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Homo Naledi: New Insights into the Complex Human Lineage

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ABSTRACT

Fossilized skeletal fragments indicate that the hominin family existed approximately seven million years ago. In recent years, the fossil record of early humans and Australopithecines has rapidly increased, and this accumulated evidence has altered our perspective on the emergence of our genus. The structure of the Rising Star cave, part of the Cradle of Humankind World Heritage Site in South Africa, had been explored by spelunkers for years, but no fossils had been reported from there. This changed in September 2013 when two South African spelunkers discovered the first known fossil bones of what is now called Homo Naledi. The Naledi collection is the richest assemblage of hominins ever discovered in Africa. Homo Naledi, as much as it enhances our knowledge, also highlights the complexity of the human lineage and our ignorance about ancient humans. This research aims to familiarize Persian-speaking researchers with this human species using the latest findings and data. The research framework is library-based and employs documentary research methods. First, we will discuss the discovery and identification of this human species, and then we will examine its morphology in comparison with other human species. We will consider the burial practices of Homo Naledi and finally discuss and analyze the engravings attributed to them. Undoubtedly, awareness of these recent discoveries, which shed more light on the origins of humans, will assist us in accurately understanding the human phylogenetic tree and its complexity.

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Introduction

In comparison to the millions of years of human life, the discovery and identification of hominin fossils is much more recent, and it has not been long since researchers began studying such fossils. There is still a long way to go before the human family tree is complete. Every once in a while, we hear about the discovery of a new human species, which complicates the human evolutionary tree further and highlights our ignorance of our past. One of these new human species is Homo Naledi, which has prompted anthropologists to reconsider the genealogy of the human genus. Lee Berger from the University of the Witwatersrand, Paul Dirks from James Cook University, and an international team of colleagues reported the discovery of over 1,500 hominin fossils from the Rising Star Cave system (Fig. 1) near Johannesburg, South Africa, representing at least fifteen individuals (Berger *et al*., 2015; Dirks *et al*., 2015). The remains have now been classified as a new species of human called Homo Naledi. In Berger et al.'s paper, they explain how the collection exhibits a unique combination of primitive and derived features (Berger *et al*., 2015). For example, the small brain size, curved fingers, and the shape of the shoulders, trunk, and hip joints resemble those of pre-human Australopithecus and early species of Homo habilis. However, the wrists, hands, and feet are similar to those of Homo neanderthalensis and modern humans. The teeth have some primitive features but are relatively small and simple, and they are situated in the jawbones (Stringer, 2015).

Dirks, Burger, and colleagues describe the fossil environment: the DiNaledi Chamber (Dirks *et al*., 2015), which is located about eighty meters inside the Rising Star structure and must have always been in perpetual darkness. It is similar to the well-known accumulation of about 6,500 human fossils at the Sierra de Atapuerca in Spain, specifically in the Sima de los Huesos. In both cases, there is no relevant evidence of human occupation. Dirks and colleagues claim that the deliberate disposal of dead bodies by a species with a brain smaller than that of Homo habilis or gorillas represents a complex behavior (Stringer, 2015). In this research, we will study and reinterpret the findings from the Rising Star cave, where the remains of Homo Naledi were discovered.

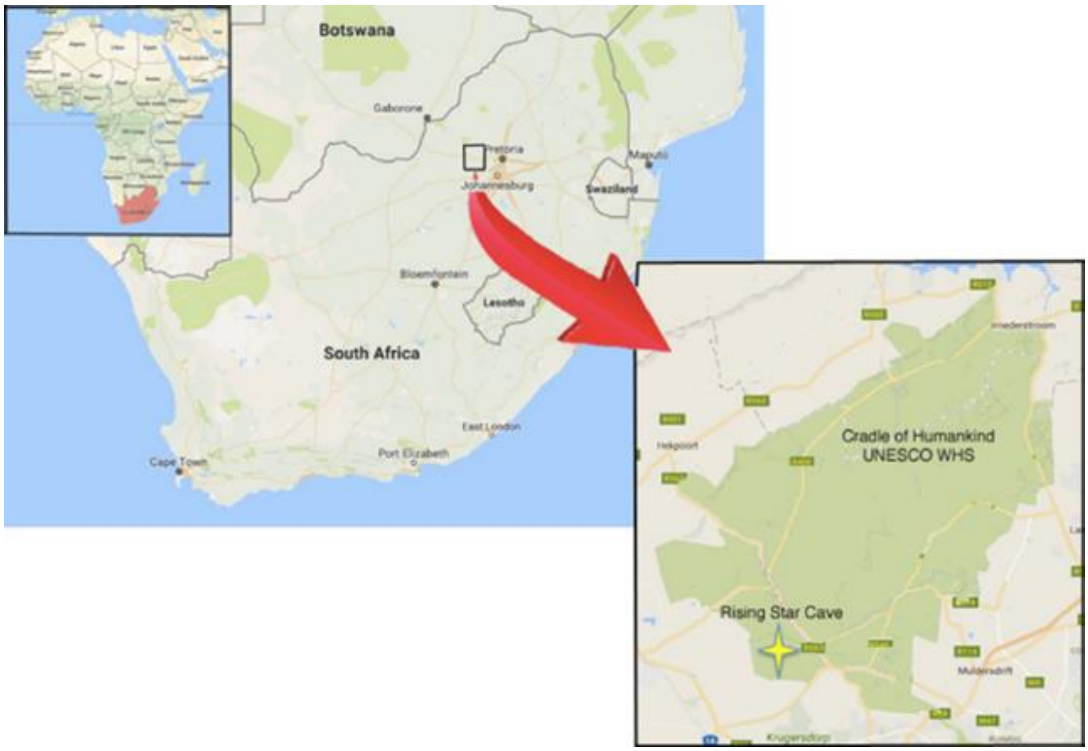

Figure 1: The geographical location of the Rising Star Cave (Hawks et al., 2017).

Research Methodology

In this writing, the research is based on library studies, and the research method is documentary. We will study and review the findings from the Rising Star Cave, where the remains of Homo Naledi have been discovered. We aim to understand Homo Naledi and answer the question of what the morphology and anatomical features of this new human species were like, and what differences and similarities we see in its morphology compared to other human species. Did Homo Naledi perform intentional burials? Do the remaining engravings indicate cognitive abilities in this human species? First, we will talk about Homo Naledi and become familiar with the discovery of this human species by researchers. Then we will focus on its morphology. After that, we will discuss and examine whether this human engaged in intentional burial or not. Finally, we will review the engravings left by them. Familiarity with these ancient human species will undoubtedly help us in understanding the evolution of humans and even the characteristics that are now considered unique to the human species.

Homo Naledi

Modern humans are now the only living species in their genus. However, until about one hundred thousand years ago, several other species existed that belonged to the genus Homo. Along with modern humans, these extinct human species, our ancestors and their close relatives, are collectively known as "hominids. " In the Rising Star Cave in the Cradle of Humankind World Heritage Site in South Africa, an extinct species of the genus Homo has been discovered from deep underground in a place called the DiNaledi Chamber (Fig. 2). This species is named Homo Naledi (Welker, 2017: 180).

Remains of at least fifteen individuals, totaling one thousand five hundred and 150 fossils (Fig. 3), were excavated from the DiNaledi Chamber in the years 2013 and 2014 (Berger *et al.*, 2015). The fossils are the largest collection of hominin species in Africa. The chamber is thirty meters underground and is accessible only through a narrow twelve-meter shaft (Fig. 2). Based on sedimentary data, the bodies were deposited over time (Welker, 2017: 180, 181).

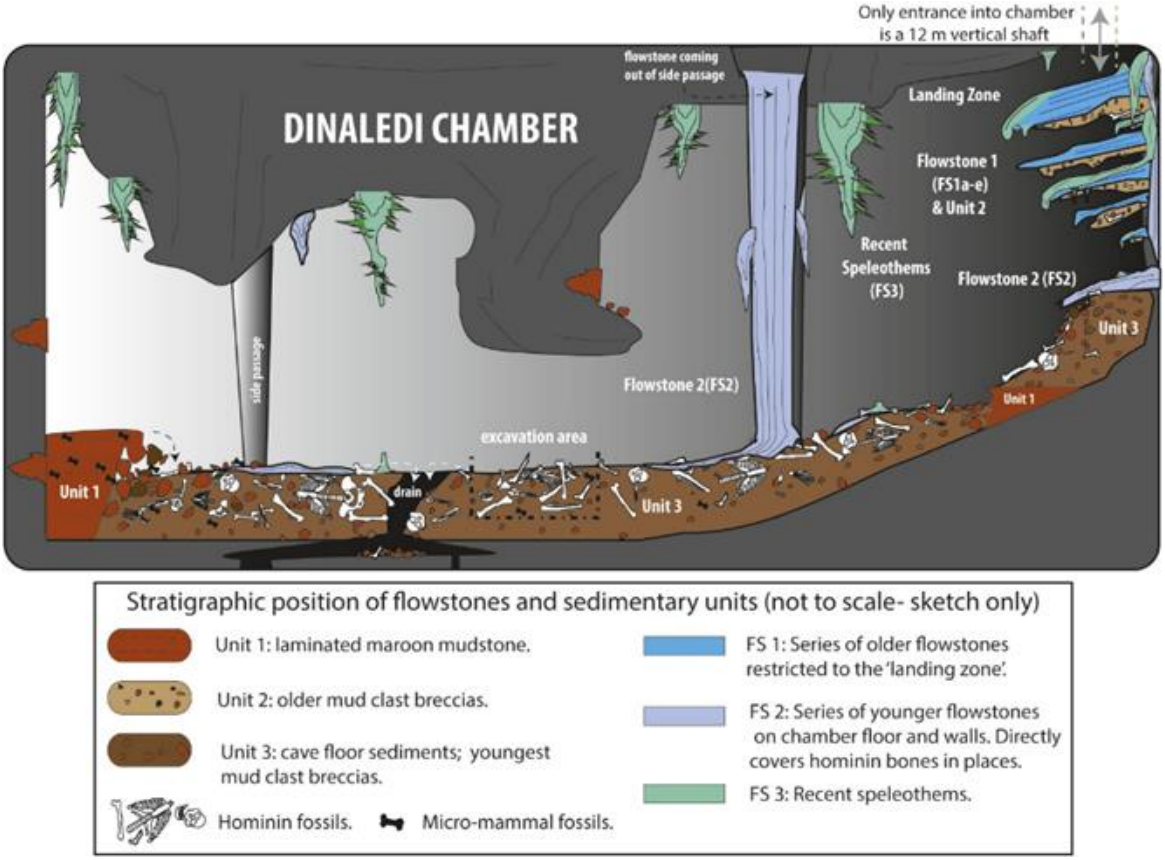

Figure 2: DiNaledi Chamber (Welker, 2017: 181).

The age of Homo Naledi was initially unclear, but its small brain led most to believe it was entirely ancient and likely lived more than one million five hundred thousand years ago. A combination of electron spin resonance (ESR) techniques on teeth, uranium-thorium on flowstone, and paleomagnetic dating has dated the DiNaledi fossils to between three hundred thirty-five and two hundred thirty-six thousand years ago (Tattersall, 2022: 127).

Figure 3: DiNaledi skeletal samples. These comprise seven hundred and thirty-seven incomplete or complete skeletal elements, many of which are formed from several reconstructed specimens. The "skeleton" design in the center of the photo is a composite of elements from multiple individuals (Welker, 2017: 182).

Morphology

The overall morphology of Homo Naledi places it within the genus Homo, while its features resemble those of Australopithecus or other early hominin genera. The derived shared traits that connect Homo Naledi to other members of the genus Homo encompass most areas of the skeleton of Homo Naledi. Shared locomotor features with humans include fully elongated lower limbs, marked by a distinct Linea aspera, strong attachments for the large gluteal muscles, a slender fibula, and an overall human-like ankle and foot structure. These aspects of the lower limbs indicate improved locomotor performance for bipedal walking. The hand of Homo Naledi exhibits aspects of human morphology in the wrist, thumb, and palm, indicating an enhanced ability for manipulation and object handling compared to Australopithecus species, including Australopithecus sediba (Kivell *et al*., 2011; Kivell *et al*., 2015; as cited in Berger, 2015).

Homo Naledi lacks the strong chewing capabilities characteristic of Australopithecus and Paranthropus, with generally small teeth throughout, a delicate symphysis, a slender mandible, lateral positioning of the temporal lines, slight narrowing behind the eye socket, and non-protruding zygomatic arches (Berger *et al*., 2015). The structural configuration of the skull of Homo Naledi, beyond the functional aspects of chewing, is shared with humans. The face of Homo Naledi features a flat and square nasoalveolar clivus (from below the nose to the start of the teeth), which is comparable to that of Homo rudolfensis (Leakey *et al*., 2012; as cited in Berger *et al*., 2015). The similarities of Homo Naledi to earlier members of the genus Homo, including Homo habilis, Homo rudolfensis, and Homo erectus, suggest that this species may have roots in the early origins and diversity of our genus (Berger *et al*., 2015).

Burials

Burials are recognized in the archaeological record as pits dug into the ground that are intentionally created for the remains of the dead (Parker Pearson, 1999; Pettitt and Anderson, 2020; as cited in Berger *et al*., 2023a). Here, we

describe burials from the Rising Star Cave structure that contain the remains of Homo Naledi. Two delineated burial features were discovered and partially excavated in the floor of the DiNaledi chamber (Dirks *et al*., 2015; as cited in Berger *et al*., 2023a), and one delineated burial feature was extracted from the floor of a projection within the chamber (Fig. 4) (Elliott *et al*., 2021; as cited in Berger *et al*., 2023a). Analysis of the stratigraphy, texture, geochemical composition, and grain size of the sediments surrounding and within the burial in the DiNaledi chamber indicates that these two burials occurred in pits that were intentionally dug.

Excavations in 2013-2014 were conducted one to two meters southwest of Feature 1 in DiNaledi. In an 80 by 80 centimeter excavation area, remains attributable to at least five individuals were found, with many elements being highly fragmented and other elements found in articulation (Berger *et al*., 2023a; as cited in Berger *et al*., 2015). A simple explanation for this configuration of skeletal remains is that these remains may represent a multi-layered display of burials that have sequentially disturbed one another. In this scenario, when pits were dug for subsequent burials, the earlier burials were disrupted. Other remains outside the DiNaledi chamber and the projection within the chamber (Hawks *et al*., 2017; Brophy *et al*., 2021; as cited in Berger *et al*., 2023a) have been discussed as potential evidence of burial practices.

The remains found in narrow, remote passages cannot be explained as the result of carnivore activity or water (Elliott *et al*., 2021; Brophy *et al*., 2021; as cited in Berger *et al*., 2023a), and it is necessary to consider that Homo Naledi may have placed these incomplete remains in these locations, likely representing a form of burial storage. There is a possibility that Homo Naledi utilized specific areas of the cave structure for burial and other burial practices, which further exploration of the cave structure may evaluate.

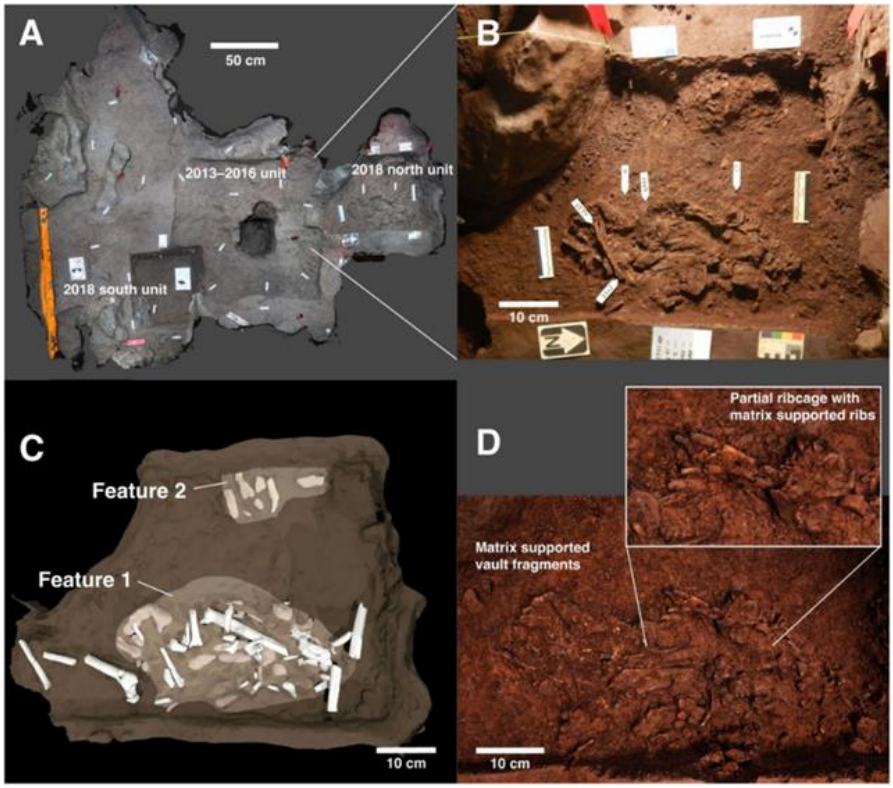

Figure 4: Burial features of the DiNaledi chamber. a) Photogrammetric model of the floor of the DiNaledi chamber and excavation areas. The locations of the excavation area from 2013-2016 and two excavation units from 2018 are labeled. (b) A photo of the excavation area including Feature 1 and Feature 2. (c) A 3D reconstruction of the excavation including the excavated skeletal materials and unexcavated materials in situ. The oval area of Feature 1 relates to the contrast of sediments and the overall outline of the skeletal materials remaining at the site. Three excavated bones on the left and one on the right were stratigraphically higher and outside of the feature. (d) A 3D reconstruction from photogrammetry of Feature 1 (Berger *et al*., 2023a).

Engravings of Homo Naledi

The production of painted, engraved, or carved designs on cave walls or other surfaces is recognized as a significant cognitive milestone in human evolution. Such conscious designs, widely interpreted as a means of denoting, recording, and transmitting information in a durable manner, were once considered exclusive to Homo sapiens during the late Pleistocene. Here, we discuss and examine the first known examples of abstract patterns and shapes engraved in the DiNaledi chamber of the Rising Star Cave in South Africa (Fig. 5). Signs have been identified that were engraved on the dolomitic limestone walls of the cave. The engravings described here consist of cross-hatching and other deeply incised geometric shapes. The surfaces bearing these engravings appear to have been prepared and smoothed. In some areas, there are remnants that create a sheen on the surface, likely indicating repeated touching or rubbing of the stone. Homo Naledi entered this part of the cave structure and buried bodies in the DiNaledi chamber and adjacent projections within the chamber (Dirks *et al*., 2017; Robbins *et al*., 2021; Berger *et al*., 2023a; as cited in Berger *et al*., 2023b). The engravings described here were found on a column in a projection within the chamber, which extends to a natural crack that connects two chambers, and researchers associate them with Homo Naledi. The engraved panels in the DiNaledi chamber are not covered by sediments, and no calcite formations that overlap with the engraved features have been identified. This complicates the assessment of the contemporaneity of the engravings with the burial evidence of Homo Naledi located just a few meters away (Berger *et al*., 2023b).

It is unlikely that any other hominin populations created these engravings. There is no physical or cultural evidence of any other hominin populations in this part of the cave structure, and there is no indication that recent humans or earlier hominins entered any adjacent areas of the cave prior to the investigations conducted by cave explorers over the past forty years. The existing evidence most closely aligns with the extinct species Homo Naledi as the creators of these markings.

Figure 5: Engravings in the Rising Star Cave (Berger *et al*., 2023b).

Conclusion

Homo Naledi was a species of early humans with a strange combination of ancient and modern features that lived only a few hundred thousand years ago in South Africa. This species had a brain the size of ancient hominins that lived millions of years ago. The discovery of hundreds of Homo Naledi fossils was the largest discovery ever made on the African continent. A key point in this context is that its young age means that Homo Naledi lived in Africa alongside several other large-brained humans, including our own species, Homo sapiens. The small brain of this species and its upper body shape resemble those of earlier australopithecines and early human species such as Homo habilis. The anatomical features of Homo Naledi indicate that it walked bipedally with a modern gait and an efficient long stride. Its shoulder position and finger shape would have aided in climbing and hanging from trees, which may have been traits inherited from a common ancestor with ape-like characteristics. Despite the young age of Homo Naledi fossils, their anatomy suggests that they could be close to the origin of the genus Homo in terms of evolution. The hands and wrists of Homo Naledi were suitable for tool-making, yet no stone tools associated with this species have been found. Dental and lower body skeletal features suggest that Homo Naledi may have had a lifestyle and diet similar to other hunter-gatherers present in Africa at the same time, such as late Homo heidelbergensis and early Homo sapiens.

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