

**Before Sapiens:
The Hominin Field Before
the Surviving Species**

PIATRA . INSTITUTE

May 2026

Abstract

The boundary around *Homo sapiens* is late in the history of human capacities. Fossils from Jebel Irhoud place early members of the clade, or a population close to it, at roughly 315,000 years ago; Omo I gives a minimum age of 233,000 years for eastern Africa. By then, bipedal locomotion, stone-flake production, long-range dispersal, large-animal processing, Acheulean biface manufacture, fire use, wooden weapon production, and extended social learning already had deep histories. Bipedality and stone working reach beyond secure *Homo*. Range expansion, biface manufacture, fire practices, and organic technologies were carried by *Homo erectus*, Neanderthal-lineage populations, Denisovans, *Homo naledi*, *Homo floresiensis*, and poorly resolved regional forms. The sapiens boundary is a taxonomic stabilization inside an older hominin field. The record has the structure of a stratigraphy: upright bodies before large brains, manipulative hands before secure species assignment, tools before modern anatomy, population networks before global replacement. The surviving species inherited this field and narrowed it by outlasting, absorbing, or replacing the other lineages. Read as a stratigraphy of dated capacities, seven of eight precede the Jebel Irhoud boundary and all eight precede Omo I, the deepest by more than four million years.

1. The species boundary

The oldest fossils usually placed near the base of the *Homo sapiens* clade come from Africa in the late Middle Pleistocene. The Jebel Irhoud material in Morocco, re-described by Hublin and colleagues and dated by Richter and colleagues, is approximately 315,000 years old. Omo I, from the Omo Kibish Formation in Ethiopia, has a revised minimum age of 233,000 years. Herto, from Middle Awash, falls later, around 160,000 years ago. These dates distribute the origin problem across African populations and morphologies.

The taxonomic label performs useful work. It lets fossils be compared, regions sequenced, and lineages named. It also encourages a false compression. The capacities later gathered under *H. sapiens* predate the moment at which the label becomes stable. The species inherited a body plan older than the genus *Homo*, a technical history older than the earliest secure *Homo* fossils, and a social ecology shaped by cooperative foraging, infant dependency, and learned extraction from difficult landscapes.

Human has wider extension here than the surviving species. It names a lineage-field: hominin bodies, techniques, social arrangements, and inherited niches through which later *H. sapiens* became possible. Species differences remain real. The modern species loses its position as the source of capacities it inherited.

The phrase “before sapiens” names a substrate. Before law, myth, ritual, or explicit doctrine can make persons, organisms have to become beings for whom tools, food sharing, teaching, memory, and group inheritance can accumulate. The archaeological and fossil record gives that deeper assembly in fragments.

2. Bipedal bodies

The hominin line becomes visible through posture before it becomes visible through cranial expansion. *Sahelanthropus tchadensis*, described from Chad and dated near 7 million years ago, remains contested, but the argument around it already turns on the position of the foramen magnum and the possibility of upright locomotion. *Ardipithecus ramidus*, at 4.4 million years ago, gives a clearer body: capable of bipedal movement on the ground, still strongly adapted for arboreal life. The starting condition was a mosaic animal in a mosaic habitat.

By the time of *Australopithecus afarensis*, between roughly 3.9 and 2.9 million years ago, bipedality had become a settled part of the hominin repertoire. The Laetoli footprints, dated to 3.66 million years ago, preserve upright walking in volcanic ash. Lucy, at approximately 3.2 million years ago, gives the same conclusion through pelvis, knee, and lower limb. These bodies walked with brains still far from modern human size.

Bipedality changed more than gait. Upright posture altered the field of action: hands were freed from routine weight-bearing; infants, food, stone, wood, and carcass parts could be carried across distance; the face and chest became more available for social display; daytime movement acquired a different thermal profile. A bipedal ape can arrive with material and depart with material. Carrying turns landscape into a sequence of delayed uses.

The order is decisive. The upright body precedes large brains by millions of years. Human history begins in feet, pelvis, hands, and habitat before it begins in the cortex.

3. Stone before secure Homo

The oldest widely discussed sharp-edged stone tools come from Lomekwi 3 in West Turkana, Kenya, dated to 3.3 million years ago. They precede the earliest secure *Homo* fossils by several hundred thousand years. Their makers remain unknown. Stone-flake production begins outside any secure monopoly by the genus that later took the name human.

Oldowan technology appears later and spreads more widely. Gona in Ethiopia gives Oldowan assemblages near 2.6 million years ago. Nyayanga in Kenya, dated between approximately 3.0 and 2.6 million years ago, places Oldowan artifacts with hippopotamus butchery and *Paranthropus* teeth. Early stone technology belongs to a technical field with multiple possible makers.

A flake is a produced edge, obtained by controlling angle, force, material, and sequence. The maker has to perceive a future cutting surface inside an unstruck core. The skill can be learned, repeated, and transmitted. The tool may be simple; the tradition exceeds a single motion. The hand learns stone through a choreography that survives across bodies.

Externalized technical inheritance appears here in a minimal but durable form. One body learns from another. One generation leaves behind cores, flakes, preferred raw materials, activity sites, and failed attempts that structure the next generation's learning environment. Technique becomes a social memory held partly outside any one nervous system.

The archaeological object records an interface between hand, material, food, landscape, and teaching. A small-brained hominin with a stable flaking tradition already inhabits an inherited technical world.

4. Early Homo and continental range

The genus *Homo* enters the record in a taxonomically unsettled field. Fossils assigned to *Homo habilis*, *Homo rudolfensis*, early African *Homo erectus* or *Homo ergaster*, and other debated forms sort differently depending on jaw, tooth, cranial, and postcranial traits. Brain size increases unevenly. Body size changes unevenly. Species names mark clusters in a fragmentary record, not steps in a procession.

By roughly 1.8 million years ago, early *Homo* populations were outside Africa at Dmanisi in Georgia. The Dmanisi fossils combine small brains, variable skull form, and stone tools with a geographic fact that carries more weight than any one trait: hominins had crossed into western Eurasia before the later human suite existed.

Homo erectus is the long-duration experiment in this record. African and Eurasian populations assigned to *H. erectus* or closely related forms persisted across an enormous span of time and space. The Nariokotome skeleton, near 1.5 million years old, shows long legs and a body plan adapted for distance. The species complex reaches Java, China, the Caucasus, and Africa. For most of the period in which hominins have been recognizably human in the wider sense, something like *H. erectus* carried the long experiment.

Acheulean technology, appearing by 1.76 million years ago at Kokiselei in Kenya, gives this expansion its most visible artifact. The handaxe is portable symmetry, a repeated form maintained across huge distances and deep time. Its uses varied, and its stability matters more than any single function. To make a biface is to maintain a projected form through a sequence of removals. The tool records planning in the medium of subtraction.

Continental range was a technical and social achievement. Movement across Africa and Eurasia required unfamiliar prey, raw materials, seasons, predators, parasites, and climates to be made usable. Bodies mattered; learned ecologies made range durable. A group had to know where water might be found, which stone would fracture, how carcasses could be opened, when movement was possible, how infants survived travel, and how danger was read. The pre-sapiens human was already a geographic learner.

5. Fire as maintenance

Fire is the most difficult major capacity to date cleanly because traces are fragile and natural burning has to be separated from controlled use. The evidence at Wonderwerk Cave in South Africa, reported by Berna and colleagues, places in situ burning inside the cave at roughly 1 million years ago. The reading as controlled rather than natural rests on the microstratigraphy: burned bone and ashed plant matter sit in undisturbed layers deep inside the cave, where wildfire and lightning do not reach. Several European and Near Eastern sites produce later and stronger evidence

for repeated fire use. By the later Middle Pleistocene, fire belongs securely to hominin life in many regions.

Fire presence and fire mastery have to be kept separate. Burned bone alone is weak evidence for hearth-centered domestic life. A hearth alone is weak evidence for cooking as a universal practice. The conservative claim is already large: before *Homo sapiens*, some hominin groups brought fire into occupied spaces, preserved it, and used it in ways that altered food, space, and social time.

Fire changes the ecology of action. It extends usable hours after sunset, pushes predators away from sleeping bodies, softens food, hardens wooden tools, and creates a place around which bodies gather after foraging ends. The day acquires a second phase, less governed by search and movement.

Fire also creates an obligation. A flame has to be fed, guarded, carried, restarted, or found again. A group that depends on fire inherits a task that exceeds any momentary use. Fuel must be gathered. Embers must be watched. A hearth must be protected from rain. Maintenance enters the social order.

Later human societies wrap fire in cosmology, sacrifice, metallurgy, cooking, home, and industry. The deeper pre-sapiens fact is simpler. Fire makes a durable center in a mobile life. Around that center, longer attention, teaching, food sharing, and night speech become easier to sustain.

6. Organic technology and teaching

Large prey changes the social problem. Cut-marked bones, marrow extraction, hunting lesions, and kill or scavenging sites rarely separate hunting from aggressive scavenging cleanly. The distinction matters less than the coordination problem. Meat from a large animal is dangerous to acquire, heavy to move, divisible among many, and perishable. A carcass creates a temporary economy.

The Schoningen spears, dated around 300,000 years ago, show that pre-sapiens hominins in Europe made carefully shaped wooden weapons. The spears are usually associated with archaic humans in the Neanderthal lineage or a closely related Middle Pleistocene population. Their preservation is exceptional because wood usually disappears. Their existence implies a larger missing inventory of organic tools: digging sticks, carrying devices, handles, shafts, traps, and containers.

Teaching sits behind such objects. Complex wooden weapons require raw-material selection, shaping, balance, and use. Stone knapping requires controlled failure. Fire requires maintenance. Children in these groups inherited capacity through more than genes. They entered a world patterned by adult practice and had to be drawn into it through demonstration, correction, imitation, tolerance, and play.

Extended childhood belongs to this same structure. Human infants are costly, slow, and dependent. The dependency is an anatomical burden and a social opportunity. Long immaturity gives a juvenile time to absorb techniques whose acquisition exceeds instinctive maturation. Cooperative

breeding, food sharing, and alloparental care create the social conditions under which expensive learners can survive long enough to become useful carriers of tradition.

Social machinery is visible even where symbols are absent. Teaching leaves traditions whose stability exceeds what naive individual discovery would produce, even when it leaves no mark shaped like a word. A handaxe industry, a fire practice, a hunting weapon, and a repeated butchery sequence are records of social transmission.

7. A crowded human planet

Homo sapiens emerged onto an occupied human planet. Neanderthal-lineage populations were established in Europe and western Asia. Sima de los Huesos in Spain, dated around 430,000 years ago, gives a large Middle Pleistocene assemblage genetically closer to Neanderthals than to Denisovans. Denisovans, first recognized from DNA in a small bone from Denisova Cave, occupied an eastern Eurasian population history that fossil morphology had barely seen.

Other lineages complicate the map further. *Homo naledi*, from Rising Star Cave in South Africa, is dated between 335,000 and 236,000 years ago, contemporary with early *H. sapiens* in Africa despite its small brain and unexpected morphology. *Homo floresiensis* survives on Flores until roughly 50,000 years ago, with roots that may reach much deeper into island Southeast Asian history. *Homo luzonensis*, described from Callao Cave in the Philippines and dated to at least 67,000 years ago for one element, adds another island lineage with a mosaic of traits.

Ancient DNA changed the ontology of this period. Green and colleagues showed that Neanderthals contributed DNA to the ancestors of present-day non-African populations, a few percent of the genome in living people outside Africa. Reich and colleagues showed that Denisovans were a distinct archaic group and that their ancestry survives especially in parts of Oceania and Asia. Later work identified additional episodes of introgression among Neanderthals, Denisovans, and modern human populations. The human tree in this period is a reticulate structure, with branches that sometimes rejoin.

Species boundaries in the hominin record are real enough for taxonomy and porous enough for ancestry. Anatomical difference, cultural difference, and reproductive separation aligned imperfectly. Some groups diverged, adapted locally, met again, exchanged genes, and disappeared as visible populations while leaving traces in descendants.

Forcing the word "human" to coincide neatly with *Homo sapiens* loses the structure of this period. Neanderthals made tools, used pigments, cared for injured individuals, occupied difficult climates, and contributed to living genomes. Denisovans survive in genes before they survive as a well-described skeleton. *H. naledi* keeps morphology from doing all the explanatory work, because a small-brained hominin near the age of early *H. sapiens* may still have carried complex behavior. The category has to be historical before it can be moral.

8. The African threshold

The emergence of *Homo sapiens* belongs to a population process across Africa. Jebel Irhoud combines a modern-looking face with other archaic features. Omo I and Herto sit in eastern Africa. Genetic and archaeological arguments increasingly favor structured African populations connected by intermittent gene flow, ecological shifts, and regional cultural variation. Scerri and colleagues describe this as an origin in subdivided populations, with the explanatory weight carried by population structure across regions.

The threshold into *sapiens* gathers older capacities under a new population regime. Upright bodies, hands, stone, fire, cooperative foraging, teaching, and long-distance ranging were inherited. The change lies in density and flexibility of recombination. Middle Stone Age Africa shows regional technologies, prepared-core methods, hafting, pigments, beads, long-distance material movement, and ecological breadth. Older capacities could now be coupled in more variable ways.

The phrase “behavioral modernity” has often carried too much weight. It invites a search for one threshold after which humans became fully human. The record is patchier. Pigment use appears in different places. Ornaments appear, disappear, and reappear. Burials and mortuary treatment vary. Long-distance exchange is intermittent. Complex technologies can be lost when populations shrink or ecologies change. Capacity is carried by demography and infrastructure as well as skulls.

The *sapiens* threshold names the stabilization of a package. The species that eventually covered the planet inherited upright walking, stone, range expansion, fire, cooperative hunting, and multiple learned traditions from an older hominin field. Its power lay in recombining those inheritances across larger, denser, more connected populations.

9. Origin myths in the record

Origin stories survive by taking one real variable and making it sovereign. Encephalization is real, and brain size changed dramatically across hominin evolution. The chronology refuses brain-first explanation. Upright walking, manipulative hands, stone technology, and range expansion were operating before modern cranial form. Intelligence in the record is distributed across anatomy, group practice, landscape, and artifact.

Species labels are indispensable and dangerous. They allow comparison, but they tempt the last surviving label to absorb the histories of the dead. A trait list assigned to *Homo sapiens* will usually contain older elements. The modern species is a carrier and recombiner of inherited capacities. Treating each capacity as a *sapiens* invention compresses millions of years of hominin work into the last taxonomic label.

Technical origins have the same problem at a different scale. A tradition is larger than an invention. Stone industries, fire practices, hunting systems, and movement ecologies persist because groups reproduce them. Invention occurs; survival depends on transmission. A tool form that lasts across hundreds of thousands of years is a social achievement before it is an individual achievement.

Replacement was the outcome of a longer process. *H. sapiens* became the only surviving hominin

species, and replacement happened in many places. The genetic and archaeological record still preserves mixture, overlap, borrowing, coexistence, and local disappearance. The human field narrowed late.

Later cultural categories depend on this older scaffold: bodies that carry, hands that make, groups that teach, foods that are shared, fires that are maintained, and landscapes remembered across generations. The scaffold is older than the categories built on top of it.

10. The stratigraphy, measured

The chronological claim can be made exact. The eight capacities are those with a single securely dated first appearance in the record above: bipedal locomotion, stone-flake production, large-animal butchery, Oldowan technology, continental dispersal, the Acheulean biface, controlled fire, and wooden weapons. Capacities whose onset has no one defensible date, symbolic marking and habitual cooking among them, are left out rather than dated by guess. Taking the earliest securely dated marker of each, and the Jebel Irhoud date of 315,000 years as the sapiens boundary, seven of the eight capacities predate the boundary. Measured against the Omo I minimum of 233,000 years, all eight do. The one capacity that does not clear the older boundary is wooden weapon manufacture, whose securely dated instance at Schoningen falls at 300,000 years, just inside Jebel Irhoud and well before Omo I.

The leads are not marginal. Bipedal locomotion, the deepest capacity in the set, precedes the boundary by 4.085 million years. The capability set spans 4.1 million years from upright walking to shaped wooden spears, and its median member precedes the boundary by 1.885 million years. Stone-flake production at Lomekwi precedes the earliest secure *Homo*, and continental dispersal at Dmanisi precedes the boundary by close to one and a half million years. The order is the one the opening asserted: upright bodies, then worked stone, then large-animal butchery, then range, then fire, then organic weapons, with the species boundary arriving last.

The boundary was also crowded. At least five other hominin lineages occupy the same window, from the Neanderthal-lineage population at Sima de los Huesos near 430,000 years through *Homo naledi*, the Denisovans, *Homo luzonensis*, and *Homo floresiensis*. The sapiens threshold is a stabilization inside this field, not its first appearance.

The dates are point estimates from the cited literature, not original measurements; the computation in `simulation/uv_run_run_all.py` reports only their stratigraphic relations, and writes every value to `simulation/output/results.json`.

11. Conclusion

The pre-sapiens record gives a layered inheritance. Bodies walked and carried. Hands learned stone. Groups divided carcasses, maintained fire, moved through remembered landscapes, shaped wood, tolerated dependent learners, and kept fragile traditions alive across generations.

By the time *Homo sapiens* appears, the human field is already old. Several lineages had carried parts

of it. Some left fossils, some left tools, some left DNA, and some left only gaps where the record should be. The modern species stands late in the sequence, inheriting capacities built across other bodies and other worlds, then becoming the population in which those capacities were amplified, recombined, and carried forward after the other human lineages disappeared.

The earlier lineages were participants in the same deep field of technical, social, and ecological experimentation. The surviving species is one historical outcome of that field. Its distinctiveness is real. Its inheritance is older.

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