Human Evolution Scientific Updates 2024

COMPILED BY CHARLES J VELLA, PHD

2024

Human Evolution Interest Group
Scientific Update

February 2024

Charles J Vella, PhD

- Nova, S51, Ep4: Hunt for Oldest DNA – Eske Willerslev, Univ. of Cambridge & Copenhagen: The Greenland aDNA
- Possible Coming Lectures:
  - Pre-Homo hominins
  - Great Myths of Human Evolution
  - Fossilization And Dating in Human Evolution
  - Origin of Modern Humans - Chris Stringer
  - Any topics or books you want to review

Two big-headed ants encircle and kill larger acacia ants: Result is a whole-savannah effect

Ants have changed lion behavior

- How invasive ants have messed up an old ecological relationship.
- Lions like to hunt zebras from behind acacia tree camouflage. They are much more effective via tree cover.
- When elephants try to eat an acacia tree, acacia ants swarm up their nostrils and bite them
- African big-headed ants are overwhelming larger acacia ants. The demise of acacia ants leave their tree home in Africa undefended and vulnerable to elephants.

Ecological Mutualism: Ants and lions

- Without acacia ants around to bite them, elephants rip up acacia trees, which increase visibility and makes it difficult for lions to catch their preferred zebra meals. Lions end up hunting buffalo instead.

- Areas with big headed ants have visibility 2.7x higher than areas without them. Lions could see farther in these area; but so could zebras. Lions killing zebras in these areas went from 62 to 22 %. Soon bison kills went from 0 to 42%. But with higher injury rates.

- Disruption of mutualism can have cascading effects on other species. A single anthill could cause a savannah-wide shift in who is eating who.

The Oldowan of Zarqa Valley, Northern Jordan

- Hominins may have left Africa 700,000 years earlier than we thought. Our hominin ancestors originated in Africa and the consensus is that they didn't leave there until about 1.8 million years ago, but stone tools found in Jordan challenge the idea
- Found Oldowan stone tools there that were made and used 2.5 million years ago.
- Thus hominins left Africa at least 700,000 years before we thought
- Oldest widely accepted evidence of hominins outside Africa is from Dmanisi in Georgia, where there are 1.8-million-year-old fossilized remains identified as *Homo erectus*.

F. Parenti…W. Neves, 2024

Oldowan tools of Jordan: Homo habilis?

- Excavated a rocky outcrop in the Upper Zarqa valley in Jordan. They focused on three rock layers. At the bottom is a layer of volcanic basalt, which their dating techniques show is 2.5 million years old. Above this is a layer of sediments laid down by a river, which contains the purported stone tools. Finally, on top is a layer of 1.95-million-year-old limestone. The researchers published these dates, based on three different methods, in a 2019 study, to little notice.
- Because some of the tools were found just above the basalt layer, Neves argues they are probably 2.5 million years old. This makes them older than any known fossils of *H. erectus*, implying that another hominin species was the first to leave Africa.
- Neves points to *Homo habilis*, which may have been present 2.3 million years ago or even earlier. “Our hypothesis is that the first hominin to have left Africa was *Homo habilis* and not *Homo erectus*,

Older than 2 Ma

- Other researchers have claimed to have evidence of hominins outside Africa older than the Dmanisi remains.
  - At Shangchen in China, researchers have described 2.1-million-year-old stone tools,
  - while at Longgupo, also in China, there are stone artefacts and hominin remains that have been claimed to be 2.5 million years old.
  - There are also claims of stone tools in northern India 2.6 million years ago.
  - However, none of these claims have been widely accepted. Either the artefacts themselves, or their ages, or both, have been questioned.

Zarga, Jordan

- The fluvial Dawqara Formation, upper Zarqa Valley, eastern side of Jordan Valley, is chronologically constrained between 2.52 and 1.98 Ma.
- Several artifact-bearing outcrops display a core and flake industry, with no handaxes nor planned flaking. We describe 40 artifacts from section 334 Lower, the earliest archeological site of the formation and one of the oldest Oldowan complexes outside Africa. Despite the occurrence of basalt rocks, all artifacts were made on chert cobbles displaying various degrees of abrasion due to fluvial transport. The industry is represented by 30 flakes and 10 cores and choppers, preferentially obtained on chert cobbles with massive-fan form, unifacially and bifacially flaked.
- The assemblage is compared to Oldowan or lower Acheulean complexes in and outside Africa, pointing to a rapid spread of unknown hominins with this flaking technology, possibly ascribable to an early *Homo* clade.

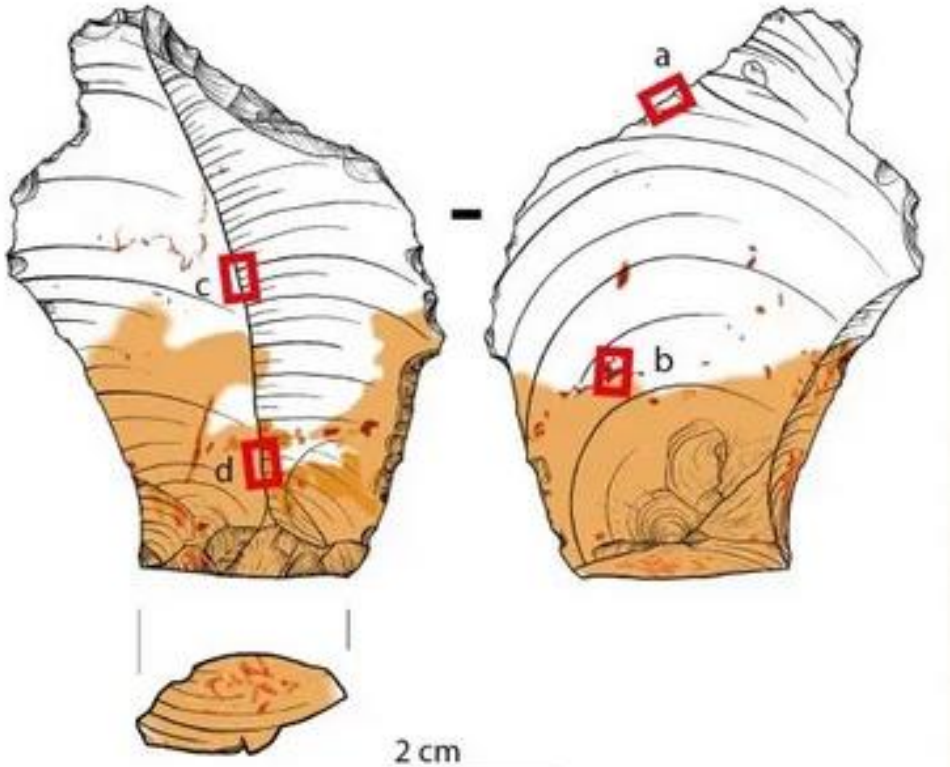
Deciphering Neanderthal Ingenuity: Evidence of Advanced Cognitive Abilities

- Recent research has unveiled a remarkable aspect of Neanderthal intelligence: their adeptness in crafting complex adhesives to bind stone tools, challenging prior assumptions of their cognitive capabilities.
- Stone tools from Le Moustier, a renowned archaeological site in France, providing a window into Neanderthal technology during the Middle Paleolithic period, approximately 120,000 to 40,000 years ago.
- The meticulous examination of stone tools from Le Moustier revealed traces of a sophisticated adhesive, comprising a blend of ocher and bitumen.

Ochre-based compound adhesives at the Mousterian type-site document complex cognition and high investment

- Tensile tests and microscopic analyses unveiled the adhesive's functionality. When combined with liquid bitumen, the ocher-rich mixture transformed into a malleable substance, ideal for tool handles. Microscopic wear patterns further corroborated the tools' use as handheld implements, exhibiting telltale signs of abrasion from ocher movement within the grip.

- The sophisticated production of multi-component adhesives reflects an advanced level of cultural and technological evolution among Neanderthals.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Ochre adhesives at Le Moustier

- Foragers of the European Middle Paleolithic also used glues, but evidence of ochre-based compound adhesives is unknown. \Here, we present evidence of this kind. Bitumen was mixed with high loads of goethite ochre to make compound adhesives at the type-site of the Mousterian, Le Moustier (France).
- Ochre loads were so high that they lowered the adhesive's performance in classical hafting situations where stone implements are glued to handles. However, when used as handheld grips on cutting or scraping tools, a behavior known from Neanderthals, high-ochre adhesives present a real benefit, improving their solidity and rigidity. Our findings help understand the implications of Pleistocene adhesive making.

Le Moustier

- The Le Moustier artifacts show that the European Middle Paleolithic adhesive technology was based on very similar processes as that in Africa.
- In both contexts, early humans deliberately produced some of their adhesives by distillation, from Podocarpus conifers in Africa and birch bark in Europe.
- Both also mixed some of their glues with ochre to make compound adhesives.

Adhesives require multitasking

- However, what do these behaviors actually imply in terms of cognition or cultural processes?

- Pioneering work on adhesive technology by Wadley et al. suggests that compound adhesives have different implications than single-component[“simple”] glues. This is because specific recipes must be followed, demanding multitasking and the use of abstraction and recursion.

- Multistep process: Bitumen, flint, and pure goethite ochre do not occur at the same outcrops but must be gathered and transported to produce the composite tool.

Equivalent cognitive capacity

- In conclusion, the Le Moustier artifacts are the oldest compound adhesives that have been found in a European context.

- We found that high proportions of ochre make bitumen more rigid and prevent it from sticking to the hand. This suggests that the adhesives were used as handles directly attached to stone tools rather than for hafting stone tools to handles.

Equivalent cognitive capacity

- This is in continuity with the behavior known from the European Middle Paleolithic (birch tar handles). They invested time and effort in making compound adhesives and had the cognitive capacities needed.

- In any case, the use of ochre as filler would appear to be present in African H. sapiens and Neanderthals, both showing almost identical adhesive technologies in all aspects (the only difference being the types of raw materials used).

The Earliest Evidence of Homo Sapiens in Eastern Asia

- Yang, S.-X.… Petraglia, M. (2024): Initial Upper Palaeolithic material culture by 45,000 years ago at Shiyu in northern China. *Nature Ecology & Evolution*
- Unearthed fragments of rock and bone dating to 45,000 years, marking the earliest evidence of *Homo sapiens* in Eastern Asia.
- In 1963, initial excavations yielded thousands of stone tools, bone fragments, and a solitary hominid fossil, providing a glimpse into the lives of ancient inhabitants. In 2013, a renewed effort led by paleoanthropologist Shi-Xia Yang launched a comprehensive investigation of the site.
- The presence of equid bones bearing butchering marks hints at a hunter-gatherer lifestyle, while the discovery of obsidian sourced from afar suggests networks of trade and travel.

Evidence of The Levallois stone-knapping method in China

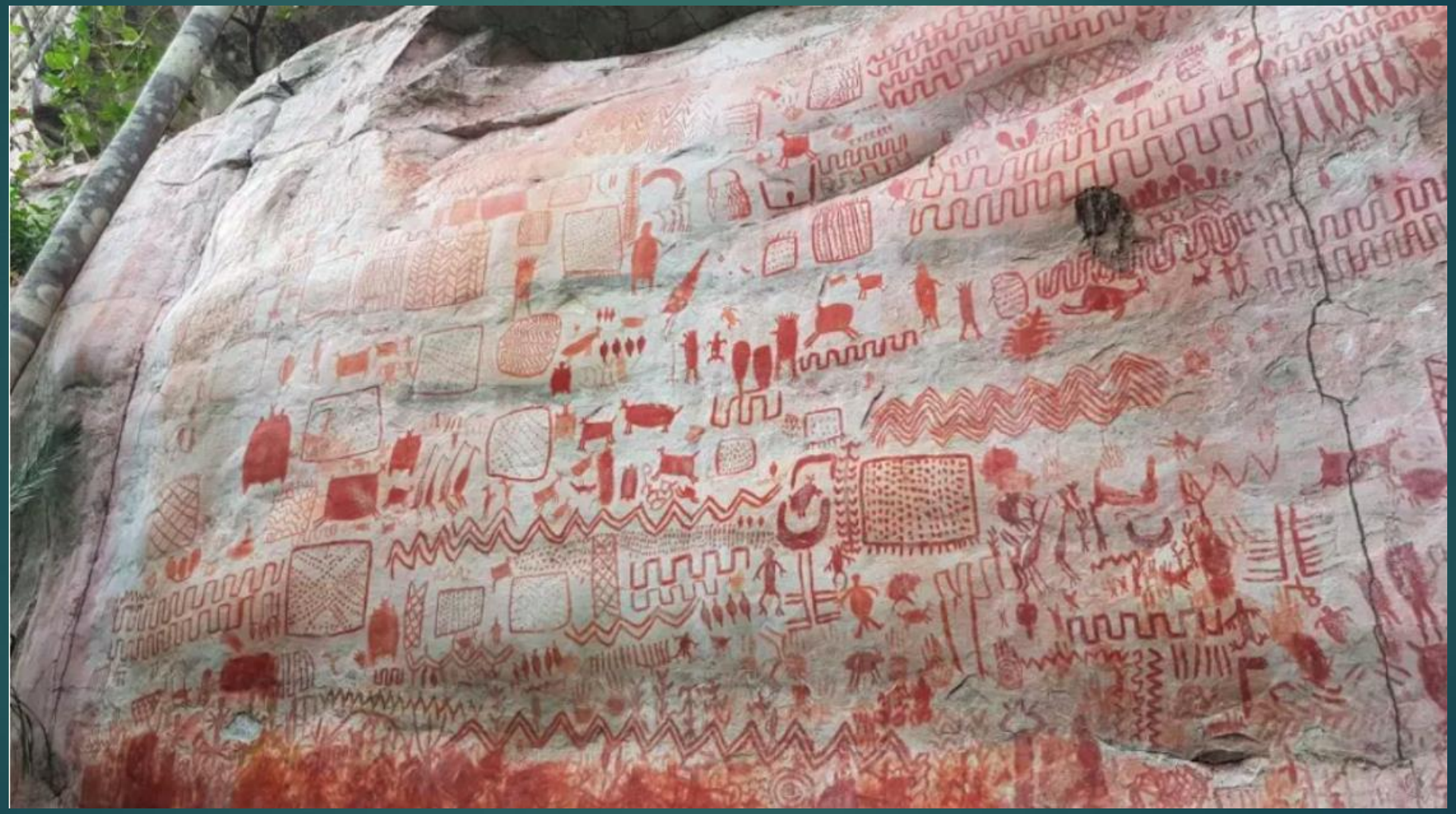
Abstract

- The geographic expansion of Homo sapiens populations into southeastern Europe occurred by ~47 ka, marked by Initial Upper Palaeolithic (IUP) technology.
- H. sapiens was present in western Siberia by ~45 ka, and IUP industries indicate early entries by ~50 ka in the Russian Altai and 46–45 ka in northern Mongolia.
- H. sapiens was in northeastern Asia by ~40 ka, with a single IUP site in China dating to 43–41 ka.
- Here we describe an IUP assemblage from Shiyu in northern China, dating to ~45 ka.

Shiyu, China by 45 Ka

- Shiyu contains:
  - a stone tool assemblage produced by Levallois and Volumetric Blade Reduction methods,
  - the long-distance transfer of obsidian from sources in China and the Russian Far East (800–1,000 km away),
  - increased hunting skills denoted by the selective culling of adult equids
  - and the recovery of tanged and hafted projectile points with evidence of impact fractures,
  - and the presence of a worked bone tool and a shaped graphite disc.
- Shiyu exhibits a set of advanced cultural behaviors, and together with the recovery of a now-lost human cranial bone, the record supports an expansion of H. sapiens into eastern Asia by about 45 ka.

Rock art at Serranía de la Lindosa, on the northern edge of the Colombian Amazon: 13 Ka



First MHs at 13 Ka in Amazon

- The first humans to settle the Amazon Basin arrived around 13,000 years ago as part of a mass migration that quickly swept across the Americas
- These early Americans lived in rock shelters, fashioned stone tools, hunted and gathered and created massive displays of rock art; and continued until the 17th century,

Fast evolution: The Mutant Wolves of Chernobyl Have Evolved to Survive Cancer

- In the shadow of nuclear disaster, these canines show remarkable resilience to the deadly disease.
- The Chernobyl Exclusion Zone (CEZ) has quickly become a 1,000 square-mile science experiment, as experts use the highly irradiated zone as a chance to understand animal biology placed under those extreme conditions.
- Studied wolves in the CEZ for a decade and found that they're thriving compared to neighboring wolf packs, likely due to reduced human contact and genetic mutations that protect again cancer.

Wolves: long-term effects of ionizing radiation.

- In 2023, another study discovered distinct genetic differences between Chernobyl dogs and dogs living only 10 miles away in Chernobyl City.
- Unexpectedly *thriving* wolf population

- These animals are forced to eat irradiated prey that ate irradiated plants that grew out of irradiated soil. Basically, it's radiation all the way down.

- Wolf populations in the CEZ are actually seven times more dense than in protected wildlife areas in neighboring Belarus.

Example of Natural selection

- They discovered over time that the wolves were consistently exposed to radiation six times higher than the legal limit for humans.
- Theory is that wolves are experiencing a kind of rapid natural selection, one likely caused by the equally rapid change in their surrounding environment. Some wolves within the CEZ contained genes that made them more resistant to cancer than other wolves.
- While still getting cancer at the same rate, these resilient canines simply weren't as impacted, allowing them to pass on those genes to a future generation.
- Found that the fastest-evolving regions within Chernobyl are in and around genes that we know have some role in cancer immune response or the anti-tumor immune response in mammals

37 Ka Art? Or utility? Ivory perforated baton from Hohle Fels Cave, Germany

Hohle Fels baton: Ancient Ivory Baton Reveals Surprising Purpose in Rope-Making

- Previously believed to be a mere work of art, this 37,000-year-old artifact now emerges as a sophisticated tool for crafting rope

- The experiment unveiled the baton's proficiency in rope creation. Employing a technique akin to twining or braiding, individual strands passed through the carved holes remained securely in place. As the strands converged, a counterpart on the opposite side deftly intertwined them, birthing a well-crafted rope.

Rope creation device

- Suspected that the holes with spiral grooves were made to have something fed through them, which led us to hypothesize that the artifact may have served to align fibers to make rope or twine.

- While twine can be made by hand without tools, by pulling and twisting plant fibers together, we tested whether or not the perforated baton from Hohle Fels could have been used to align, twist, and combine fibers to make rope.

Rope making at 37 Ka

- Microscopic examination revealed fibers adhering in the area of the holes and grooves. Performed experiments to test the functionality of individual holes and of the four holes in combination with sinew from deer, flax (*Linum*), hemp (*Cannabis*), cattail (*Typha*), linden (*Tilia*), willow (*Salix*), and nettles (*Urtica*) . Had positive results for cattail, linden, and willow. Cattail was particularly applicable.
- The tool's relevance lies in making thicker, stronger rope consisting of two to four strands. We twisted and fed bundles of cattail leaves through the holes. The holes help to maintain a regular thickness of the strands and facilitate the addition of new material necessary for making long stretches of rope.

Function of grooves

- The grooves help to break down the leaves and orient the fibers while maintaining the torsion needed for rope making.
- The four-holed tool is then pulled with regular speed over the strands. Behind the tool, the strands combine automatically into a rope as a result of their twisting tension.
- The number of holes used determines the thickness of the rope. Because one person is needed to twist and maintain tension on each of the strands and one to operate the *Lochstab*, three to five people would be needed to use a four-holed *Lochstab* for rope making.
- Our experiments using cattail and four or five participants typically produced 5 m of strong and supple rope in 10 min

How to make rope at 37 Ka

Everyone needs rope

- Paleolithic life would be difficult without rope, twine, or leather straps of some kind. Every ethnographically studied group of hunters and gatherers uses rope or twine for a wide variety of purposes.

- The cooperative work required to make rope using the perforated batons from the Swabian Aurignacian required complex and well-coordinated communication and shared goals.

- We can now add rope making technology using perforated batons to the innovations associated with the arrival of Aurignacian hunter-gatherers in Central Europe

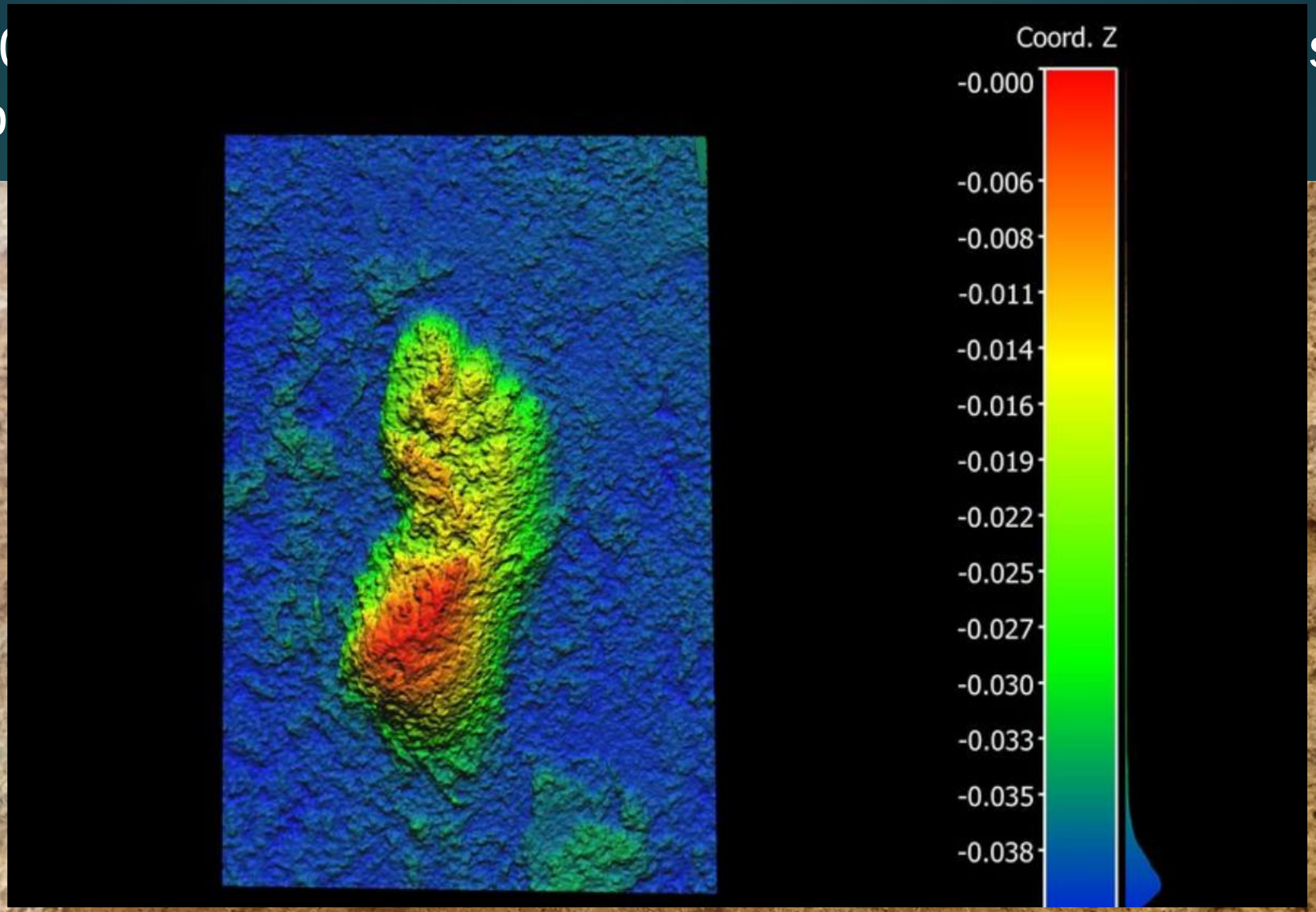
Researchers discovered 85 footprints made by humans thousands of years ago at a beach in Morocco

Footprints

90,000-year-old human footprints found on a Moroccan beach are some of the oldest and best preserved in the world

- A trackway containing 85 well-preserved human footprints that are some of the oldest in the world.
- Analysis of the site, which is the only known human trackway site of its kind in North Africa and the Southern Mediterranean, revealed two trails containing a total of 85 human footprints stamped into the beach by a group of at least five early modern humans.
- Researchers determined that a multigenerational group (which included children, adolescents and adults) of *Homo sapiens* walked on the beach roughly 90,000 years ago, creating the pathways.

153,0 st
Homo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Archeologists in South Africa have discovered the footprints of *Homo sapiens* dating to 153,000 years ago, the oldest known tracks attributed to our species

- The record-breaking finding is one of many unearthed in Africa over the past few decades. Since the report of 3.66 million-year-old footprints at the site of Laetoli in Tanzania over 40 years ago, paleoanthropologists have found more than 100 walking trails preserved in rocks, ash and mud left by our hominin ancestors.

- Used optically-stimulated luminescence (OSL) to figure out when the impressions were made.

Unlocking Ancient Secrets: Jewelry Reveals Nine Lost Cultures

- In a groundbreaking study published in *Nature Human Behaviour*[1], researchers delve into the intricate world of ancient jewelry, unearthing evidence of nine distinct lost cultures that thrived across Europe between 34,000 and 24,000 years ago.

- The study challenges the notion that the Gravettians, a presumed homogenous group of Ice Age hunter-gatherers, were a singular entity. Through a meticulous analysis of over 130 personal ornaments from Gravettian sites across Europe, the research unveils a rich tapestry of cultural diversity.

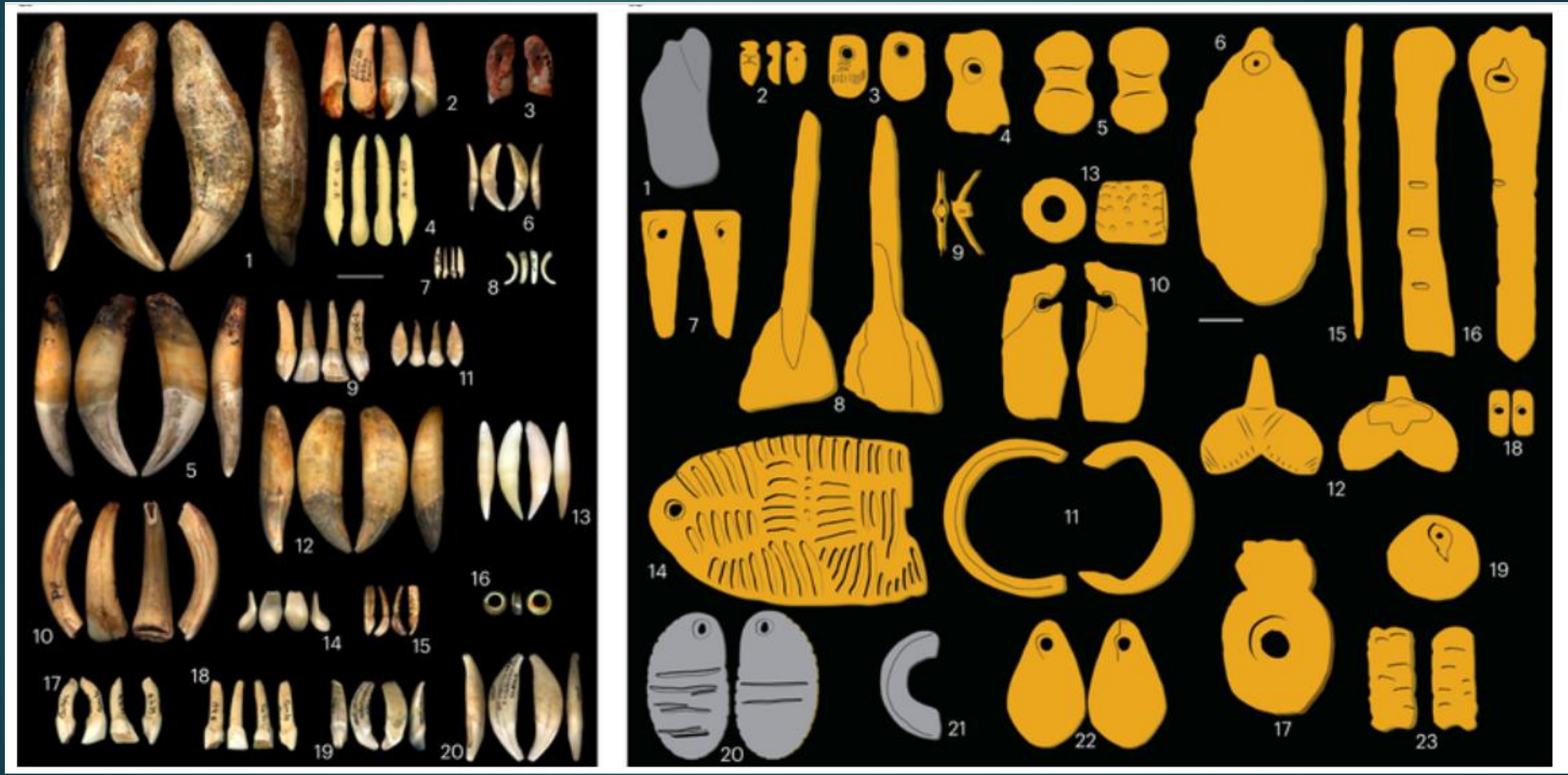
Cultural identity via jewelry

- Jewelry, it appears, was not merely a fashion statement but a complex language conveying cultural nuances. The ornaments ranged from carved ivory pendants to beads made from coral, each telling a unique story of cultural identity. The study found that certain symbols persisted over time, echoing the endurance of cultural messages.

Jewelry = Cultures

- The findings align with the isolation-by-distance theory, suggesting that geographical proximity played a significant role in shaping shared cultures.
- While raw material availability influenced ornament composition, the study highlights that cultural choices drove the selection of materials, challenging the notion that the environment dictated ancient fashion.
- Demonstrates that Gravettian ornament variability cannot be explained solely by isolation-by-distance.
- Analysis of Gravettian ornaments identified nine geographically discrete cultural entities across Europe. While broadly in agreement with paleogenetic data, our results highlight a more complex pattern, with cultural entities located in areas not yet sampled by paleogenetics and distinctive entities in regions inhabited by populations of similar genetic ancestry.

Gravettian personal ornaments



A genome sequence from a modern human skull over 45,000 years old from Zlatý kůň in Czechia

- Modern humans expanded into Eurasia more than 40,000 years ago following their dispersal out of Africa. These Eurasians carried ~2–3% Neanderthal ancestry in their genomes, originating from admixture with Neanderthals that took place sometime between 50,000 and 60,000 years ago, probably in the Middle East.
- In Europe, the modern human expansion preceded the disappearance of Neanderthals from the fossil record by 3,000–5,000 years.
- Here, we analyze a genome generated from the skull of a female individual from Zlatý kůň, Czechia.
- A population that had no genetic descendants.

•Kay Prüfer, et al., 2021

Zlatý kůň in Czechia

- The authors present the genome sequence of a >45,000-year-old female Homo sapiens individual from the site of Zlatý kůň, Czechia.

- Her genome carries ~3% Neanderthal ancestry, similar to those of other Upper Palaeolithic hunter-gatherers.

- However, the lengths of the Neanderthal segments are longer than those observed in the currently oldest modern human genome of the ~45,000-year-old Ust'-Ishim individual from Siberia, suggesting that this individual from Zlatý kůň is one of the earliest Eurasian inhabitants following the expansion out of Africa.

3 new articles in Nature: Homo sapiens reached the higher latitudes of Europe by 45,000 years ago

- Late Neanderthals persisted in western Europe several millennia after the occurrence of *H. sapiens* in eastern Europe. Local hybridization between the two groups occurred, but not on all occasions.
- Archaeological evidence also indicates the presence of several technocomplexes during this transition, complicating our understanding and the association of behavioral adaptations with specific hominin groups[4].
- One such technocomplex for which the makers are unknown is the Lincombian–Ranisian–Jerzmanowician (LRJ), which has been described in northwestern and central Europe

Dorothea Mylopotamitaki…Jean-Jaques Hublin, 2023

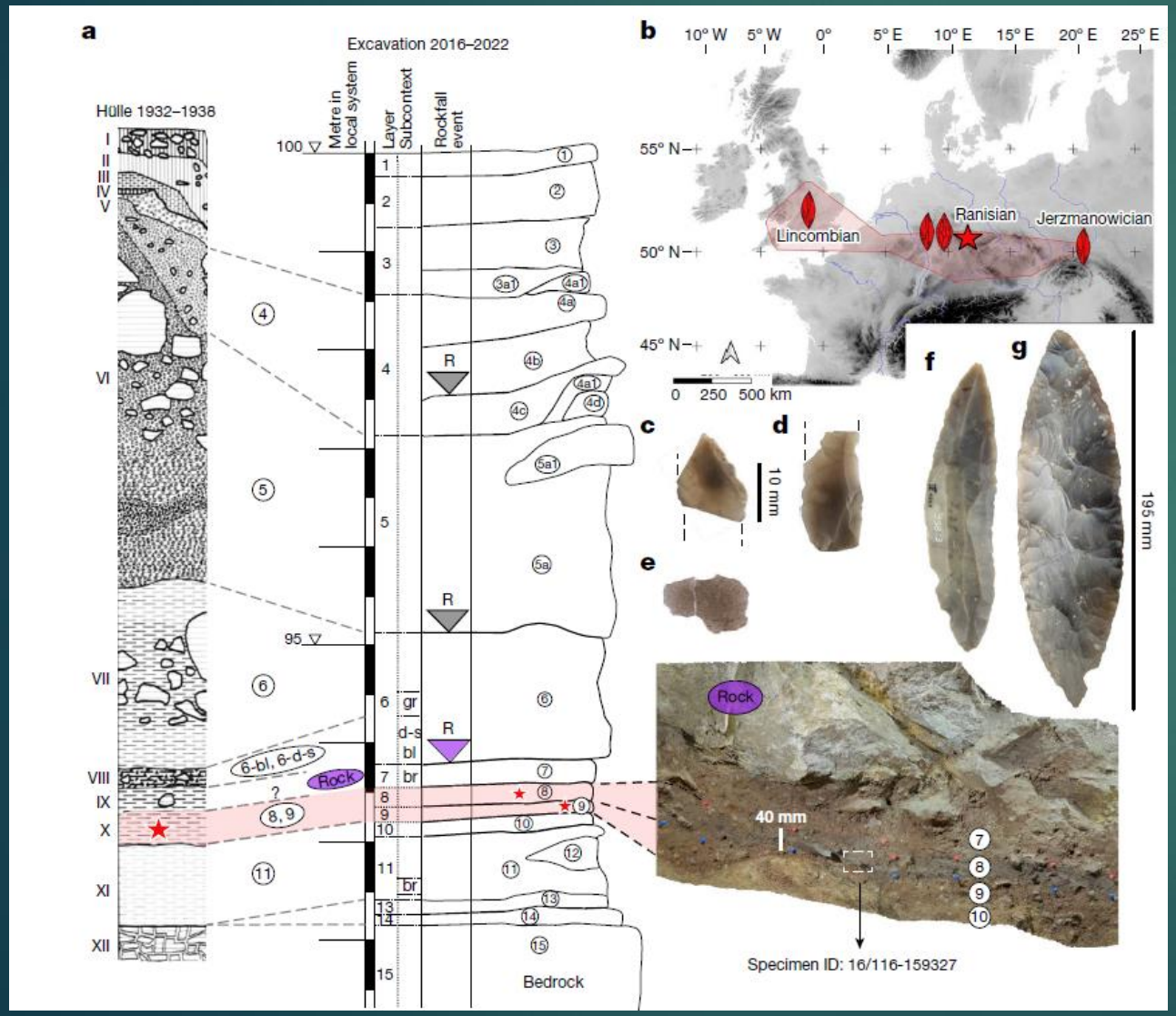
Ranis, Germany

- Here we present the morphological and proteomic taxonomic identification, mitochondrial DNA analysis and direct radiocarbon dating of human remains directly associated with an LRJ assemblage at the site Ilsenhöhle in Ranis (Germany).

- These human remains are among the earliest directly dated Upper Palaeolithic *H. sapiens* remains in Eurasia.

- We show that early *H. sapiens* associated with the LRJ were present in central and northwestern Europe long before the extinction of late Neanderthals in southwestern Europe.

Stratigraphy with location of H. sapiens bones, map of LRJ sites and lithics from Ranis.



The site Ilsenhöhle in Ranis is one of the eponymous LRJ sites based on its unique composition of bifacial and unifacial points.

Neanderthals and humans lived side by side in Northern Europe 45,000 years ago

- A genetic analysis of bone fragments unearthed at an archaeological site in central Germany shows conclusively that modern humans—Homo sapiens—had already reached Northern Europe 45,000 years ago, overlapping with Neanderthals for several thousand years before the latter went extinct.

- The findings establish that the site near Ranis, Germany, which is known for its finely flaked, leaf-shaped stone tool blades, is among the oldest confirmed sites of modern human Stone Age culture in north central and northwestern Europe.

LRJ culture made by H. sapiens

- The Lincombian–Ranisian–Jerzmanowician (LRJ) culture or technocomplex: The new findings demonstrate that "Homo sapiens made this technology, and that Homo sapiens were this far north at this time period, which is 45,000 years ago

- About 24 feet below the surface, they found layers that contained leaf points — which are like spear points — and human bone fragments.

- Suggests that the leaf point technology scientists had once attributed to Neanderthals was used by H. sapiens.

Ranis: Cave, bone, LRJ tools

Ranis, Germany

The cave where archaeologists found the ancient human remains sits below a medieval castle in Ranis, Germany.

Stone tools from the LRJ at Ranis. 1) partial bifacial blade point characteristic o…

Ranis, Germany, 45 Ka

- "The Ranis cave site provides evidence for the first dispersal of Homo sapiens across the higher latitudes of Europe. It turns out that stone artifacts that were thought to be produced by Neanderthals were, in fact, part of the early Homo sapiens toolkit," J. Hublin said.

- "This fundamentally changes our previous knowledge about the period: Homo sapiens reached northwestern Europe long before Neanderthal disappearance in southwestern Europe."

- The bone fragments were initially identified as human through analysis of bone proteins—via paleoproteomics

Lincombian–Ranisian–Jerzmanowician (LRJ) tools and Ranis

- Through three publications, new LRJ tools are analyzed, along with bone of reindeer, bison, woolly rhinoceros, cave bears, hyena, glutton, Arctic fox, wolf and glutton, and a total of 13 human fragments, including some from the excavation 1932-38.
- From mitochondrial DNA recovered from 11 fragments (7 from excavation 1932-38 and 4 from 2016-22), it has been determined that these are the remains of *H. sapiens*. Molecular dating of genetic material results between 49-41 ka, consistent with the radiocarbon dating of 47-42 ka of the sedimentary layers from which they came.
- Genetic material has also made it possible to relate this group to the individual *sapiens* of Zlat-ka (Czech Republic), of about 45 ka, which by the way has a 3 per cent of Neanderthal traces in its genome (no Neanderthal traces is reported in the remains of Ranis).

Reestimate of Neandertal-Sapiens Divergence Date

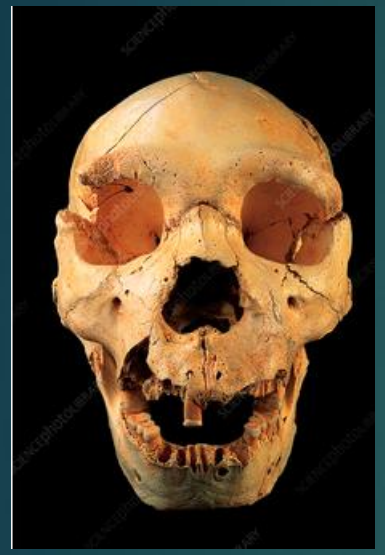
- Historic estimate of Neandertal-Sapiens split = 650-500 Ka
- New statistical method: problem of estimating species TMRCAs (Time to Most Recent Common Ancestor), given a genome sequence from each species and a large known phylogenetic tree; on Neanderthal, Denisovan, and Chimpanzee mtDNA genomes to better estimate their TMRCA with modern humans; employed advanced computer software, BEAST2
- Results date the human – Neanderthal TMRCA to be 408 Ka, considerably later than values cited in other recent studies.
- Human-Chimpanzee TMRCA = ~5 Ma
- Human – Sima de los Huesos Ns – Denisovans TMRCA = ~ 841 Ka
- Human –Neanderthal TMRCA = ~ 408 Ka

Keren Levinstein Hallak1 and Saharon Rosset1, 2024

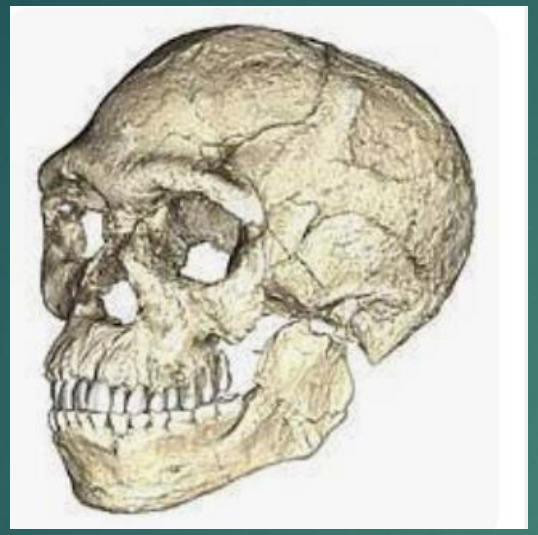
CJV: Earliest *H. sapiens, Ns*

- 765–550 Ka: MH-N split
- 415 KA: early Ns at Sima de los Huesos, Spain
- 315 Ka: Jebel Irhoud, Morocco
- 300 Ka: Kabwe/Broken Hill, Zambia (H. rhodesiensis); not 600 Ka or H. heidelbergensis
- 259 Ka?: Florisbad, South Africa
- 171 Ka: Omo, Ethiopia
- 160 Ka: Herto, Ethiopia
- 90 Ka: Skhul, Israel

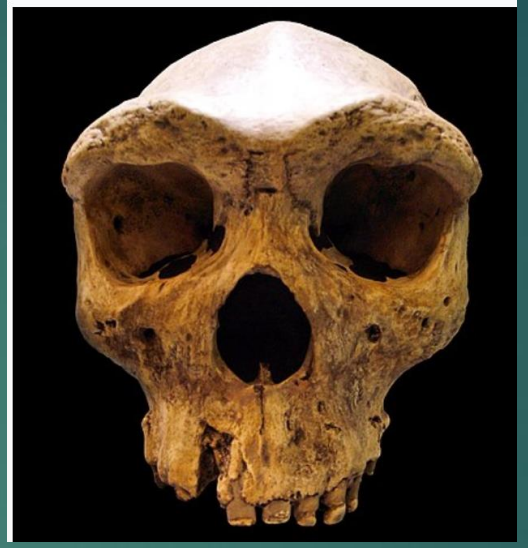
Sima de los Huesos
Cranium 5



Jebel Irhoud, H. sapiens

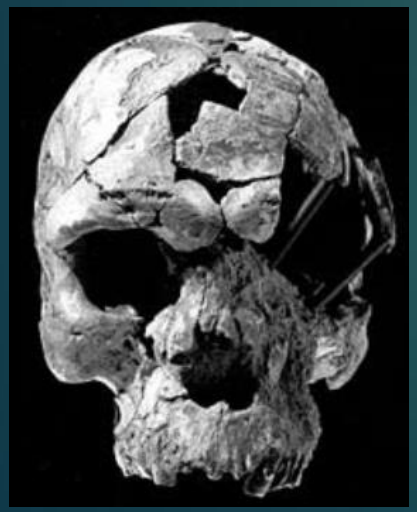


Kabwe 1



Omo 1, H. sapiens

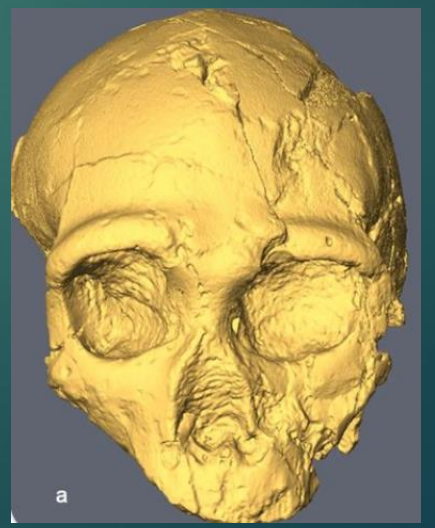
Herto



Skul, Israel

Florisbad

Apidima



: Zlat-ka

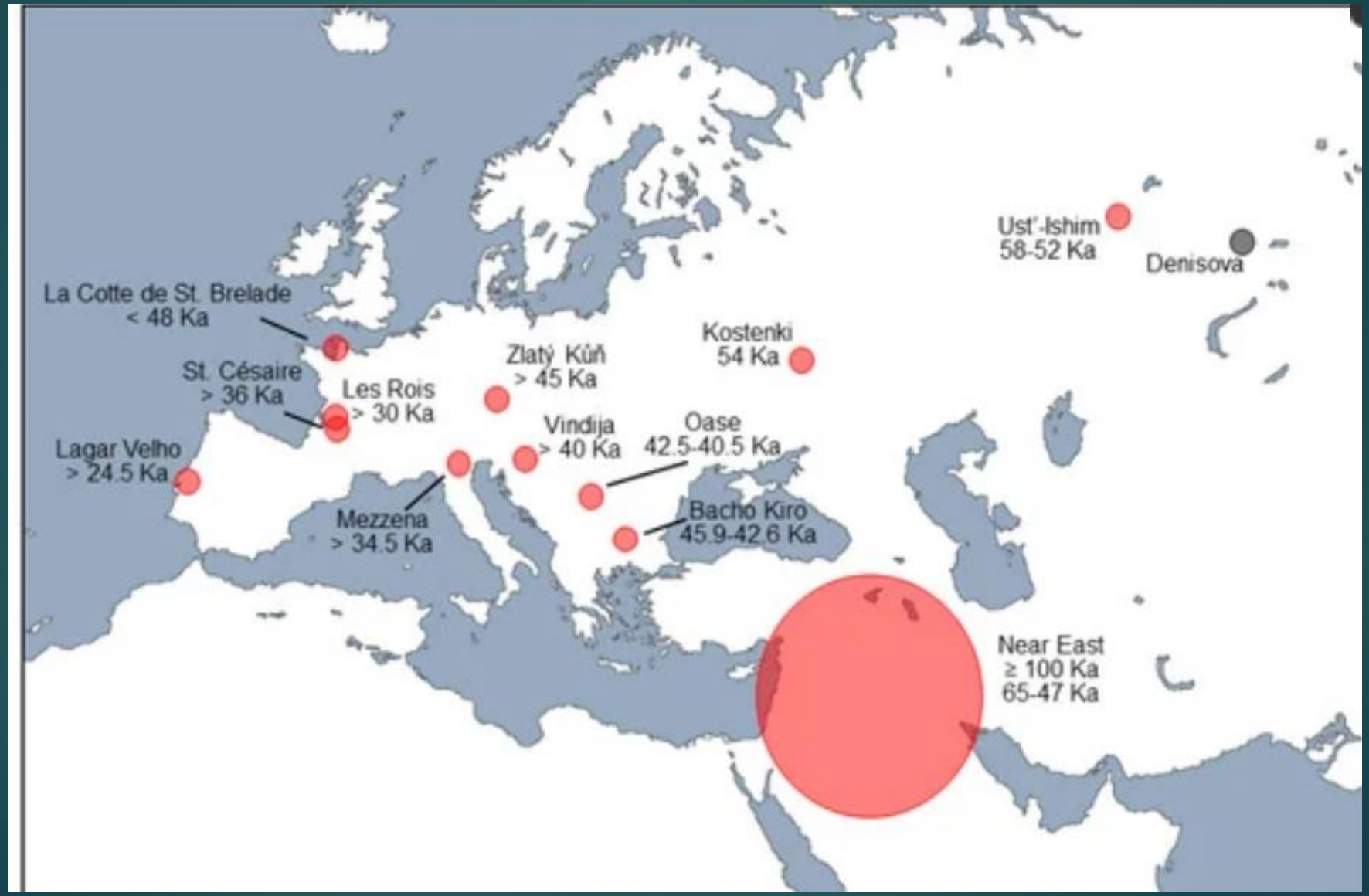
List of earliest *H sapiens* in Europe

- 270 Ka: Hohlenstein–Stadel, Germany (N femur with sapiens mtDNA)
- 210 Ka: Apidima, Greece
- 60 Ka: estimated N-MH interbreeding in Western Eurasia (Near East); consistent with introgressed modern human genes in a 50 Ka-old Neandertal from the Altai Mountains of Siberia
- 54 Ka: Mandrin Grotto, France: a tooth; then at 45 Ka
- Earliest credible evidence H. sapiens stone tools found in South-Central Europe (Bohunician industry): Brno-Bohunice and Stránská skála (Moravia) (48 Ka), Bacho Kiro and Temnata Cave (Bulgaria), Dzierzyslaw (Poland)
- 45 Ka: Ranis, Germany: 10 bones -- – (no later European descendants) (N % untested)
- 45 Ka: Zlat-ka (Czech Republic) (3% N)

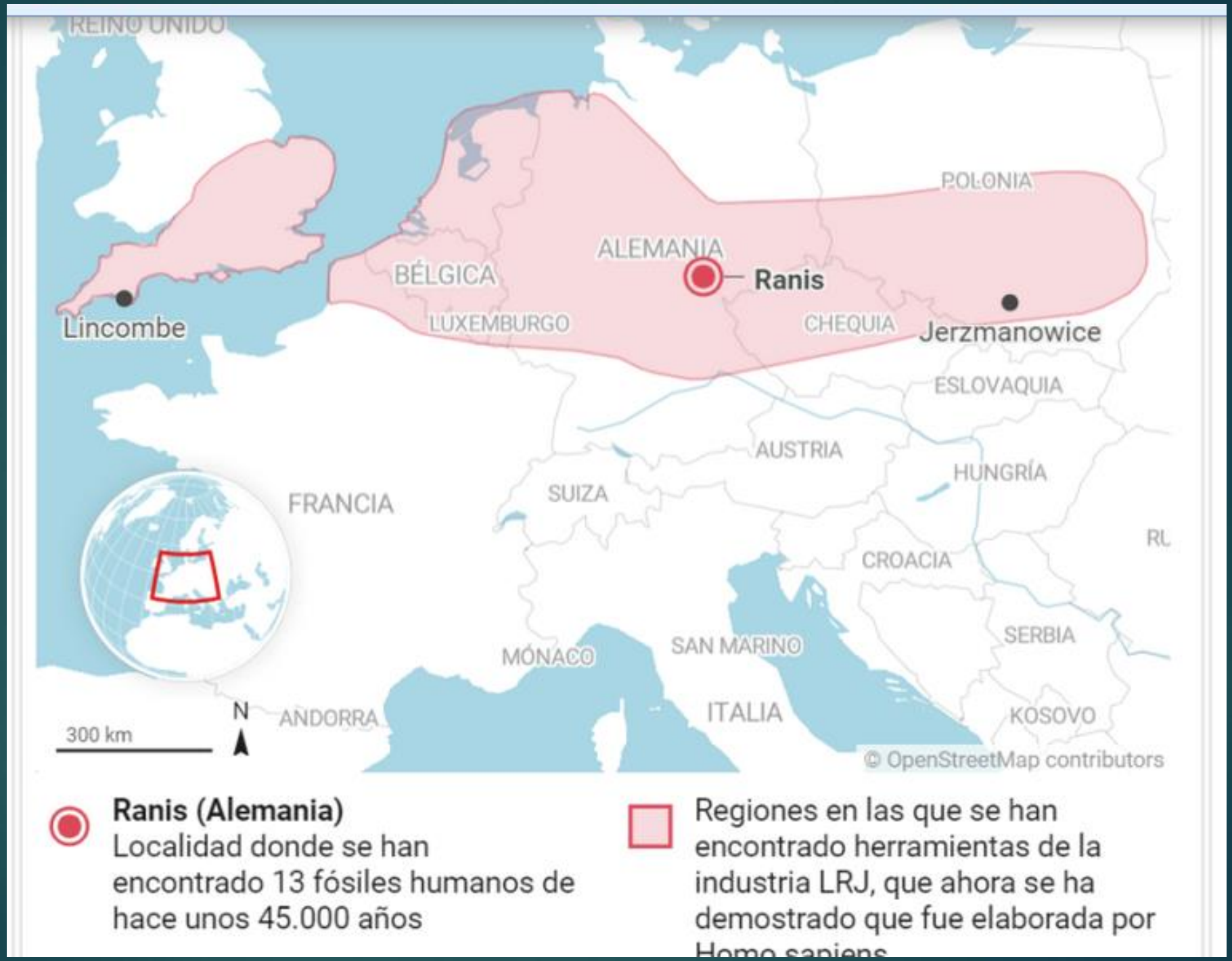
List of earliest *H sapiens* in Europe

- 45 Ka: Bacho Kiro cave, Bulgaria (3% N) ++ (had European descendants)
- 45 Ka: Ust'-Ishim, Siberia (3% N) --
- 44-42: Kent's Cave, Britain
- 42 Ka: Peştera cu Oase, Romania (6% N) --
- 40 Ka: Tianyuan, China ++
- 39-36 Ka: Kostenki 14, Russia (?% N) ++
- 38-36 Ka: Buran-Kaya, Crimea ++
- 30 Ka: Sungir, Russia (3% N) ++

Map of western Eurasia showing areas and estimated dates of possible Neandertal–modern human hybridization (in red) based on fossil samples from indicated sites.



Location of Ranis and Extent of LRJ technocomplex



Ranis – LRJ tech

- Between 1932 and 1938, stone tools were found at the Ilsenhhle site in Ranis (Thuringia, Germany) linked to a cultural period between the Middle Palaeolithic and the Upper Palaeolithic known as Lincombian-Ranisian-Jerzmanowskian (LRJ).

- This technocomplex has also been found at other sites in central and northwestern Europe, with varying datings between 44 and 41 ka.

- This culture had been associated (with difficulties) with the species *Homo neanderthalensis*.

- New excavation at Ilsenhle that took place between 2016 and 2022.

Dating

- At the base, layer 11 dates to 55,860–48,710 bp. Layers 9 and 8, associated with the LRJ, date to 47,500–45,770 and 46,820–43,260 bp, respectively
- In addition, six newly identified human bones from layer X in the 1930s collection, thought to be associated with the LRJ, were directly radiocarbon dated =46,950–42,200 bp.
- We tested 11 of the hominin remains for the preservation of ancient mitochondrial DNA (mtDNA). enabled us to identify each of the 11 skeletal fragments as belonging to ancient H. sapiens

Cold Temperature

- A temperature decline with low temperatures and an open steppe environment during all phases of the LRJ occupations.
- Temperatures reconstructed for the coldest phase, about 45,000–43,000 cal bp (overlapping with both layer 8 and layer 7), were 7–15 °C lower than those of the modern day and are consistent with a highly seasonal subarctic climate in full stadial conditions.
- LRJ at Ranis was made by hominins with H. sapiens mtDNA. This indicates that pioneer groups of H. sapiens expanded rapidly into the higher mid-latitudes before much later expansions into southwestern Europe, where directly dated Neanderthal remains are documented until about 42 Ka.

Conclusion

- Although non-directly dated and non-genetically identified, a human deciduous tooth from Grotte Mandriin also suggests an H. sapiens incursion into southeastern France as early as about 54 Ka.

- If confirmed, this evidence would create a complex mosaic picture of Neanderthal and H. sapiens groups in Europe between about 55 to 45 Ka.

- Pioneer H. sapiens groups were small and possibly left no notable genetic traces in the later Upper Palaeolithic hunter-gatherers in Europe.

- The early presence of H. sapiens in the modern day British Isles is further evidenced by the disputed dating of the Kent's Cavern maxilla, probably associated with LRJ stone tools at this site. Archaeological and mtDNA data further suggest that LRJ H. sapiens at Ranis were connected to populations of eastern and central Europe. If the Initial Upper Palaeolithic (IUP) Bohunician of Moravia and the LRJ are related technocomplexes, then the LRJ is part of the IUP expansion into Europe

Conclusion

- There are no human remains preserved from the Bohunician, but the Zlatý kůň H. sapiens skull from the Czech Republic overlaps with the dates for both the Bohunician and the LRJ at Ranis.

- Notably, nine out of ten Ranis mtDNA genomes cluster with the Zlatý kůň individual and one clusters with the Fumane 2 individual, both of whom are other early H. sapiens individuals who lived around the same time in Europe as the Ranis specimens described here.

- This connects the LRJ hominins to a wider population network of initial H. sapiens incursions into Europe.

Ns did not disappear before H. sapiens arrival

- Demonstration that the LRJ was produced by H. sapiens

- The hypothesis that Neanderthals disappeared from northwestern Europe well before the arrival of H. sapiens—which is largely based on the chronological hiatus observed between Neanderthal-made late Middle Palaeolithic assemblages and H. sapiens-made Aurignacian assemblages—can now be rejected.

Mitochondrial DNA

- All but one of the 13 Ranis fragments were quite similar to one another and, surprisingly, resembled mtDNA from the 43,000-year-old skull of a woman discovered in a cave at Zlatý kůň in the Czech Republic (who had 3% N DNA). No N DNA was analyzed in the Ranis bones.

- Those pioneering groups of modern humans adapted to the cold and a landscape of steppe and tundra, but used Ranis' cave briefly and intermittently, competing with hyenas and bears for the faunal resources of the place; longer and most intensive presence in the cave of Bacho Kiro (Bulgaria) in the same time.

Cold landscape

- Results show that cold climates prevailed across LRJ occupations, with a temperature decrease culminating in a pronounced cold excursion at ~45,000–43,000 bp.
- Humans used the site even during this very cold phase. This demonstrates that humans operated in severe cold conditions during many distinct early dispersals into Europe and suggests pronounced adaptability.
- N DNA analysis in MHs at Ranis is underway

The ecology, subsistence and diet of ~45,000-year-old Homo sapiens at Ilsenhöhle in Ranis, Germany

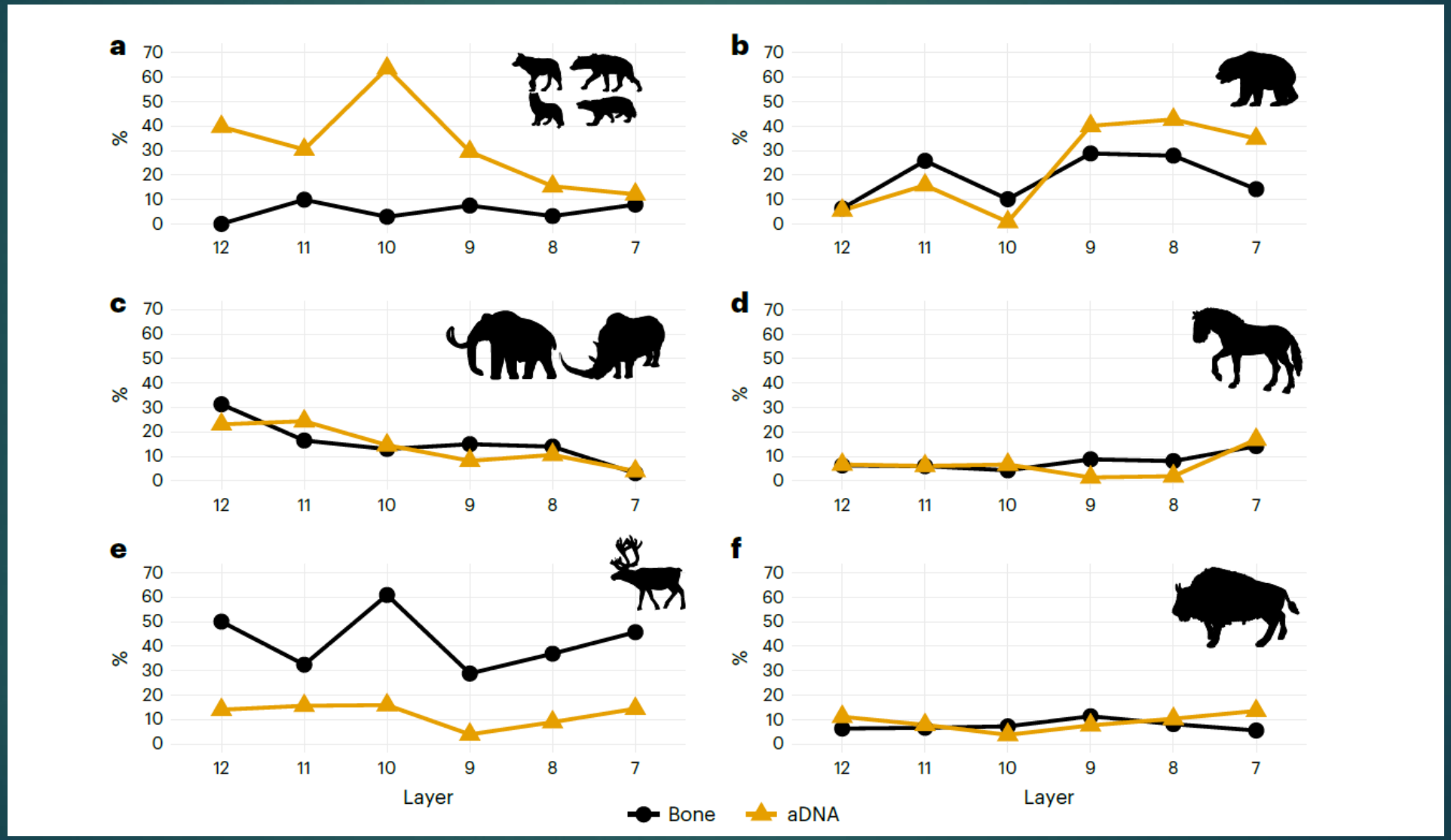
Geoff M. Smith…J-J Hublin, F. Welker, 2024

52 animals

- Bulk collagen carbon and nitrogen stable isotope data from 52 animal and 10 human remains confirm a cold steppe/tundra setting and indicate a homogenous human diet based on large terrestrial mammals.

- This lower-density archaeological signature matches other Lincombian–Ranisian–Jerzmanowician sites and is best explained by expedient visits of short duration by small, mobile groups of pioneer H. sapiens

Overview of the bone fragments and ancient mammalian DNA identified across layers 12–7 at Ilsenhöhle in Ranis.



Ranis during the cold

- Between 55 and 40 ka (layers 12–7) the large cave Ilsenhöhle at Ranis was predominantly used for hyaena denning and cave bear hibernation.

- In general, carnivore dens contain a higher species diversity compared to human accumulations, and we have illustrated the important role of carnivores in the faunal accumulation in the LRJ layers at Ranis.

- Human presence fluctuated as seen by the presence of morphologically identifiable human remains, humanly modified bones and stone artefacts.

Coldness

- H. sapiens occupation occurred initially during climatic conditions ~7–8 °C cooler than today (~48–45 ka), followed by their presence during a period of extreme cold (~45–43 ka), as indicated by abundant cold-adapted taxa (for example, reindeer, wolverine, arctic fox, woolly rhino and mammoth) and stable isotope data.
- Traces of fire use are sparse, although micromorphological analysis does indicate increased fire use in layer 87 compared to other layers at Ranis.
- Human butchery signatures are scarce and mainly focused on marrow exploitation from a range of species (equids, cervids and, occasionally, carnivores).

Carnivores dominant

- Data confirms a human diet focused on cervids (including reindeer), rhinoceros and horse suggesting these early H. sapiens populations had a diet similar to contemporary Neanderthals.
- These indicate that despite its large geographic extension, from Moravia into Britain, LRJ occupations predominantly relate to cold, open environments with grassland and shrub tundra comprising juniper, dwarf birch and willow.
- At LRJ sites cold-adapted species dominate (for example, horse, woolly mammoth, woolly rhinoceros, reindeer and lemming), and carnivores (for example, wolf, hyaena and red fox) played a dominant role in the accumulation of the faunal remains
- Conversely, human input at LRJ sites is generally low, and this ephemeral presence of human activity in carnivore dens is a common feature across the Palaeolithic

Short term visits

- Suggests a low-intensity site use by these early groups of H. sapiens and an LRJ settlement pattern dominated by short-term hunting stations.

- The scarce archaeological signature of the LRJ can be best explained by small group sizes of these pioneer H. sapiens populations.

- Their highly mobile lifestyles resulted in expedient visits of short duration at localities which are otherwise occupied by carnivores. The presence of a sub-adult individual opens up the possibility that these short-term stays included family groups