carcasses.

- The tradition of catching raptors dates to at least 130 Ka, for at least 85,000 years before MHs arrived in Europe

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

Stewart Finlayson, et al., 2019

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.
- They were systematically using large raptors such as vultures and eagles and large falcons; but not ducks
- The eagle remains largely constituted wing bones and talons, which are far from the most appetizing parts of the bird.

Birds

- In big raptors, talons are particularly large and strong, but experimental research showed that in many sites Neanderthals were removing claws from behind, and in the process cutting right through the tendons, while also apparently avoiding the shiny talon itself.

- This duality is also seen with wings: sometimes it's probably about getting out tendons, but often the butchery marks point to Neanderthals actually seeking the primary flight feathers.

- Instead, aesthetics or a symbolic interest in some cases was part of, or the primary, motivation.

Feather and claw

- Another potential realm of N symbolic behaviour: what Neanderthals were doing with birds.

- There's plenty of evidence that they were also eating them; the Zaskalnaya bone also bears marks from removing meat.

- However, there are hints that things sometimes went beyond mere survival. In particular, in a number of sites wings are more common than might be expected. They're far from the meatiest parts, yet often have the most cut marks and come from unusual species: in the raven layer at Zaskalnaya, there's also a bone from a grey heron's wing.

Ns and bird talons

- While the presence of other body parts from chough and grouse point to use as food, raptors are only represented by butchered wings, whether lammergeier, greater spotted eagle, black vulture or even diminutive merlin.

- But bird feet/talons may also have been a focus of attention. Again at Zaskalnaya, in the raven's layer the end toe bone from an eagle was found, while the older level A12 at Fumane produced an eagle claw. And even the grouse from Level A9 there seem to show an excess of foot bones, despite being hunted and brought back whole from the nearby pine forest.

Raptor talons

- Systematic studies have found a similar pattern of butchered raptor feet or claws - especially eagles - across a number of locales dating between 100 ka and 45 ka in France and Italy.

- In some places there's more than one: at the collapsed cave site of Les Fieux, a few kilometers south of the Dordogne valley, 20 bones from large raptors from multiple layers are almost all talons. Most tantalizingly, two of the biggest white-tailed eagle toe bones from the same layer were missing the talons; perhaps having been taken elsewhere.

Neandertal Modified White-Tailed Eagle Talon necklace, 130 K

White tail Eagle

Krapina, Croatia

- Presence of eight talons indicates that the Krapina Neandertals acquired and curated eagle talons for some kind of symbolic purpose.

Radovčić D. et al., 2015

Krapina eagle talons

- Theories that talons were adornments existed, but became amplified after eight butchered white-tailed eagle talons from Krapina were proposed to be a necklace.
- Along with a toe bone, microscopic examination found smoothed-over cut marks and small, bright areas that resemble contact polish from rubbing against both soft and hard things.
- However, proposals that the talons were originally strung together are difficult to support since even though they all come from the uppermost level, it's a thick deposit and there's no proof they were associated with each other, much less as a single, impressive object.

Found in different areas; necklace, rattle?

Mix of 2 different pigments

Colored bird feathers

- Color is one of the key things that makes feathers attractive, and it's notable that many species Neanderthals were interested in had distinctively dark plumage: blacks, dark browns, greys.

- Even talons and claws are typically black and glossy. Red is present too: the sooty feathers of male black grouse are set off by red 'topknots', while chough combine shiny black plumage with red or yellow bills, red feet and black claws

- Significantly, in 2020 pigment was identified on the same talon at Krapina as the collagen fiber, and it's another mixed recipe: red and yellow minerals, charcoal and clay.

- This association strongly suggests that in some places, bird parts were part of the Neanderthal aesthetic palette.

Birds

- But why these birds?

- Many of the species that seem to have received special treatment like birds of prey or the crow family were well known to Neanderthals, attending like familiars at their kill sites.

- Chough in particular may even have become habituated, since they live by caves, feed in pasture where large herbivores graze, and as can be seen at ski resorts, are partial to human rubbish.

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