

Homo erectus



Tbilisi, September 2026

100 + 35

Conference Abstracts

Session I – Reassessment and Evolutionary History of *Homo erectus*

Keynote lecture

The History of *Homo erectus*

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Abstract

This presentation focuses on the most geographically widespread and one of the longest-lived early hominin taxa. It reviews the history of the discovery and recovery of the *Homo erectus* hypodigm in Eurasia and Africa, considers the strengths and weaknesses of different taxonomic interpretations of that hypodigm, and explores how researchers have viewed its evolutionary history over the more than 130 years since Dubois proposed *Pithecanthropus erectus* provided a link “from the anthropoid apes to Man”.

Oral Presentations

What remains to be discovered about the brain of *Homo erectus*?

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Abstract

Palaeoneurology is inherently a challenging field because the anatomical structure we seek to study—the brain itself—is no longer preserved. Consequently, the internal surface of the cranial cavity, the endocast, is used to infer brain morphology. Although the skull and brain develop in close association throughout an individual's life, the precise nature of this relationship has remained poorly quantified. As a result, the traditional interpretation of endocranial morphology and surface depressions as proxies for cerebral structures relied largely on indirect anatomical inference rather than on direct validation.

We recently conducted a detailed analysis of the brains and their corresponding endocranial surfaces of 75 living individuals to improve the interpretation of endocranial imprints. This reference dataset is now being used to reassess the fossil record and refine our understanding of brain evolution.

Here, we present a comprehensive description of brain size and morphology in numerous specimens attributed to *Homo erectus*, together with a detailed assessment of endocranial imprints, explicitly indicating our level of confidence regarding their correspondence with cerebral sulci. Our results show that the brain of *Homo erectus* differs from those of the well-represented recent species *Homo neanderthalensis* and *Homo sapiens* in terms of size, shape, and overall proportions. The fossil record further demonstrates that brain evolution was not a linear process driven primarily by increasing brain size.

Moreover, identifying cerebral imprints in *Homo erectus* remains particularly challenging because of the limited preservation of endocranial features and the species' distinct cerebral organization compared with living humans, which currently serve as our reference model for interpreting fossil endocasts. These findings indicate that much remains to be discovered about the brain of *Homo erectus*.

Palaeoproteomics and human evolution: what's going on and what's next

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Abstract

Palaeoproteomics has rapidly matured from a proof-of-concept technique into a valuable tool to investigate human evolution. Its established power lies in retrieving deep-time molecular information, often succeeding where ancient DNA fails. Recent applications contributed to: (i) reconstruct the phylogeny and diversity of extinct taxa, (ii) determine the sex of fragmentary fossil remains from tooth enamel peptides, and (iii) push the timeline for the recovery of genetic information beyond ten million years. Looking forward, the next phase of palaeoproteomics promises to move beyond simple protein identification towards more detailed biological narratives. The major frontiers include the systematic analysis of even older material, the recovery of richer proteomes, and the integration of machine learning for more sophisticated data interpretation. As analytical sensitivity improves, palaeoproteomics could address increasingly complex questions about human evolution and human-environment interactions.

New insights into locomotor adaptations of the Dmanisi hominins

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Abstract

At ca. 1.85-1.77 Ma, the Dmanisi hominins are an important benchmark for evaluating locomotor adaptations in early *Homo*. For example, the postcranial elements of Dmanisi hominins, offering the earliest examples of hominin postcranial morphology outside of Africa, are featured in arguments for selective pressures favoring expanded ranging behavior in early *Homo*, specifically evidence of improved walking economy. Here, new analyses of select Dmanisi postcranial bones are integrated into the body of work documenting a mixture of more and less derived features in the lower limbs of these hominins. Features of Dmanisi long bone diaphyses and articular dimensions, when contextualized within a comparative framework of extant hominoids and fossil hominins, continue to portray postcranial adaptations that combine a tantalizing mix of more and less derived traits. Less derived traits continue to be relatively more prominent in the leg and foot. This reinforces the notion that Dmanisi hominins do not appear to have been as modern human-like in their walking performance as subsequent members of genus *Homo*, and that the initial hominins migrating out of Africa likely exhibited different walking mechanics than later members of genus *Homo* still in Africa. Postcranial adaptations favoring the efficient bipedalism that

exemplifies modern humans were still an evolutionary work in progress during the initial half of the Early Pleistocene.

Postcranial anatomy of the Dmanisi hominins: body form, habitual locomotion, and early Homo dispersal

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Abstract

At 1.77 Ma, Dmanisi preserves a partial subadult skeleton and postcranial remains from several adults, offering a rare view of body form and habitual locomotion during early Homo dispersal into Eurasia. This presentation integrates evidence from the vertebral column, pectoral girdle, upper limb, lower limb, and foot.

The axial skeleton is compatible with upright posture and habitual bipedal loading, and three-dimensional analysis places the immature Dmanisi lumbar vertebra within the range of age-comparable modern humans. The upper limb retains low humeral torsion and a distinctive pectoral-girdle configuration, although shoulder orientation cannot be reconstructed from any single anatomical variable. The lower limb and foot demonstrate habitual terrestrial bipedalism. Relatively elongated lower limbs, human-like ankle function, a longitudinal arch, and an adducted hallux indicate effective striding locomotion. Analysis of the adult femur adds an important dimension. Modern-like femoral-to-humeral shaft strength and femoral-neck cortical distribution indicate full commitment to terrestrial bipedalism, without evidence of a substantial arboreal component. Nevertheless, the relatively small femoral head, superoinferiorly expanded femoral neck, and non-mediolaterally expanded proximal shaft imply reduced and differently oriented hip-joint and gluteal-abductor forces compared with African *Homo erectus* and recent humans. These features may reflect greater lateral displacement of the body's center of mass during single-limb support. Low tibial torsion, unusual metatarsal robusticity, fifth-metatarsal internal structure, and talar morphology reinforce this distinctive habitual loading pattern.

The Dmanisi postcranium therefore documents modular evolution: fully terrestrial bipedalism coexisted with distinctive axial, upper-limb, femoral, and pedal morphologies. Its gait differed subtly but meaningfully from the typical African *Homo erectus* and recent-human pattern. In a heterogeneous landscape and Mode 1 archaeological context, this locomotor configuration was sufficient for Eurasian dispersal. It may reflect either an early dispersal predating typical Homo

erectus gait mechanics or ancestry from a contemporaneous non-erectus African lineage, without requiring multiple taxa at Dmanisi.

The disappearing act of the wisdom tooth

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Abstract

Agensis of wisdom teeth, or third molars is a common feature of modern humans. The prevalence of missing third molars varies among populations, and is thought to be relatively recent change in human evolution. Developmentally, third molars are the last molars to be initiated, and their development and eruption is typically delayed in mammalian species. Experimental studies on mouse molars suggest that third molars do not develop when the size of the second molar is about half of the first molar. Humans are exceptions to the experimental prediction because in the individuals lacking third molars, the size of the second molar remains quite similar to that of the first molar. In addition to humans, there are other mammalian taxa that show comparable agensis of their third molar. I will examine comparative data showing third molar agensis, and discuss these patterns in the context of third molar agensis and molar proportions in early *Homo*.

Scars of Survival: Trauma, Disease, and Death among the Dmanisi Hominins

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Abstract

The Early Pleistocene site of Dmanisi (Georgia; 1.81–1.76 Ma) has yielded an unparalleled assemblage of hominin remains representing at least five individuals from a single paleodeme. Beyond their importance for understanding the earliest dispersal of *Homo* into Eurasia, these fossils provide a rare glimpse into the health, disease, injury, and mortality of some of the earliest humans living outside Africa.

Here we present paleopathological evidence from several Dmanisi individuals, revealing a population exposed to substantial biological and environmental challenges. Three individuals two mature adults (D2280, D4500) and an elderly edentulous (D3444), most probably males, exhibit cranial lesions consistent with healed blunt-force trauma. The location and morphology of these

injuries suggest episodes of possible interpersonal violence, raising the possibility that physical aggression was a recurring component of social behavior.

Among the most remarkable findings is a rare osteogenic neoplasm identified on the frontal bone of the edentulous individual D3444. Macroscopic and CT analyses support the diagnosis of osteoma, representing one of the earliest known examples of a bone tumor in the genus *Homo*.

Evidence for mortality-related events is also preserved. The adult cranium D2280 exhibits perimortem damage consistent with carnivore activity, potentially inflicted by one of the big carnivores present at Dmanisi about 1.8 million years ago, providing a rare glimpse into the dangers faced by early humans on a new continent.

Together, these findings suggest that life at Dmanisi was marked by conflict, disease, predation, and survival. The Dmanisi fossils preserve not only the anatomy of some of the earliest migrants but also the biological and social challenges they faced nearly 1.8 million years ago.

New conceptual issues on hominin phylogeny and their implication regarding *Homo erectus* evolutionary paradigms

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Abstract

Since the attribution of the first fossils to *Homo erectus* at the end of the nineteenth century, the intraspecies morphological and morphometric variation, geographical distribution, and taxonomic status of this species have been the subject of acrimonious ongoing debate. Controversies intensified as new discovery of additional fossil material were made, raising the fundamental questions regarding concepts of species variation and delimitation, taxonomic significance of anatomical characters used to define different groups, methodologies employed to differentiate these groups and, more particularly what ought to be the definition and composition of the genus *Homo*.

The Dmanisi fossils occupy a central position in light of this context. With successive new discoveries taxonomic designations proposed for these specimens generated extensive discussion and disagreements. This exemplifies the persistent lack of consensus related to the number of species represented within the *Homo* hypodigm, the morphological criteria used to delimit these species and assess their relationships, and the absence of a consistent methodological framework for investigating taxonomic diversity within the genus *Homo*.

In this presentation, we provide a concise overview of the principal hypotheses regarding taxonomic diversity within the genus *Homo* and discuss their implications for interpreting morphological variation—particularly among the Dmanisi specimens—as well as for models of

hominin dispersal and phylogenetic inference. We also review the major phylogenetic hypotheses that have been proposed, the methodologies on which they are based, and several methodological considerations relevant to evaluating the phylogenetic position of the different *Homo erectus* groups and the Dmanisi hominins.

Revisiting African early *Homo* and the Dmanisi hominins

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Abstract

The virtual reconstruction of the *Homo habilis* holotype OH 7 prompted an evaluation of the fossil record of early *Homo*, including several of the specimens discovered at Dmanisi, Georgia¹. Analyses of the mandibular and maxillary dental arcades showed that the shape variability in the sample is most consistent with the presence of three species, *H. habilis*, *H. rudolfensis* and *H. erectus*. The comparative context of this study included modest samples of extant humans and great apes to quantify intraspecific and interspecific variation, as well as the casts of a few mandibles and maxillae of *A. afarensis* to represent ancestral morphology. Following up on this study a major effort was made to explore gnathic morphology in more detail in both extant and extinct hominine species²⁻⁴. The greatly expanded extant sample includes *Homo sapiens* and all species and subspecies of *Pan* and *Gorilla*². Moreover, the full *A. afarensis* sample from Hadar and Laetoli was analyzed to assess early hominin gnathic morphology based on one of the largest and well-preserved hypodigms in the human evolutionary record. Informed by our improved understanding of intraspecific and interspecific variation, analyses of dental arcade diversity among early *Homo* fossils can now be revisited, incorporating additional specimens such as D4500. Apart from assessing the three established early *Homo* species, we will explore the degree and pattern of variation shown by the three dentulous Dmanisi individuals, and make comparisons with other early *Homo* specimens.

The Anatomy of dispersal: new perspectives from the Dmanisi postcranium

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Abstract

The Dmanisi hominin assemblage, dated to approximately 1.77 Ma, provides a unique window into the biology of *Homo* during the earliest well-documented dispersal beyond Africa. Although research at Dmanisi has transformed our understanding of morphological variation in early *Homo*, much of this discussion has centred on its exceptionally rich cranial and dental record. The postcranial remains, particularly the lower limb, have received comparatively less attention despite their importance for reconstructing body form, locomotion, and dispersal capabilities.

This talk has two main aims. First, I will review current knowledge of the Dmanisi postcranium, focusing on the lower limb and previous anatomical and functional interpretations of the femoral, tibial, patellar and pedal remains. These findings are considered within the broader morphological diversity of Early Pleistocene *Homo*, including comparisons with the East African fossil record and specimens commonly attributed to *Homo erectus*. Second, I will explore the potential of newly identified pelvic and lower-limb remains, together with recent methodological developments, to expand this anatomical framework and address evolutionary questions related to locomotion and body shape. I will discuss how these fossils, together with the previously described material, may benefit from recent methodological developments in paleoanthropology. These include virtual reconstruction and statistical shape modelling of fragmentary remains, three-dimensional geometric morphometrics, analyses of internal bone structure and biomechanical properties, finite element analysis, and integrated approaches to joint and lower-limb function. Such methods also offer new opportunities to compare Dmanisi with key African and Eurasian Early Pleistocene fossils and to investigate morphological variation beyond traditional element-by-element comparisons.

Ultimately, integrating existing evidence, newly identified remains, and emerging analytical approaches may allow us to move from describing individual anatomical features towards reconstructing the Dmanisi locomotor system as a whole. This provides a framework for addressing a broader evolutionary question: what anatomical configurations of the postcranial skeleton were sufficient to enable the earliest successful dispersals of *Homo* beyond Africa?

The Relationship Between Time, Distance, and the Interpretive Framework for Dmanisi

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Abstract

Twenty years ago I completed my doctoral thesis focused on the Dmanisi mandibular assemblage with the primary aim of testing whether or not the sample could be accommodated within a single hominin taxon. Two decades later, it is interesting to reflect on how much our understanding of this question has changed given the subsequent work at Dmanisi, as well as the advances within the broader field. Even some of the more basic questions, such as whether or not the Dmanisi hominin assemblage consists of one species or two, remain not fully resolved. One of the most significant changes in our understanding of human evolution since the early 2000s has been the framework through which we understand the process of dispersal, range expansion, and hominin interactions associated with the emergence of *Homo sapiens* in the later Pleistocene. I argue that our refined understanding of mobility, population dynamics, and the phylogenetics of later Pleistocene hominin populations provides new ways of addressing lingering questions that are site-

specific to Dmanisi, as well as broader questions about the relationship between Dmanisi and the initial emergence of *Homo erectus* out of Africa in the Lower Pleistocene. While the relationship between Neandertals, Denisovans, and *Homo sapiens* is a later human story, the insights we have gained on that story provide new ways of exploring *Homo erectus* as the first “cosmopolitan species,” as well as the critical place of the Dmanisi site.

Inspecting the semicircular canal morphology of early Homo from Dmanisi: Taxonomic and phylogenetic implications

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Abstract

The Dmanisi hominin sample offers the opportunity to investigate the morphological variation and evolutionary relationships of the earliest known *Homo* assemblage out of Africa. However, the taxonomy and phylogenetic relationships of this paleodeme with other Plio-Pleistocene hominins are debated. We applied a diffeomorphic deformation 3D geometric morphometric approach to investigate the shape of the semicircular canals and vestibule of the Dmanisi specimens in comparison with a Plio-Pleistocene hominin sample, as well as extant *Homo sapiens* and *Pan* with the aim of exploring intra- and inter-taxic variations.

Four of the Dmanisi individuals exhibit greatest affinities with African early *Homo*, albeit with some morphological variation, due to the possession of relatively small and somewhat vertically compressed anterior and posterior semicircular canals, as well as a relatively large lateral canal. D4500 differs from the others and from early *Homo* specimens due to its larger lateral semicircular canal and mediolaterally compressed posterior one. The same signal is suggested by a canonical variate analysis performed using hominin genera as grouping factor: all Dmanisi specimens are classified as *Homo*, although one side of D4500 falls outside the typical range of variation of the comparative *Homo* sample and plots closest to the *Paranthropus* group. All individuals besides D2280 represent outliers for all groups based on typicality probabilities. To test whether the Dmanisi variation exceeds intraspecific thresholds, we conducted a bootstrapped morphological disparity analysis on the full sample including extant species. The semicircular canal and vestibule shape disparity of the Dmanisi sample appears comparable to that of modern humans and slightly higher than in chimpanzees and, particularly, bonobos.

Despite being roughly contemporaneous, no clear affinities are recovered with Asian *Homo erectus*, as the latter shows a derived, later *Homo*-like morphology, whereas Dmanisi demonstrates closest similarities to African early *Homo* (*H. habilis* and *H. rudolfensis*). Taken together, these results are consistent with the presence of a single, morphologically variable early *Homo* paleodeme at Dmanisi.

A meta-analytic examination of the reliability of character-based phylogenetic analyses for fossil taxa

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Abstract

Despite significant advances in paleogenomics, phylogenetic hypotheses for pre-600,000 YBP fossil taxa are reliant on character-based analyses. Several hypotheses for the evolutionary relationships of known hominin taxa have been offered, using discrete characters in parsimony analyses (e.g. Strait et al., 1997; Strait and Grine, 2004; Mongle, et al., 2023). However, the reliability of these character-based studies was challenged by a series of papers by Collard and colleagues (e.g. Collard and Wood, 2000, 2001; Collard et al., 2001).

To examine the utility of character-based parsimony analyses broadly, we examined primate cladistic phylogenies, many generated after the publication of Hennig in English and before the widespread availability of molecular systematics. These results were contrasted with later molecular based phylogenies. We used a variety of metrics of tree dissimilarity to quantify the difference between the molecular and character-based trees, including Robinson-Folds, Jaccard, Matching Split, Nodal Split, Mutual Cluster, Cophenetic, and MAST. We examined trees at many levels of precision – from small clades that resolve species within genera to broader trees at the genus and above. Statistical significance was quantified by generating distances for the same statistics among 1000 random trees with the same number of tips as the clade examined. Each set of 1000 trees generates 0.5 million distances (for each metric). These distances make a distribution against which the original dissimilarity can be evaluated.

Our results indicate that in almost no case was there complete concordance between the character-based tree and the molecular tree. However, the character-based phylogenies were not in any sense

‘far’ from the molecular trees. Results showed a range of distances values relative to the randomly generated trees, but the average was well below 0.05 of the distance distributions. We interpret these results to indicate that character-based parsimony analyses show a broad reliability to reconstruct the evolutionary tree of taxa and instill some faith in our character-based phylogenetic hypotheses for fossil humans.

Investigation of the dental structural organization of the Dmanisi hominins: Taxonomic and phylogenetic implications

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Abstract

During the last couple of decades, the taxonomy and evolutionary relationships of the Dmanisi hominins were intensely debated. They are generally attributed to *H. erectus* s.l., but were sometimes regarded as a distinct species (*Homo georgicus*), or even considered to represent two distinct coexisting taxa: *H. erectus* and another hominin. Compared to crania, for which complete and undeformed hominin specimens are sparse in the Late Pliocene to Early Pleistocene record,

teeth are the most abundant elements and preserve valuable taxonomic and phylogenetic information in their structure. We investigate various aspects of dental structures, including the morphology of the enamel-dentine junction (EDJ), pulp and roots of the three individual preserving teeth: the D2700/D2735 adolescent, the D2282/D211 young adult and the D4500/D2600 adult. From our observation of non-metric traits of the EDJ, all specimens exhibit a similar combination of features including developed expressions of the Carabelli trait and protostylid, short dentine horns, long lower molar roots. In two individuals (D2700/2735 and D4500/D2600), these features are more developed than in *H. erectus* s.l., resembling the morphology of *Australopithecus* and *H. habilis*, as well as *Meganthropus*. D2282/D211 exhibits less marked accessory traits, showing a more intermediate morphology between *H. erectus* s.l. and *Australopithecus*-*H. habilis*. Interestingly, D2282/D211 has smaller teeth than the other two individuals from Dmanisi, which could also be related to the difference in morphology. In addition, the latter two individuals exhibit anomalies at EDJ level, including a feature consistent with *dens evaginatus* in the central basin of the right M³ of D2700/D2735 and a vertical slit along the hypoconid of the right M₃ of D4500/D2600. While the case of D2282/D211 and D2700/2735 are more difficult to interpret, D4500/D2600 differs in dental morphology from *H. erectus* s.l. and may represent another hominin lineage that dispersed outside Africa rather than a typical representative of *H. erectus* s.l.

Session II – Life History and Behavioral Aspects of *Homo erectus*

Keynote lecture

Dmanisi: An Archive of Earliest Adaptations to Temperate Eurasia

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Abstract

The discovery of many well-preserved hominin fossils at Dmanisi has established the site as a unique record of the early dispersal of hominins from the tropics to temperate Eurasia. The significance of those fossils has been enhanced by the dating of the site and paleoenvironmental reconstructions enabled by study of rich paleontological data. This set the stage for ongoing studies of the adaptations of the Dmanisi population to the regional landscape. A major component of our studies is an archaeological testing program designed to define the stratigraphic and spatial extent of artifacts and faunas over the Dmanisi promontory. These tests show that stratified deposits of Stratum A and B are preserved over at least > 4 Ha of the promontory. This is compelling evidence for repeated occupations by a well-established and highly mobile population in the southern Caucasus. Testing also showed that pipe and gully deposits are spatially confined to the northern part of the upper promontory; this lead to excavation of three blocks containing hominin fossils and identified targets for future excavations. Importantly, tests also revealed targets for excavation of occupation materials in the large areas with artifact-bearing stratified, buried surfaces in both Stratum A and Stratum B deposits on the lower promontory. This opportunity to recover materials from multiple strata over a large area define Dmanisi as a unique archive of evidence for early *Homo erectus* adaptations and behaviors.

Oral Presentations

First *Homo erectus* of Anatolia: An extraordinary fossilization environment and exceptional recovery

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Abstract

Anatolia occupies a pivotal geographical position for understanding the dispersal and settlement of early humans throughout the Old World, lying at the crossroads of Africa, Europe, and Asia. In 2002, a fragmentary hominin cranium was discovered within travertine deposits at the Kocabaş locality in the Denizli Basin, southwestern Anatolia. A multidisciplinary chronological study combining cosmogenic nuclide dating ($^{26}\text{Al}/^{10}\text{Be}$) and paleomagnetic analyses established an age of approximately 1.1 Ma for the fossil-bearing layer. This chronology is further supported by the associated Late Villafranchian large-mammal assemblage.

Three-dimensional reconstruction of the Kocabaş cranial remains demonstrated that they belonged to a single young-adult individual. Comparative morphological and metric analyses of Pleistocene hominin specimens from Africa, Asia, and Europe indicate that the Kocabaş individual falls within the morphological variability of *Homo erectus*. Its anatomical affinities with African and Asian *H. erectus* specimens highlight the significance of Anatolia as a geographical and evolutionary interface between populations dispersing across Eurasia. Its age, anatomical characteristics, and geographical position make the Kocabaş hominin important evidence for the early occupation of Anatolia and contribute to filling a major palaeoanthropological gap in the Eurasian fossil record. In conventional archaeological and paleontological research, fossil remains are typically recovered through controlled excavation within sedimentary sequences. The Kocabaş fossil is exceptional because it was not originally deposited within a conventional sedimentary layer; rather, it was preserved through rapid burial by ambient calcium-carbonate precipitation in a hydrothermal setting. In such an environment, plant, animal, and other organic remains may become successively encapsulated, making rapid carbonate precipitation a fundamental taphonomic mechanism distinct from conventional sedimentary fossilization.

Following the cessation of the hydrothermal system, potentially driven by tectonic activity, the accumulated calcium carbonate undergoes diagenesis and lithification, ultimately forming travertine. Because travertine is widely quarried and processed as a building stone, paleontological materials preserved within it may be exposed incidentally during extraction and cutting. The Kocabaş hominin fossil was discovered precisely in this context, during the industrial extraction and processing of travertine.

Thus, the Kocabaş fossil is distinctive not only because of its unusual mode of discovery but also because of its geological setting, taphonomic history, and preservation mechanism. It represents an exceptional example of hominin fossilization in which rapid calcium-carbonate precipitation within an open-atmosphere geothermal system played a central role in the burial and preservation of organic remains. This unusual geological context demonstrates that travertine-forming systems may constitute an underrecognized source of palaeoanthropological evidence and highlights the potential importance of industrially exposed travertine deposits for the recovery of otherwise inaccessible fossil remains.

Barranco León and Fuente Nueva 3 (Orce, Andalusia, Spain): Behavior and Adaptation of the First Hominins in Western Europe

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Abstract

Since their discovery in the 1990's, ongoing excavations and multidisciplinary research at the open-air Oldowan sites of Barranco León and Fuente Nueva 3 (1.4 Ma and 1.2 Ma, respectively) in the Orce Archeological Zone of the Guadix-Baza depression (Granada, Spain), continue to provide valuable information about the behavior and adaptive flexibility of the first hominins to arrive in western Europe. In recent years, multi proxy investigations have established a baseline from which to interpret evidence from the stone tool kits, offering a clearer picture of the survival strategies and behavioral adaptations that enabled hominins to thrive in the shifting landscapes of Early Pleistocene Europe. Results from these multilevel sites designate a mosaic of landscapes, characterized mainly by lacustrine and palustrine settings and dominated by open Mediterranean woodlands. While situated only a few kilometers apart, each site presents distinct depositional contexts that conditioned lithic raw material sourcing and techno-economic choices, while assemblage variability suggests a broad range of activities carried out both at and beyond the excavated localities. Despite this variability, the abundant stone tools manufactured from local limestone and flint are distinctively Oldowan in nature. With the notable exception of spheroids, they lack standardized large and small format tools, although specifically patterned technologies reveal a coherent set of cognitive templates that must have been shared and transmitted through time. Occupying the resource-rich, water-dominated landscapes of the Baza paleolake system, early hominins transformed stone-tool production and use into a key adaptive strategy. This investment likely enhanced their ability to exploit diverse resources and compete successfully within ecosystems inhabited by a rich guild of large herbivores and carnivores, facilitating their long-term persistence at the westernmost edge of Eurasia.

Orozmani: A New 1.8-Million-Year-Old Early Pleistocene Site in Georgia

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Abstract

Orozmani represents a newly discovered, highly significant, and unique Early Pleistocene archaeological site in the South Caucasus, located 13 km west of the famous Dmanisi site. According to geochronological data, the site is dated to 1.77–1.83 Ma and is stratigraphically bracketed between two volcanic lava flows: the lower porous Mashavera basalt (1.83 Ma) and the upper massive Orozmani basalt (1.77 Ma). Despite a highly limited excavated area of only 17 square meters, the site has yielded an exceptionally high concentration of archaeological and paleontological material. Fieldwork has recovered approximately 200 Oldowan-type lithic artifacts—primarily represented by flakes, cores, choppers, and debris—associated with a diverse

Early Pleistocene fauna. Additionally, a palaeo-surface was fragmentarily documented during the 2025 excavation season. The exceptional scientific uniqueness and international significance of the site are underscored by the direct discoveries of fossil hominin remains: a hominin (*Homo erectus*) tooth discovered in 2022 (identified as a lower left fourth premolar – LIP4) and a hominin mandible excavated during the 2025 season. Phytolith analyses and the carbonate characteristics of the sedimentary layers (B1 and B2) indicate a progressive aridification of the environment, transitioning from warm and humid conditions to a drier climate. This transition coincides with the end of the Olduvai subchron and closely parallels the late stages of the Dmanisi “A” layers. Given the unique scientific material recovered from such a constrained area, Orozmani is rapidly emerging as a palaeoanthropological site of global significance.

Tool-Supported Scavenging – A Cutting-Edge Advantage

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Abstract

Scavenging is considered as one of the early options for hominins when they began to include meat and fat in their diets. This strategy does not rely on killing skills or advanced technology, ensuring nevertheless access to animal tissues as valuable food resources. Carcasses are abundantly available in all ecosystems from the equator to the poles, and they come in all sizes. However, in the presence of other predators, time which can be spent interacting with a carcass becomes a critical variable. A rapid removal of animal tissues from a carcass reduces the impact of competition with other predators.

The Cut&Run ABM allows to quantify the advantage humans gain from tool-supported scavenging and allows to compare it with strategies where hominins exploit carcasses without tools. The Cut&Run ABM simulates competition with other scavengers and allows to measure various monitoring variables like survival rates, time budgets or return rates. We designed two different scenarios to compare tool-supported versus unsupported scavenging strategies. In the unsupported scenario, hominins start a scavenging trip, when they feel hungry. They approach a carcass as a group and consume meat and fat directly at the carcass until they are disturbed or they replenished their energy deposits. In the tool-supported scenario, hominins start slicing parts off a carcass when they find one. These parts are subsequently transported to a safe area, where they are consumed without further disturbance. This advantage, however, comes with costs of searching for raw materials, transport, and tool manufacture.

We introduce the Cut&Run model and measure, compare, and discuss various output variables. The model allows us for instance to measure return rates under various resource densities, to count

encounters between hominins and carnivores at and beyond carcasses, and to monitor time budgets. The model therefore allows to characterize scavenging behavior on a quantitative level, and is ready to be calibrated for local fossil communities.

The Engel Ela Basin (Danakil Depression, Eritrea): An Early Pleistocene Acheulian Site on the Way to Eurasia

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Abstract

The Engel Ela Basin, in the NW sector of the Danakil Depression (Eritrea) is a complex site of around 60 km² with an important fossil fauna and Acheulian record. It is situated close to the Ethiopian border, 20 km south to the Buia Basin, where an important paleoanthropological record is known since the 1990s. The Engel Project started on 2012 and, since then, we have done 120 days of fieldwork, doing the geological mapping, stratigraphy, sampling for magnetostratigraphy, ESR and Cosmogenic nuclides dating, and continuous survey and archaeological excavations at the sites of Delahaitu, Ado Qwawleh, Gameré, Luba Gadhi, and Erau. The chronology of all the series is comprised between 1.8 and 0.7 Ma, corresponding to the second part of the Early Pleistocene. This research has contributed to unearth an important quantity of early Pleistocene fossil mammals, composed by *Elephas recki* ssp., *Ceratotherium simum*, *Hippopotamus gorgops*, *Metridichoerus modestus*, *M. compactus*, *Kolpochoerus majus*, *Giraffa* cf. *camelopardalis*, *Bos* cf. *buiaensis*, Hippotragini indet. (cf. *Oryx* sp.), Cf. *Theropithecus* sp., Cercopithecidae indet., Hayenidae indet., *Crocodylus* cf. *niloticus*, and *Chelonia* indet., together with abundant small and large size Acheulian tools. The geographic situation of Engel Ela, together with Buia, in the north-western sector of the Afar triangle, on the way to Eurasia following the Red sea coast, is giving new information to know the ecological scenario where early humans evolved, survived and dispersed to the northern continent during the Early Pleistocene.

Strategies of Human Perception and Exploitation of the Environment: Results of Petroarchaeological Research in the Kvirila Basin

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Abstract

Reconstructing Palaeolithic strategies of raw-material procurement, mobility, and the exploitation of living space is one of the important objectives of Stone Age research. In the South Caucasus, the first petroarchaeological study of flint raw materials was conducted in western Georgia. The

study aims to establish the relationship between the archaeological assemblage from Layer I of Jruchula Cave, dated to 140,000 years ago, and the natural flint outcrops of the Kvirila Basin. As part of the study, 74 natural flint outcrops were investigated in the Kvirila Basin and classified into three stratigraphic families and 14 genetic types/microfacies. The archaeological assemblage, in turn, yielded 21 distinct flint groups. Comparison of these groups with the natural sources makes it possible to reconstruct patterns of flint procurement at local, regional, and long-distance scales. The geoarchaeological study demonstrates that the typological diversity of flint characteristic of the Kvirila Basin is clearly reflected in the archaeological assemblage. Most of the assemblage is of local and regional origin, with a predominance of flint derived from primary outcrops. At the same time, a small group of flint types was identified that does not correspond to any of the investigated natural flint outcrops in the region and was presumably transported from more distant areas. This suggests that both raw-material quality and the type of natural occurrence influenced raw-material exploitation strategies.

As a result of the study, the first flint lithothèque in Georgia was established within the Stone Age Collection of the Georgian National Museum, including a reference sample database, an atlas, and a distribution map of flint raw materials in the Kvirila Basin. This represents the first attempt to introduce a petroarchaeological approach to flint research in Palaeolithic studies in Georgia and has contributed to the integration of the South Caucasus into international flint databases, including the PCR “Réseaux de lithothèques” and GDR “Silex”.

The Behavioral and Technological Evolution of the Genus *Homo* and Its Impact on Hominin Land-Use at Olduvai Gorge, Tanzania

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Abstract

Early *Homo* may have begun butchering carcasses for food as early as 2.8 Ma. However, evidence of this behavior prior to 2.0 Ma is limited with some examples likely misidentified, rather than representing true evidence for butchery. After 2.0 Ma cut marks and percussion marks become more common in the fossil record. Yet, it has recently been argued that there is not a measurable increase in the carnivorous signal with the appearance of *Homo erectus*, despite the morphological and technological changes observed in the species. This paper will present evidence that there is a clear increase in both the number of butchered fossils and stone tools per cubic meter of excavated sediment after the appearance of *Homo erectus* at Olduvai Gorge, Tanzania. These increases also coincide with a change in distribution of archaeological sites within the Olduvai Basin going from clustered during the Oldowan to dispersed during the Acheulean. This shift suggests *Homo erectus* was less constrained on the landscape than earlier hominins and may have had a more dominant position in the paleoecosystem of Olduvai Gorge.

Rethinking Tighennif (ex. Ternifine), Algeria: New Multidisciplinary Insights into a Landmark Early Pleistocene Hominin Site in North Africa

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Abstract

Tighennif (formerly Ternifine), Algeria, is a key Lower Paleolithic locality for investigating early hominin behavior and adaptation in North Africa. The site is renowned for its hominin fossils, historically attributed to *Homo erectus*, associated with a savanna fauna and Acheulean lithic assemblages. Earlier investigations, however, focused primarily on paleontology and provided limited archaeological and contextual information. Fundamental questions have therefore persisted concerning the site's stratigraphic framework and chronology, the depositional relationships between faunal remains and stone artifacts, and the behavioral significance of its archaeological record.

To address these questions and investigate hominin behavior in relation to changing ecological contexts, renewed multidisciplinary research at Tighennif integrates archaeological excavation, stratigraphic and taphonomic analyses, lithic and faunal studies, and geochronology. The resulting field and laboratory evidence is substantially revising our understanding of the site's chronology, formation processes, and archaeological record. Our results show that: (i) stratigraphic variation across the site documents multiple archaeological horizons, including Oldowan and Acheulean occurrences separated by an erosional disconformity; (ii) the archaeological deposits are older than previously estimated; (iii) taphonomic evidence indicates limited post-depositional disturbance and generally low-density archaeological occurrences in which faunal remains substantially outnumber lithic artifacts; and (iv) cut marks and hammerstone-percussion damage on large-mammal bones provide evidence that Acheulean hominins had primary access to animal carcasses. Deliberate modification of some bones further suggests their potential use as tools.

Together, these findings provide a substantially revised chronological, stratigraphic, and behavioral framework for Tighennif. The recognition of distinct Oldowan and Acheulean occurrences, combined with evidence for carcass processing and possible bone-tool use, reinforces the site's significance for investigating the emergence and development of early hominin subsistence, technology, and adaptation in North Africa.

Plio-Pleistocene stone tools from Eastern Morocco and the hominin settlement of Maghreb
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Abstract

Aïn Beni Mathar – Guefaït region, south of Oujda, Eastern Morocco, is part of an ancient fluvio-lacustrine basin corresponding to the westernmost range of the Haut Plateaux and Salt Lake region of Maghreb, a physiographic unit placed between the Mediterranean and Saharan domains and far from the Atlantic influence. This region is currently part of the upper Moulouya watershed. Since 2006, this region has been the objective of a cooperative project between the University Mohammed Premier from Oujda (Eastern Morocco) and the Catalan Institute of Human Paleoecology and Social Evolution of Tarragona (Catalunya, Spain). It resulted in the discovery of dozens of archaeological and paleontological sites that allowed us to build a dense heritage cartography of the region for the first time. Among all it outstands a paleontological site dated by biostratigraphy, palaeomagnetism and ESR to the Late Pliocene. This site served to the palaeoecological reconstruction of the final Neogene in the basin.

Among the archaeological sites three of them are reported here: Aïn Tabouda, Oued el Haï and Gara Soultana. These are three newly discovered Mode 1 occurrences in stratigraphic context directly dated by magnetostratigraphy and ESR to 3.03-2.61 Ma (Aïn Tabouda), 2.84-2.61 Ma (Oued el Haï), and 2.47-2.03 Ma (Gara Soultana). These results indicate an early settlement of the Maghreb during the Late Pliocene and protracted population presence through to the Early Pleistocene, which greatly expands the geographic range of Late Pliocene hominins and highlights their ability to colonize mid-latitude regions. Although the earliest hominin tools reported so far sustain the long-held view that the first stages of technological development occurred within tropical Eastern Africa, the findings reported here advocate pan-African hominin evolution, with the expansion of savannah landscapes during recurrent Green Sahara Periods playing a pivotal role across North Africa.

Olduvai Gorge Coring Project (OGCP) and Kilombe Project contributions to *Homo erectus* time and palaeoenvironmental frameworks, Tanzania and Kenya.

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Abstract

In Africa, one of the earliest discoveries of *Homo erectus* was that during 1960 by Louis Leakey of OH 9 near the top of Bed II at Louis Leakey Karongo, Olduvai. So, it is surprising that this find has not affected palaeoanthropological thinking as much as other African *H. erectus* finds. One aspect is that OH 9 has been difficult to place timewise because of the dearth of ⁴⁰Ar/³⁹Ar datable tuffs at Olduvai younger than Bed I (<1.8 Ma).

In order to improve the time framework and palaeoenvironmental reconstructions relating to hominins (*Paranthropus boisei*, *Homo habilis*, *Homo erectus*, archaic and modern *Homo sapiens*),

the Olduvai Gorge Coring Project's (OGCP 2014 and 2023) drilling programs intersected Olduvai basin-fill. This has proved the basin's existence since at least 2.25 Ma. However, because time constraints are less certain during Beds II, III, IV, Masek, Ndutu and Naisiusiu (1.8 Ma-0 Ma), during which *H. erectus* and *H. sapiens* evolved, it was decided to generate age-depth profiles from $^{40}\text{Ar}/^{39}\text{Ar}$, palaeomagnetic and tuff fingerprint techniques applied to cores. Providing boundary ages for Beds II, III, IV and Masek Beds for the first time, this facilitates the dating of individual hominin finds and transitions between species and cultures relating to *Homo erectus* range and limits, including: *Homo erectus*/Acheulean assemblages in Beds III/IV and Masek Beds, including OH 23 and OH 34; Acheulean assemblages at the HEB site; and youngest *Homo habilis*/Oldowan assemblage with OH 13 skull at MNK.

Olduvai is away from the Ngorongoro Volcanic Highlands refugium, however Acheulean and Oldowan lithic tool assemblages from Kilombe Caldera-fill allow a cultural record to be studied in what would have been a refugium setting for *H. erectus* and the transition from *H. habilis*. The age range includes that of the Dmanisi *H. erectus* finds, and the newly revealed transition from Oldowan to Acheulean cultures are worthy of extended analysis. The alluvio-lacustrine caldera-fill contains Acheulean and Oldowan assemblages and artefacts at multiple levels. Excavated examples include: (1) One of three Oldowan assemblage levels, which comprises lithic tools crafted from Kilombe trachyte, in association with skeletal material, including bovid longbones and *Hippopotamus gorgops*, with evidence of carcass processing; and (2) Acheulean finds and assemblages, including handaxes and other bifaces. Oldowan lithics assemblages from three levels contribute to a continuous record across the cultural transition. Like Olduvai, an age-depth profile generated from $^{40}\text{Ar}/^{39}\text{Ar}$ analysis of fresh tuff samples allows all levels to be dated precisely in a continuous and well dated sequence. Taken together, Olduvai and Kilombe will allow comparisons of hominin activities between off-refugium and this highly fortuitously preserved refugium setting.

The Cognitive Abilities of *Homo erectus*: Insights from Experimental Archaeological Studies

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Abstract

The fossil taxa *Homo erectus* was a very long-lived and evolutionarily important stage of hominin evolution, found in Africa and Eurasia, emerging around 2.0 million years ago, with relict populations apparently existing in places down to perhaps 100,000 years ago. Some of these populations were certainly ancestral to later hominin forms, including our own species, *Homo sapiens*. Here we will compare and contrast the inferred cognitive abilities of *Homo erectus* with earlier and later hominid forms, based primarily on technology and behavioral patterns, and especially focusing on insights from experimental replicative and functional studies.

Session III – Migrational Diversity and Environmental Context of *Homo erectus*

Keynote lecture

Broad isotopic eco-niches in East African *Homo erectus* by ~2 Ma and implications for expansions into the mid-latitudes of Eurasia

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Abstract

The stable light isotopes of carbon and oxygen of soil carbonates and mammalian tooth enamel have provided a rich source of information about the nature of South and eastern African environments and the diets of fauna and hominins over a period of >4 million years. For carbon isotopes in particular, these tropical and semi-tropical landscapes have the conspicuous structural vegetation advantage that, with some exceptions, its grasses and sedges are markedly distinct from tree, shrub and herb growth forms allowing calculation of relative dependencies and shifts through time. Further, oxygen isotopes reflect broader rainfall patterns (mostly from the Indian Ocean) modified by local differences such as dominant source and its distance, altitudes, the nature of water bodies, as well as predictable transformations in plants and mammalian guts. A large body of isotopic data now exists for soil carbonate, and faunal and hominin tooth enamel in eastern Africa that has allowed tracking of shifts in vegetation and diets of fauna and hominins from the Plio-Pleistocene. Recently ecological niche theory has been applied to investigate distinctions between taxa and individuals using published data. Most recently new data from laser ablation analyses of enamel sequences that uniquely provide a record of individual-level shifts provide further detail. The results for eastern Africa suggest that as early as >4Ma, hominin diets were taxonomically and individually variable. A major shift occurred ca. 2Ma in which *Paranthropus* diets became increasingly monotonous in contrast to coeval *Homo* individuals that show strong intra- and inter- individual isotopic variability suggesting a major shift to very broad ecological niches. I argue that this dramatic broadening and the (apparent) timing of early out-of-Africa is unlikely to be a coincidence. Tracking similar niche transformations and dietary distinctions in non-tropical latitudes is more challenging. Nevertheless, the more subtle, within-individual tooth enamel sequences developed for tracking seasonal and altitudinal shifts in Eurasian domestic fauna offers one way forward.

Oral Presentations

One Among Many: The Carnivore Guild of Dmanisi and the Place of *Homo*

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Abstract

The Early Pleistocene site of Dmanisi, Georgia (1.85–1.76 Ma), preserves the earliest substantial osteological record of *Homo* outside Africa alongside one of the most diverse carnivore guilds known from the Old World at that time. The assemblage comprises 14 carnivoran taxa, including five medium- to large-sized felids, the giant hyaenid *Pachycrocuta brevirostris*, three canids, *Ursus etruscus*, and four mustelids. The palaeobiogeographical and ecological affinities of the Dmanisi guild were compared with approximately coeval European, Asian, and African assemblages on the basis of their generic and specific composition together with the ecological traits of each carnivoran. The results indicate strong similarities with European Late Villafranchian assemblages, although Asian assemblages share several felid and canid ecomorphotypes. In contrast, eastern and southern African guilds show lower similarity, partly because of their more diverse hyaenid communities. Within this highly competitive trophic community, early *Homo* was not an ecologically dominant presence but one competitor among many. Access to meat, fat, and marrow probably required direct competition with large carnivores, whether through scavenging, carcass defense, or kleptoparasitic interactions. The association of abundant carnivores, Oldowan technology, and morphologically primitive *Homo* therefore supports a scenario in which the first Eurasian hominins occupied a contested trophic landscape, with only limited control over animal resources.

Spiral-horned antelopes from Dmanisi (Georgia)

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Abstract

The fossil sample accumulated during more than three decades of excavations at Dmanisi permits the recognition of two distinct spiral-horned antelopes, providing new insights into the evolution and diversification of Eurasian Antilopini.

Two spiral-horned antelope species with contrasting horn-core torsion patterns are represented in the Dmanisi fauna. The homonymously twisted form is referred to *Pontoceros surprine*, whereas the heteronymously twisted form resembles the genus *Spirocerus*.

Dmanisi provides the earliest record of *Pontoceros*. Its morphology differs consistently from that of younger representatives of the genus, indicating that the Dmanisi population represents a distinct species. The heteronymously twisted form closely resembles *Spirocerus* but is distinctly smaller, supporting its recognition as a new species.

The occurrence of these two spiral-horned antelopes at Dmanisi documents a major faunal turnover among western Eurasian Antilopini, marking the replacement of characteristic Late Pliocene–Early Pleistocene assemblages dominated by *Gazella* and *Gazellospira torticornis*. Their co-occurrence at Dmanisi highlights the region as an important area for the diversification and dispersal of spiral-horned antilopines

Life in a Dynamic World: Mammalian Perspectives on the Paleoenvironments of *Homo erectus*

Larisa Grawe DeSantis

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Abstract

The evolutionary success of *Homo erectus*—the first hominin to disperse widely beyond Africa and persist for well over a million years—coincided with a period of increasing climatic variability throughout the Early and Middle Pleistocene. Orbital forcing, shifting monsoon systems, and glacial-interglacial cycles reshaped vegetation structure, resource distribution, and habitat stability across the landscapes that early humans occupied. Yet the question of how these environmental fluctuations affected the ecosystems inhabited by *Homo erectus* remains an active and evolving area of paleoanthropological research. Fossil mammals offer a window into this dynamic environmental history. As co-inhabitants of the same landscapes, sympatric herbivores and carnivores encode information about vegetation structure, climate, and ecological pressures through their diets, morphology, and behavior—providing lines of evidence that are complementary to hominin fossil records. This talk explores how a range of paleoecological approaches, including dental microwear texture analysis, stable isotope geochemistry, and functional morphology, can be used to reconstruct paleoenvironmental change across Pleistocene landscapes associated with *Homo erectus* occurrences. By integrating multiple, independent lines of mammalian evidence, we can move beyond simple habitat reconstructions toward a more nuanced understanding of habitat heterogeneity, seasonal and interannual resource availability, faunal turnover, and ecosystem resilience in the face of climatic instability. These mammalian records offer critical context for interpreting the ecological flexibility that may have underpinned the remarkable adaptability, geographic dispersal, and long-term persistence of *Homo erectus* across a striking diversity of environments—from open grasslands to woodlands and

riparian corridors. Ultimately, situating *Homo erectus* within this broader mammalian paleoecological framework enriches our understanding of the environmental pressures and opportunities that shaped one of the most successful hominin species in the human evolutionary record.

Paleoenvironment and hominin adaptations in the Megalopolis basin: the case of a Pleistocene refugium and what this means for human evolution

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Abstract will be updated

FoodWays: Exploring the influence of plant foods on Pleistocene hominin migration into western Eurasia

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Abstract

Early African hominins lived in narrow bands of habitats that were limited by rainfall, temperature and net primary productivity. Beginning roughly 1.8 million years ago (Ma), *Homo erectus* s.l. was the first hominin to leave eastern and southern Africa and occupy a variety of new habitat types across Eurasia. There they were exposed to a suite of novel challenges stemming from the increased seasonality, cold temperatures, and unfamiliar resources of the higher latitudes. How western Eurasian *H. erectus* overcame these challenges to occupy this new ‘climate envelope’ remains debated. The FoodWays project investigates how dietary behaviors such as consumption of plants, fire use, and fermentation, may have enabled *H. erectus* to expand into the new habitats of western Eurasia. We are developing a nutritional database of relevant wild edible plants and other sessile foods, and collecting data on the energetic costs to acquire and process these foods. We are also developing new methodologies to identify the use of these foods and food processing techniques in the archaeological record. Finally, we are building an agent-based model to explore how the distribution of plant foods and use of food processing techniques may have influenced *H. erectus* migration, and to compare the effects of these factors to other proposed key changes, such as new technologies or new social networks.

Endocranial Adaptations in the Dmanisi Sabertoothed Felids: Implications for Predator–Hominin Interactions

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Abstract

Large carnivorans structured Early Pleistocene vanished ecosystems through active predation, interference competition and carcass monopolisation. Guild composition and hunting strategies modulated prey distribution, animal-resource access and mortality risk, potentially constraining the dispersal and persistence of early *Homo* in Eurasia. At ca. 1.8 Ma, Dmanisi records an incredibly diverse carnivoran guild, including the sabertoothed felids *Homotherium* and *Megantereon*. Using computed tomography and morphometrics, we compare brain and frontal-sinus morphology in both genera. *Homotherium* displays rostral expansion of the brain frontal cortex, dorsoposterior enlargement of the occipital region and frontoventral expansion of the temporal lobe. This combination is consistent with enhanced visual and auditory processing, sensorimotor coordination in open environments and increased processing of socially relevant information. *Megantereon* exhibits a rostrocaudally compressed cerebrum, an enlarged frontal region, increased occipital folding and cerebellar enlargement. This mosaic suggests greater reliance on vision than hearing, three-dimensional motor control, and enhanced motor and somatosensory integration during forelimb-assisted prey restraint and precise bite placement. The Dmanisi *Homotherium* frontal sinus differs markedly from other individuals of the same species (e.g. Incarcial complex), although both show similar relative volume and surface-to-volume ratios, suggesting individual variation or sexual dimorphism. Non-metric multidimensional scaling (NMDS), an ordination that maps similarity in sinus geometry, anatomical position and ecology, places the *Homotherium* specimens near extant large pantherine felids, while the comparative *Megantereon* specimen occupies an intermediate position between pantherine and feline felids (albeit closer to pantherine). These affinities favour cranial-stress redistribution during large-prey capture and killing over sprint-related thermoregulation. These neurocranial contrasts identify two predator-hominin interaction regimes: a mobile, potentially coordinated *Homotherium* producing spatially diffuse risk in open terrain, and a concealment-dependent *Megantereon* concentrating risk near structural cover. At Dmanisi, this partitioning predicts spatial heterogeneity in encounter risk and carcass accessibility, providing a mechanistic basis for assessing how carnivore-guild composition constrained hominin movement and animal-resource acquisition.

Eurasian rhinocerotines (Mammalia, Rhinocerotidae) during the Early Pleistocene: paleobiogeographic and paleoecological implications for the environmental context of early *Homo* dispersals

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Abstract

Rhinocerotines were among the most characteristic large herbivores of Early Pleistocene Eurasian faunal communities. Their evolutionary history, dispersal dynamics and ecological adaptations provide key evidence for reconstructing environmental change, faunal turnover and biogeographic patterns across Eurasia, and may contribute to a better understanding of the ecological background of early *Homo* dispersals. During the Early Pleistocene, Eurasian rhinocerotines underwent important taxonomic and ecological changes, involving the persistence, replacement and regional differentiation of several lineages traditionally referred to *Stephanorhinus*, *Coelodonta*, *Dicerorhinus* and *Rhinoceros*. However, their fossil record remains heterogeneously documented and taxonomically challenging. The systematics, phylogenetic relationships and paleobiogeographic history of several taxa are still debated, partly because of fragmentary key specimens, conservative dental and postcranial morphologies, ontogenetic and sexual variability, and repeated convergent evolution of similar morphological traits. This contribution reviews the paleobiogeographic distribution, paleoecological significance and evolutionary trajectories of Early Pleistocene Eurasian rhinocerotines, with particular emphasis on the Caucasus, the Mediterranean area and eastern Eurasia. Revised records from these regions are considered as key evidence for reconstructing dispersal routes, regional faunal exchange, ecological partitioning and habitat structure during a crucial phase of mammalian turnover. Particular attention is given to the Early Pleistocene rhinoceros record from Dmanisi, whose geographic position between western and eastern Eurasia makes it especially relevant for interpreting faunal dispersals and environmental changes. By integrating systematic, biochronological and paleoecological evidence, rhinocerotines offer a valuable framework for contextualizing Early Pleistocene terrestrial ecosystems and the environmental conditions encountered by early *Homo* during its dispersal across Eurasia. Future research should focus on the revision of historical collections, broader comparative datasets, explicit assessment of intraspecific variability, and the integration of morphometrics, phylogenetics, geochronology and multi-proxy paleoecology.

***Homo erectus* and Early Pleistocene Large Mammalian Faunas in China**

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Abstract

Homo erectus represents a crucial stage in human evolution, having made considerable advances in the manufacture and use of lithic tools and being the first hominin lineage to control fire. In China, *H. erectus* is the earliest known hominin, with multiple fossil sites discovered to date, including *H. erectus yuanmounensis*, *H. erectus lantianensis*, *H. erectus yunxianensis*, *H. erectus nankinensis*, *H. erectus hexianensis*, and *H. erectus pekinensis*. The large mammalian faunas associated with these sites are of great significance both for understanding Pleistocene mammal evolution and for assessing the impact of hominin activity on large mammals. In this study, several

well-documented *H. erectus* localities—Yuanmou, Gongwangling, and Zhoukoudian—are included in the analysis. Selected Paleolithic sites, such as Nihewan, Renzi Cave, and Longgupo, serve as important comparative localities, while key Pleistocene mammalian sites, including Longdan and Luotuo Hill, are used as reference localities. We examine the genus-level similarity between the fauna from the Yuanmou hominin site and those from other Chinese localities of varying ages and regions, with the aim of exploring the zoogeographic patterning of Early Pleistocene large mammalian faunas in China. The Yuanmou fauna, representing an early Early Pleistocene mammalian assemblage in southern China, exhibits a higher degree of resemblance to other southern Chinese faunas than to northern ones, and shows greater similarity to early Early Pleistocene faunas than to those from the late Early Pleistocene. These findings suggest that geographic location played a significant role in the dispersal and exchange of large mammals, and that faunal composition shifted in response to critical environmental events during this period. Notably, the Tuoqidong fauna in southern China shows less similarity to the Yuanmou fauna, whereas the Gongwangling fauna in northern China shows greater similarity. This indicates that, owing to their particular environmental settings, these two localities likely facilitated the exchange and co-occurrence of mammalian taxa from both southern and northern China.

The Dmanisi Bones Were Accumulated by a Palimpsest of Processes

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Abstract

The vertebrate taphonomic record from Dmanisi is vital to understanding not only how the site formed, but in turn suggests the best models for interpreting the paleontology, paleoecology, and the interactions among *Homo* and the rest of the fauna. The taphonomic sample includes 7568 identified and unidentified mammalian specimens, and an additional 3,400 bones from the screens that were examined for taphonomic information. Surface modifications such as tooth marks, tool marks, abrasion are presented as well as the relative proportions of mammalian taxa. Modifications by the hominins indicate both early access to meaty portions (usually interpreted as the result of hunting or power scavenging) and also late access elements (likely scavenged). Skeletal element frequencies are presented for the most abundant taxa at the site—*Equus altidens*, *Pseudodama nestii* and mortality profiles from the *Equus* spp. Felidae species and *Pachycrocuta brevirostris* were important means for accumulating the fauna, but hominin activity and natural deaths also affected the assemblages. The last phase before burial was mainly carnivores bringing bones into dens and gravitational pull into the low spots in the pipes and gullies. The Dmanisi site as a whole does not match the models of singular normative site formation processes and is best interpreted as a palimpsest of events close together in time. Increased consumption of the meat of medium and large mammals remains an important hypothesis for human spreading north out of Africa.

Poster Presentations

Ecological Flexibility Rather than Habitat Tracking Enabled the First Hominin Dispersal into Eurasia: Evidence from Dmanisi

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Abstract

The ecological challenges facing the first hominins to disperse beyond Africa, and how they met them, remain unclear. Whether early hominins tracked familiar African-type habitats or tolerated novel environmental conditions is a central unresolved question in dispersal research. The Dmanisi site (1.83–1.77 Ma), the oldest undisputed hominin locality outside Africa, is well placed to address it. Here we combine mammal ecomorphology, herbivore dietary reconstructions, and pollen data with climate model simulations to reconstruct climate and vegetation at Dmanisi during hominin occupation. Proxy-based reconstructions and model output converge on an annual mean temperature of 9–11 °C and annual precipitation of 480–580 mm, markedly cooler than the tropical settings of the African Early Pleistocene. These values place Dmanisi in a region of biome space where forest, woodland, and grassland probabilities overlap, with forest and woodland dominant. Herbivore dietary analysis is consistent with this, showing a predominance of browsers and mixed feeders, and re-analysis of the published pollen data likewise indicates relatively wooded vegetation, with grasses making up only ~20% of the assemblage. Temporal analysis, however, shows that vegetation composition responded to even small shifts in climate, with forest/woodland and grassland alternating as the dominant component through the occupation. Our results therefore imply a dynamic mosaic that differed in both climate and structure from the ecosystems in which early *Homo* evolved, and in which no persistent African-analogue habitat was available to be tracked. This supports ecological flexibility rather than habitat tracking as a driver of the first hominin expansion into Eurasia.

Carnivore Richness, Hominin Range Expansion, and the Taphonomy of Hominin Scavenging during the Early Pleistocene

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Abstract

Scavenging is generally recognized as the mode by which hominins initially began to more consistently consume animal-based resources from large mammalian fauna. This transition into more meat and marrow consumption began in the late Pliocene and intensified with the radiation of bipedal hominins around two million years ago. Despite a broad consensus on the importance

of meat in the diet of late Pliocene/Early Pleistocene hominins, the environmental factors that permitted such a niche expansion can be hard to identify. Often large felids, especially machairodontines like *Megantereon* and *Homotherium*, are assigned as potential carcass providers for hominins, as mechanical constraints in their dentition prevented them from completely consuming a carcass, leaving most in-bone resources intact. Conversely, the consumption patterns of large hyaenids often lead to the exhaustive processing of meat and marrow. The relatively high carnivore diversity in Early Pleistocene Eurasian carnivore guilds likely contributed to hominins successfully expanding their dietary niche and geographic range into Eurasia (Coil, 2025). Building on previous research, this paper explores the potential impacts of felid and hyaenid richness on scavenging opportunities by analyzing the taphonomic record at Early Pleistocene archaeological sites. Previous research (e.g., Pobiner, 2015, 2020) has suggested that we should see more evidence of hominin scavenging in ecosystems that are dominated by felids. In addition, we should expect more evidence of scavenging in those ecosystems that lack large bone destroyers, like hyenas, compared to those sites where they are present and/or abundant. The analysis focuses on cut mark and percussion mark frequencies, the location of cut marks on the carcasses, the interpretations of the timing of hominin carcass access at each site, and the overall interpretation of carnivore-hominin interaction. These data are then compared to felid and hyaenid richness, as estimated through the number of different species on the taxon list.

No Evidence for Substantial Meat Consumption by *Homo* at Swartkrans ca. 1.8 Ma

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Abstract

Major evolutionary events including brain size increase, technological advancement, and expansion out of Africa occur seemingly simultaneously with the appearance of *Homo erectus* in the hominin fossil record between 2 and 1.8 Ma. It has been hypothesized that members of the genus *Homo* began to incorporate animal resources (especially mammalian meat) into its diet, and that this behavior catalyzed these key adaptive transitions. However, while it has been inferred from morphological (e.g., small jaws and teeth) and archaeological evidence (e.g., stone tools and butchered bone) that *Homo* ate meat, the nature, timing, frequency, and importance of this behavior remains unclear. In this study, we evaluate the diet of ca. 1.8-million-year-old hominins, including

Homo sp. (n = 5) and *Paranthropus robustus* (n = 9) from Swartkrans, South Africa. We use carbon ($\delta^{13}\text{C}_{\text{enamel}}$) and nitrogen ($\delta^{15}\text{N}_{\text{enamel}}$) stable isotope data of fossil tooth enamel from these hominins and associated fauna (n = 243) to reconstruct the ancient food web at this site and the trophic position of hominins within it. Whereas $\delta^{13}\text{C}$ reflects the types of plant resources at the base of the food web (e.g., C₃ versus C₄ vegetation), $\delta^{15}\text{N}$ provides information on trophic position and protein sources. $\delta^{13}\text{C}_{\text{enamel}}$ values indicate that both hominins relied predominantly on C₃ resources, with a minor contribution from C₄ foods. $\delta^{15}\text{N}_{\text{enamel}}$ values for all Swartkrans hominins ($\bar{x}$ = 6.2 ‰) are lower than those of carnivores from the site ($\bar{x}$ = 10.4 ‰) – comparable to those of contemporaneous herbivores and primates ($\bar{x}$ = 5.9 and 5.2 ‰, respectively). Notably, *Homo* has a low median $\delta^{15}\text{N}_{\text{enamel}}$ ($\bar{x}$ = 4.7 ‰) indicating that it did not regularly consume substantial quantities of mammalian meat. Instead, it appears to have incorporated resources low in $\delta^{15}\text{N}$ into its diet in this region.

A distinctive pattern of bipedal locomotion in the Dmanisi hominins

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Abstract

The Dmanisi hominins, dated to approximately 1.8 Ma, document an early expansion of *Homo* into Eurasia. The proximal femur D4167 provides a direct window into hip mechanics and habitual locomotor behavior during stance in these early Eurasian hominins. Here, we assess its morphology to evaluate whether it conforms to the pattern documented in African *Homo erectus* or retains features characteristic of australopiths, providing insight into early human bipedal evolution.

Computed tomography was used to quantify femoral head and neck dimensions, cortical thickness distribution, and proximal femoral shaft geometry. Comparative data include modern humans, extant nonhuman hominoids, australopiths, and early *Homo* specimens. D4167 has a long femoral neck and low neck-shaft angle, features shared with all early hominins and consistent with the wide biacetabular breadth inferred for these taxa. The femoral neck exhibits superoinferior cortical asymmetry, more closely resembling the human pattern than the variable pattern documented among australopiths. This distribution is consistent with directional loading associated with the hip-abductor mechanism during bipedal stance.

At the same time, D4167 has a relatively small femoral head, a neck expanded superoinferiorly relative to head breadth, and a proximal shaft with limited mediolateral reinforcement. These features align Dmanisi more closely with australopiths than with African *H. erectus*. The combination of more human-like cortical organization and australopith-like external geometry

suggests that Dmanisi was a habitual terrestrial biped, but did not possess the proximal femoral configuration characteristic of African *H. erectus*. Differences in femoral morphology may reflect variation in the magnitude and orientation of hip-joint reaction and abductor forces during stance, potentially involving greater lateral displacement of the body's center of mass over the supporting limb. Dmanisi thus illustrates locomotor diversity during the Eurasian dispersal of *Homo* and indicates that the evolution of human-like bipedal mechanics proceeded through distinct morphological combinations rather than a single transition.

Edible Plants in the Dmanisi Landscape – Paleobotanical Insights into Early Human Environments

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Abstract

The Dmanisi record of *Homo erectus* in Georgia is the oldest direct evidence of the first hominin expansions from Africa into Eurasia. Since then, humans were almost continuously present in this region and required an energy- and nutrient-rich diet. As plants contribute to the amount and variety of obtainable food resources, vegetation and vegetation diversity are important factors for human habitats. Plant fossils on one hand are a base for quantitative vegetation and climate reconstructions. On the other they provide direct and indirect evidence for the availability of potential plant food resources. Previous pollen analyses based on samples from the Dmanisi fossil site document a diversified vegetation following altitudinal zones: While at lower altitudes and in the valley open vegetation (meadow-steppe or forest-steppe) predominated, the adjoining mountain slopes were covered by deciduous broadleaf forests – in the lower mountain belt with *Castanea*, *Tilia* and *Quercus*, in the middle mountain belt dominated by *Fagus*, *Carpinus*, and *Ulmus*. High-mountain forests and subalpine vegetation are also reflected in the pollen spectra. The application of a newly developed statistical relationship between the standing vegetation and the pollen record from regional subfossil soil surface samples confirms this interpretation. In addition to the fossil plant remains (pollen and carpoflora) recovered from the site, also reconstructed modern-analog vegetation can serve to shed light on potential plant food resources for *Homo erectus*. In total, the diverse mosaic landscape in the surroundings of the Dmanisi fossil site provides multiple plant foods, which are easy to access and rich in nutrients. Forests offer the highest numbers of edible plant parts, followed by alluvial forests and open woodlands. Moreover, the resources from those vegetation units comprise more food of higher quality than from steppes. Especially fruits and nuts from woody plants add to an energy- and nutrient-rich diet.

What's for Dinner, Mama *erectus*? Modelling the Diet and Energetic Requirements of a *Homo erectus* Female in the Site of Dmanisi, Georgia

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Abstract

The emergence of *Homo erectus* in Africa 1.9 M years ago brought with it an increase in both brain and body size respective to previous hominins. These changes had a significant impact on the energetics of the species, as a bigger body size correlates to a higher total energy expenditure (TEE). The increased energetic needs of a larger body posed a particular demand for females, who bear the additional costs of gestation and lactation. Recent estimates using doubly labelled water modelling suggest that to meet these energetic requirements, a high-quality diet and potentially increased social cooperation were likely required for females to meet their energetic needs. However, the specific subsistence strategies that could have supported these demands remain poorly understood. The scope of this project is to investigate how a female *Homo erectus* at the site of Trinil could have met her increased energetic requirements through the available dietary resources. By compiling a database of both faunal and botanical remains associated with the site and their nutritional values, this study will try to model different combinations of resources capable of meeting the estimated TEE values. The energetic costs of acquiring these resources will be incorporated into the calculations using ethnographic and hunter-gatherer subsistence datasets. By combining paleoenvironmental, nutritional, and ethnographic data, this study aims to clarify how subsistence strategies may have supported the reproductive and energetic demands of *Homo erectus* females, thus contributing to broader discussions on the ecological success of early humans.

Phenotypic Effect of Rickets in the Enamel of Human Molars

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Abstract

A child mandible with limited background information was identified in the FMNH collections. The radiocarbon dating yielded an estimated age of AD 1630–1665. Micro-CT scanning of the mandible revealed that the unerupted teeth exhibited characteristic features of rickets, such as pitted enamel, sharp incisal edges, widened pulp chambers, and interglobular dentin. Correctly formed enamel is essential for tooth function, and vitamin D deficiency disrupts both the enamel matrix secretion and mineralisation, resulting in malformed and weakened teeth. Dental tissues do not remodel, meaning that developmental defects remain throughout life. It remains unclear whether the dental changes associated with nutritional rickets represent a distinct phenotype or simply the extreme end of normal variation. To develop quantitative measures of rachitic enamel defects, we compare the enamel distribution of the affected mandible with molars of other museum samples. We additionally compare human teeth to orangutan molars, which are similar in shape, but have a much more complex occlusal surface due to uneven enamel distribution. A

methodological challenge in analysing human molars is their highly variable morphology, hampering the identification of normal and abnormal variation in enamel distribution. Our computational modelling revealed topographic features that are susceptible to the effects of rickets. Topographic analyses of both the enamel surface and the enamel-dentin junction (EDJ) show rachitic molars to have similar but more pronounced enamel features compared to other human samples. Some aspects of rachitic molars resemble those of orangutan molars, suggesting similarities in the mechanisms regulating enamel distribution. Overall, enamel formation appears to be particularly sensitive over concave areas of the EDJ, especially in teeth that form during the first years of life. Topographic methods show promise for the analysis and diagnosis of the complex phenotypes characteristic of rachitic teeth.

Testing the Inhibitory Cascade Model in the Dmanisi Hominins

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Abstract

The Inhibitory Cascade (IC) model predicts relative molar proportions ($M1 > M2 > M3$) based on a developmental balance between activating and inhibitory signals and has been used to link tooth development to evolutionary trends across mammals, including hominins. Whether the Dmanisi hominins—key to understanding the earliest dispersal of *Homo* out of Africa (~1.77 Ma)—follow this modern human developmental pattern remains untested.

We measured mesiodistal lengths of all three left and right lower molars, bilaterally, in a modern Finnish comparative sample ($N=189$, children from the mother-child dataset) from radiographs, and calculated $M2/M1$ and $M3/M1$ ratios following Kavanagh, Evans & Jernvall (2007). Three Dmanisi mandibles (D211, D2600, D2735—specimen numbers from the Dmanisi fossil collection) were measured from CT scans for higher precision. A significant positive relationship was found between $M2/M1$ and $M3/M1$ in the modern sample (right side: $N=161$, $p<0.0001$, $R^2=0.17$; left side: $N=165$, $p<0.0001$, $R^2=0.34$), broadly consistent with IC model predictions. $M3$ s make a relatively small share of the total molar row in two of the Dmanisi specimens, even when compared to the Finnish sample.

The three Dmanisi individuals fell within the modern human IC distribution: D211 and D2735 closely matched the pattern predicted by the modern regression line on both sides, while D2600 showed a comparatively larger $M3$ relative to $M1$, at the upper boundary of modern human variation. This suggests that the developmental relationship constraining molar proportions in modern humans was already established in early *Homo* populations at Dmanisi, with the range of individual variation seen at the site remaining consistent with a single, variable species rather than indicating a fundamentally different developmental pattern.

Reconstructing Early Human Foodways: Investigating Edible Plant Taxa and Their Bioavailability in Early Pleistocene European Environments

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Abstract

Exiting a once-limited range of habitats, *Homo erectus* migrated outwards out of Africa to occupy diverse environments in western Eurasia. This is a testament to early humans' adaptive profile and their use of sessile resources, such as a combination of cosmopolitan and ecologically restricted edible plants, to meet their nutritional needs. However, access to the macronutrients offered by different plants is highly context-dependent across seasons and biomes, shaping possible migratory pathways into the region. Successful foraging also requires cultural and ecological knowledge to identify available valuable plants and subsequent investment into extracting and processing edible parts efficiently. Early humans' food-processing niche can thus be presumably connected to knowledge transmission that unlocked greater dietary choices in different environments. This entanglement between early humans and edible plants remains underexplored. Confronting these gaps in understanding early human foodways requires integrated approaches, expanding on an 'Optimal Foraging' theoretical framework. This poster presents ongoing work reconstructing valuable edible plants contemporary to early Pleistocene west Eurasia. This preliminary survey of plants in early human diets lays the foundations for mapping the "foodscapes" of the past. Using multiproxy data based on archaeobotanical assemblages, paleoenvironmental reconstructions, and modern ethnographic data, potential plant usage by hominins may be inferred.