Discovering Human Origins

Fossils, Practices, and Controversies

by

Paige Madison

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved October 2020 by the
Graduate Supervisory Committee:

Jane Maienschein, Chair
William Kimbel
Manfred Laubichler
Richard Creath
Ben Hurlbut

ARIZONA STATE UNIVERSITY

December 2020

ABSTRACT

This dissertation is an historical analysis of the science of human origins, paleoanthropology, examining the intersection of science and culture around fossil human ancestors (hominins) over the last century and a half. Focusing on fossils as scientific objects, this work examines three controversial fossils from the science's history asking, how do fossils formulate, challenge, and reconfigure notions of what it means to be human? The introduction reviews the historiography of paleoanthropology and the gaps that exist in the literature. Chapter two examines the first case study, the type specimen of Homo neanderthalensis, known as the Feldhofer Neanderthal, providing a biography of the object from its discovery in Germany in 1856 until its species designation in 1864. Chapter three briefly links the Neanderthal's story in time and space to the next fossil's story. Chapter four picks up the story of paleoanthropology in 1924 in South Africa, with the discovery and initial analysis of a specimen nicknamed the Taungs Baby, which was labeled a new hominin species, Australopithecus africanus. Chapter five is another brief chapter connecting the Taungs Baby story in time and space to the final specimen examined in this work at the end of the century. Chapter six examines the final case study, a specimen discovered in 2003 in Indonesia, designated a new species named Homo floresiensis and nicknamed the Hobbit. Through comparing contrasting, and connecting the stories of these three specimens, three major conclusions emerge about the field. First, the fossils themselves play an important role in knowledge production about the hominin past. Second, scientific practice shaped both interpretations of fossils and larger questions of what it means to be human. Third, the scientific practice is itself shaped by local culture, which continually interacts with attempts to establish a global

perspective about the human past. The perspective gleaned through the eyes of these three fossils therefore reveals the way shifting, rather than eternally true, claims are embedded in culture and intertwined with the perspectives of the humans conducting the science.

ACKNOWLEDGMENTS

A project that covers a vast stretch of time and crosses three continents necessitates an enormous amount of support and assistance. An astounding number of people have made this possible by supporting my work, encouraging the questions I have asked, and inviting me into their museums, archives, field sites, and villages to share their perspectives. Thank you to the Center for Biology and Society at Arizona State University for being a vibrant intellectual home that allowed me to move outside traditional disciplines. Support from Jessica Ranney, as well as everyone at the Center and the School of Life Sciences has been essential to my development and has allowed everything from exploratory archival missions to cross disciplinary conferences. A huge thank you to everyone on the Institute of Human Origins, for welcoming an historian into your classes, seminars, and journal clubs. This extraordinary group of researchers have provided unapparelled insight into the science of paleoanthropology in the making, informing every aspect of this work. This project would not have been possible without the support of the John Templeton Foundation, a special thanks to Paul Wason for continuously encouraging the cross disciplinary endeavor as well as my science outreach. Thank you also to the Fulbright Program for a fellowship that opened a window into Indonesian science and culture. I am also grateful for the Critical Language Enhancement Award, which allowed me to study Indonesian.

Research for the first case study was conducted in number of archives in London, England in 2014. Thank you to the Royal College of Surgeons Library for allowing me to dive into the papers of George Busk, as well as the Natural History Museum London Library, the British Library, the Linnean Society, the Royal Institution, and Imperial

College London, particularly to Anne Barrett for navigating the Thomas Henry Huxley Collection. When I began the research for the second part of this work, I was fortunate to return to these now familiar places with new questions and fresh eyes. Thank you to the RCS Library for hosting me for weeks in Arthur Keith's papers, particularly to Fahema Begum for her endless help, as well as University College London special collections. A special thanks to Professor Christopher Dean for the discussions about the personalities and methods of twentieth century researchers—these always helped me evaluate the archival material. I was also fortunate to have visited a true treasure trove of archives in South Africa; thank you to the University of Witwatersrand for allowing me endless time with Raymond Dart's papers, as well as Heidi Fourie at the Ditsong National Museum of Natural History, for a chance to examine Robert Broom's story. The history can only mean so much without the context of paleoanthropology in the present; thank you to everyone there who spoke with me, including Lindsay Hunter and Bernhard Zipfel.

Embarking on the final case study demanded a transition from archives to fields and laboratories—requiring the support of a staggering number of people who opened their doors. A tremendous thanks to Thomas Sutikna, Matt Tocheri, Wahyu Saptomo, and Jatmiko for inviting me to visit the field site of Liang Bua to join the excavations from 2017. Observing the research on the ground, day in and day out, allowed for a perspective that would have otherwise not been possible. I am enormously grateful to the Liang Bua Team, including Richard Roberts, Hanneke Meijer, Elizabeth Grace Veatch, Agus Julianto, Sekar Rizqy, Benyamin Tarus, Ande Mali, and the community across Teras, Bare, and Golo Manuk, *ca kilo*. Thank you to Wahyu and everyone at Pusat Penelition Arkeologi Nasional for providing me access to archival material. I am grateful for those

at AMINEF/Fulbright Indonesia, including Alan Feinstein for continuous support for this project. Thanks as well to the interviewees who provided international perspective on the *H. floresiensis* story, including Henry Gee, Lorraine Cornish, William Jungers.

Thank you to the editors who have helped me think through my research and get it publication-ready, including those at *Journal of the History of Biology, Endeavour, History and Philosophy of the Life Sciences, and The British Journal for the History of Science*. A huge thanks to all the participants of the Beyond Human Evolution Workshop for being willing to have big conversations about fossils and meaning, including Ian Tattersall, William Kimbel, Bernard Wood, Jeffrey Schwartz, Chris Manias, Matthew Goodrum, Michael Ruse, Michael Reidy and especially thank you to my co-organizer, Kate MacCord. Special thanks for the support for this event from IHO.

I am forever grateful to have joined such an incredible cohort of graduate students at the Center and IHO, thanks to each of you, especially Kate, my guiding light. Endless thanks to my Montana State crew, Michael Reidy and Patrick Anthony. None of this would have been at all possible without the endless support of my mother and my sister, Holly and Laura. Mom and sis: there are not enough sentiments in the world to properly thank you, this dissertation is for you. The nature of this work has required me to be somewhat nomadic, and I am eternally grateful to those who opened their homes to me and made that lifestyle possible, including the Reynes's, the Gray's, Kate and Challie, the Fleischer's (and their Jura), and many others. Lastly, thank you tremendously to my committee members, including my chairs, William Kimbel and Jane Maienschein. The example you have set will forever ensure that my evidence-based claims will always be situated in the larger picture and I will never stop asking "so what?"

TABLE OF CONTENTS

Page

LIST OF FIGURES

Figure Page

CHAPTER 1

INTRODUCTION

> Measurement, on which the whole possibility of science depends…is not an impersonal event that occurs with impartial universality. It's a human act, carried out from a specific point of view in time and space, from the one particular viewpoint of a possible observer.[1]
>
> Michael Frayn

Introduction

Who are we? Where did we come from? How did we come to be here? There are many different ways that humans seek answers to these profoundly meaningful, personal questions. One particular approach emerged in the nineteenth century around a set of material evidence—hardened, broken, and rendered fragmentary by vast stretches of time: the fossilized remains of human ancestors and close relatives. Such evidence, if examined carefully and systematically, it was suggested, could reveal clues about our evolutionary past. This way of knowing about ourselves as humans and our origins occurred at first in fits and starts and in unlikely places, the bits of fossilized bones and teeth accidentally unearthed as they were shoveled from quarries and blasted out of mines. But over the course of a century and a half, this effort to know humans' past and place in nature coalesced into a global scientific discipline; a discipline that deliberately collected, analyzed, and compared vast amounts of evidence from distant corners of the globe.

This dissertation is a history of paleoanthropology, the science that investigates human origins from a deep time perspective, primarily through fossils. A multifaceted

[1] Michael Frayn, *Copenhagen* (New York: Anchor Books, 1998), 71.

discipline with a complicated history, multiple aspects of paleoanthropology's definition are problematic, from its boundaries to the term itself. One, however, thing is clear: fossil humans and their ancestors and close relatives (hominins) make up a core piece of evidence in the discipline.[2] For the purposes of this dissertation I focus on that central component, the bones themselves. The section that follows provides a brief overview of paleoanthropology's history, before describing my approach and contribution to the literature.

Resurrecting Paleoanthropology's History

The first fossils that emerged from the ground and were recognized as seemingly blending human and ape-like characters arrived in the mid nineteenth century, during a time of immense intellectual change. Only recently had it been discovered that humans had a deep past, and this recognition was just beginning to merge with radical ideas about evolution and immense change over time.[3] Surfacing sporadically in caves and quarries, these ancient bones challenged scientists with the task of trying to understand and reconstruct their own history from these fragments of material evidence within this

[2] I am following the lead of historian of science Marianne Sommer on this, see Marianne Sommer, *Bones and Ochre: The Curious Afterlife of the Red Lady of Paviland* (Cambridge: Harvard University Press, 2007): 8.

[3] A. Bowdoin Van Riper, *Men Among the Mammoths: Victorian Science and the Discovery of Human Prehistory* (Chicago: University of Chicago Press, 1993); Donald Grayson, *The Establishment of Human Antiquity* (New York: Academic Press, 1983); Martin Rudwick, *Worlds Before Adam: The Reconstruction of Geohistory in the Age of Reform* (Chicago: University of Chicago Press, 2010); Martin Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* (Chicago: University of Chicago Press, 2005); Peter J. Bowler, *Evolution: the History of an Idea* (Berkeley, CA: University of California Press, 2003).

context. This moment, in the mid-nineteenth century, is often perceived as when the field, which would later coalesce as paleoanthropology, began.[4]

From the arrival of the first widely recognized specimen of a potentially ancient human in the Neander Valley, Germany, the material evidence slowly began to accumulate across Europe. These often accidental discoveries, disturbed by mining activities and human expansion, were distributed across assorted locations from Germany to Belgium. The finds only provided small glimpses into the past, with naturalists often struggling to identify major differences between the large brained skulls that appeared and modern humans living across the globe.[5] During this time, naturalists constructed intricate hypotheses about the still largely unknown, deep human past, populated by more distant creatures that appeared half human and half ape. They fabricated imagined ancestors who lacked defining human features, such as speech, and constructed theoretical continents on which human evolution might have occurred.[6] Without abundant evidence of the contours and details of this past, researchers largely hypothesized answers to big questions regarding humans' past and place in nature.

At the end of the nineteenth century and into the first decades of the twentieth, the new discipline of paleoanthropology began to expand beyond the boundaries of Europe and scientists sought out the fossils deliberately, rather than waiting for them to surface

---

4 As discussed in Matthew Goodrum, "The History of Human Origins Research and its Place in the History of Science: Research Problems and Historiography," *History of Science* 47 (2009): 339. Though not all scholars agree, see: Pat Shipman and Paul Storm, "Missing Links: Eugène Dubois and the Origins of Paleoanthropology," *Evolutionary Anthropology: Issues, News, and Reviews* 11, no. 3 (2002): 108-16.

5 Matthew R. Goodrum, "The Beginnings of Human Paleontology: Prehistory, Craniometry, and the 'Fossil Human Races,'" *The British Journal for the History of Science* (2016): 387-409.

6 For example, Charles Darwin, *Descent of Man* (London: John Murray, 1871); Ernst Haeckel, *The History of Creation* (London: Kegan Paul, Trench & Co, 1876); Sumathi Ramaswamy, *The Lost Land of Lemuria Fabulous Geographies, Catastrophic Histories* (Berkeley: University of California Press, 2004).

accidentally. Finds slowly began to accrue from more distant parts of the globe, turning up in the riverbanks and mines of European colonies from Asia to South Africa. These discoveries increasingly looked less human-like and more ape-like—though not always in the same manner. It quickly became clear that interpreting the fossils' meaning and significance was not an easy task—and different researchers reached wildly divergent conclusions about each fossilized jawbone and partial cranium.[7]

The second half of the twentieth century saw the increasing professionalization of the science, with progressively larger expeditions setting out to explore desert plains, underground caves, and rift valleys in search of fossils and numerous institutions evolving and expanding to train researchers. Geographically focused, well funded searches for the material evidence of our past resulted in a rapidly accruing record, and numerous finds began to erect an outline of the hominin story. Scientific focus narrowed in on eastern Africa, where smaller brained, upright walking (bipedal) ancestors and relatives began emerging at a rapid pace. While the accumulation of these fossils led to a clearer outline of, and set of themes within, the human story, it also began to point to potentially more diversity and complexity having existed in the past than expected.

Throughout this history, as researchers argued over new finds and developments, the science of human origins was frequently characterized by controversy. The most common explanation for the prevalence of controversy is the personal and therefore

[7] Peter J Bowler, *Theories of Human Evolution: A Century of Debate, 1844–1944* (Baltimore: Johns Hopkins University Press, 1986); Richard Delisle, *Debating Humankind's Place in Nature, 1860–2000: The Nature of Paleoanthropology* (Upper Saddle River, N.J.; Pearson Prentice Hal, 2007); Ian Tattersall, *The Fossil Trail: How We Know What We Think We Know about Human Evolution* (Oxford: Oxford University Press, 1997).

"emotional" nature of the subject matter, and personal egos of researchers.[8] In 1958, for example, anatomist W.E. Le Gros Clark claimed that "undoubtedly, one of the main factors responsible for the frequency with which polemics enters into controversies" in paleoanthropology "is purely an emotional one."[9] "It is a fact," he went on to argue, "that it is extraordinarily difficult to view with complete objectivity the evidence for our own evolutionary origin, no doubt because the problem is such a very personal one."[10] There is a difference in emotion, this perspective claims, between studying a topic like biochemistry, and a "cradling in one's hands a cranium drawn from one's own ancestry," that leads researchers to become invested in their fossil analyses in particular ways.[11] Humans are simply standing too close to their own family tree to be able to see it clearly.

There is certainly no shortage of controversy in paleoanthropology's history, but this dissertation will provide an alternative view of the accumulation of fossil specimens over the last century and a half and our understandings of debates that surrounded the specimens. As we will see, the nature of paleoanthropological controversies is much more complex—and more interesting—than just scuffles about ego and emotion.

Approach

Given the fundamental role of fossil human remains in the discipline, I approach paleoanthropology's history in this work through a focus on the fossils.[12] In an excursion

---

8 Ernst Mayr, *Animal Species and Evolution* (Cambridge: Harvard University Press, 1963): 21.

9 Wilfrid Le Gros Clark, "Bones of Contention," *The Journal of the Royal Anthropological Institute of Great Britain and Ireland* 88, no. 2 (1958): 132.

10 Clark, "Bones," 132.

11 Clark, "Bones," 132.

12 Though not every discovery I discuss will be fully fossilized, including the type specimen of *Homo floresiensis*, LB1, which is not fossilized.

that traverses Europe, Africa, and Asia, I investigate the roles that these scientific objects play in crafting understandings of humans and their past throughout the discipline's history. I examine three hominin discoveries in particular, asking how their interpretations and meanings were determined, contested, and disputed by a set of researchers. I am especially interested in the scientific practices these researchers employed to study the bones—as well as the cultural and historical setting of which they were located.

This work joins a growing body of scholarship in the history of science that concentrates on material objects, or "things."[13] There are two major advantages of organizing the narrative around objects—rather than around ideas, people, or institutions. First, it allows the analysis to transcend a range of conventional categories and partitions. These categories might include cultural and geographic divisions, or divisions that have been constructed in the historiographical literature, such the field versus the laboratory and professional scientists versus amateurs.[14] Freeing the analysis from any limitations imposed by these circumscribed, sometimes artificial categories, a fossil-centered approach provides a different angle from which to view the science. This viewpoint casts

---

[13] Lorraine Daston, *Things That Talk: Object Lessons from Art and Science* (New York: Zone Books, 2004); Lorraine Daston ed., *Biographies of Scientific Objects* (Chicago: University of Chicago Press, 2005); Samuel Alberti, "Objects and the Museum," *Isis* 96 no. 4 (2005): 559-571; Fa-ti Fan, "Circulating Material Objects: The International Controversy over Antiquities and Fossils in Twentieth-century China," in *The Circulation of Knowledge Between Britain, India and China: The Early-Modern World to the Twentieth Century*, eds. Lightman & Stewart (Leiden: Brill, 2013): 209-236.

[14] Robert E. Kohler and Jeremy Vetter, "The Field," *A Companion to the History of Science* (2016): 282-95; Jeremy Vetter, "Cowboys, Scientists, and Fossils: The Field Site and Local Collaboration in the American West," *Isis* 99, no. 2 (2008): 273-303; Susan Leigh Star and James R. Griesemer, "Institutional Ecology, Translations and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39," *Social Studies of Science* 19, no. 3 (1989): 387-420.

a wider lens on the people who engage with the fossil, the places where analyses are conducted, and the scientific practices applied.

The second benefit of studying things is that doing so allows an examination of a tension that surrounds scientific objects, derived from the fact that they are at once real entities and at the same time historically contingent. Fossils are concrete objects that make up the physical evidence of humans' evolutionary past. They are static, often unchanging for millions of years. Yet interpretations of them—their status, meaning, and significance—varies dramatically depending on the historical setting and the observer. This tension has been called "the brute intransigence of matter, everywhere and always the same" on the one hand and "the plasticity of meaning, bound to specific times and places" on the other.[15]

The Fossils

"The essence of a scientific object," historian Lorraine Daston has claimed, "is its potential for surprise, its capacity to outstrip expectations and imagination framed by the current way of thinking or doing."[16] That depiction precisely describes the three fossils at the core of this dissertation. Each emerged from the ground and quickly transitioned to the center of big controversies regarding humans' past and place in nature. None of the finds fit within expectations for what a fossil hominin should look like, given the contemporary ways of thinking. While each was proposed as the type specimen of a new species of human ancestor or relative, the validity, identity, and significance of each

15 Daston, *Things That Talk*, 16.
16 Daston ed., *Biographies*, 12.

specimen was intensely debated. Each unsettled understandings of "the human," instigating controversies regarding proper methodology in the science of human origins.

The first fossil in this story is a specimen known as Feldhofer 1. Discovered accidentally by quarry workers in 1856 in the Neander Valley, Germany, it was the first ancient, human-like creature to be recognized, widely discussed, and interrogated in terms of its human status.[17] As this surprising partial skull (cranium) and skeleton passed through a series of hands and circulated outside the valley and across Europe, it provoked debates about where the boundary of "human" lay—and what a fossil human ancestor should look like. Feldhofer 1 displayed an unexpected mosaic of characteristics; combining a human-sized brain with a shockingly massive, ape-like brow ridge, for example. The fossil became known colloquially as the Neanderthal Man and eventually scientifically as *Homo neanderthalensis* in 1864.[18] It problematized the idea that large brains were a uniquely human feature, while raising questions about how humans should be defined, where they fit within the natural world, and who should be authorized to make claims on their fossilized remains.

[17] Although "recognized" and "widely recognized" are the key words here, there were earlier discoveries, see: Paige Madison, "The Forgotten Fossil: The Wild Homo Calpicus of Gibraltar," *Endeavour* 40, no. 4 (2016): 268-70; Bernard Wood, "The 'Neanderthals' of the College of Surgeons.," *Annals of the Royal College of Surgeons of England* 61, no. 5 (1979): 385; Alex Menez, "The Gibraltar Skull: Early History, 1848–1868," *Archives of Natural History* 45, no. 1 (2018): 92-110.

[18] Schaaffhausen in George Busk, "Translation with Comments of 'On the Crania of the Most Ancient Races of Man by D. Schaaffhausen," *Natural History Review* (1861): 155–76; William King, "The Reputed Fossil Man of the Neanderthal," *Quarterly Journal of Science* 1 (1864): 88-97.

Figure 1 The Neanderthal specimen, courtesy of the University of Bonn

The second specimen in this story is that of an equally controversial fossil known as the Taungs Baby. Discovered somewhat accidentally in a South African mine in 1924 and passed through a similar series of hands from quarry owners to university professors, this partial skull also surprised scientists by confronting them with a bewildering set of human and ape-like characteristics.[19] Though unquestionably more primitive-looking than any fossil discovered to date, the Taungs Baby also instigated debates about what should be considered human. The specimen also raised a unique set of questions due to its nature as that of a juvenile. The Taungs Baby was put forward by its discoverer as a new genus and species of human ancestor, *Australopithecus africanus*. Much like with the Neanderthal Man, however, the fossil's designation and was intensely debated and entirely dismissed by some researchers.

[19] Raymond Dart, "*Australopithecus africanus*: The Man-Ape of South Africa," *Nature* 115, (1925): 195–199; Arthur Keith, "The Fossil Anthropoid Ape from Taungs," *Nature* 115 (1925): 234; Grafton Elliot Smith, "The Fossil Anthropoid Ape from Taungs," *Nature* 115 (1925): 235.

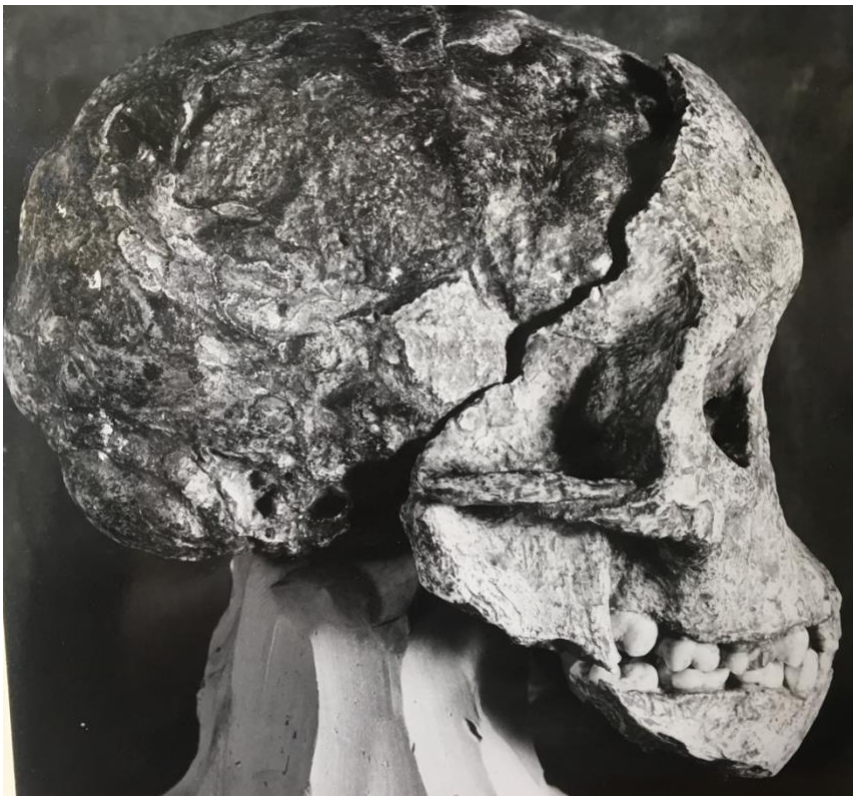


Figure 2 The Taungs Baby specimen, courtesy of University of Witwatersrand

Finally, the third specimen is a contentious specimen unearthed in a limestone cave in 2003 on an Indonesian island. Known colloquially as the "Hobbit" and scientifically as LB1, this complete skull and partial skeleton also presented a mixture of human-like and "other" traits that challenged scientists' understandings of both humans and human origins more broadly.[20] The tiny brained individual, discovered alongside stone tools, was another example of a specimen that combined traits thought to be unique to humans, with traits that were clearly very different, while challenging overall patterns thought to have been present in the past. To some researchers, this controversial

[20] Peter Brown et al., "A New Small-Bodied Hominin from the Late Pleistocene of Flores, Indonesia," *Nature* 431, no. 7012 (2004): 1055-61.

specimen represented a new species, *Homo floresiensis*, while to others, it was a misinterpreted modern human in need of reevaluation.

Figure 3 The Hobbit specimen, courtesy of the Liang Bua Team

Driving Question

Taken together, these three fossils, discovered approximately three quarters of a century apart in vastly different parts of the world, form three important points on the arc of the story of paleoanthropology. The overall aim of this dissertation is to compare, contrast, and connect these three fossil's stories in order to derive lessons about the field. I treat each specimen as a case study of an object that necessitated reevaluations of ways of knowing about the human past, asking how scientists attempted to understand the

controversial bones. For each fossil, I ask the driving question: How do fossils formulate, challenge, and reconfigure notions of what makes us human?

Each case study is a biography of an object, following the specimen from its moment of discovery into the heart of the science of human origins.[21] In order to look closely at each fossil and its context, these biographies are tightly circumscribed in time, each covering less than eight years of the fossils' early analysis. Between each case study, I have inserted a short, linking chapter that connects the cases in in time and space, while beginning to draw out the lessons derived from comparing their stories. By bringing together these case studies, this fossil centered approach will result in a new perspective on paleoanthropology's history, filling gaps in the literature while raising novel questions about the science and its past.

The Historiography

Paleoanthropology's history has generally been told, broadly speaking, by two different groups of scholars who have approached the task in distinct ways. For much of the discipline's history, historical analyses were undertaken by the paleoanthropologists themselves. Their keen interest in their field's development, complimented by their knowledge of the discoveries and relevant competing theories, allowed them to piece together numerous historical surveys with narratives that are driven by the discoveries.[22]

---

[21] An example of this approach within paleoanthropology, that I draw from here is: Sommer, *Bones and Ochre*.

[22] Tattersall, *The Fossil Trail*; John Reader, *Missing Links: The Hunt for Earliest Man* (London: Collins, 1981); Jeffrey H. Schwartz, *What the Bones Tell Us* (Tucson: University of Arizona Press, 1998); Erik Trinkaus and Pat Shipman, *The Neandertals: Changing the Image of Mankind* (Alfred a Knopf Inc, 1993).

Historians of science have only recently become interested in paleoanthropology, and they have produced a set of examinations of the intellectual development of the field.[23] The result is two general bodies of literature that emphasize different aspects of the scientific process and thus portray the science in two different ways. In this section, I briefly review these two bodies of scholarship, identifying three major gaps in this literature that exist within them, which I aim to address with this dissertation.

The first of these methods, the discovery driven approach, places the fossils centrally in the historical narrative. While some attention is paid to the context within which the fossils were interpreted, including historical actors' theoretical commitments to certain evolutionary theories, for example, it is the fossils that take central stage. By tracing the accumulation of fossils (and therefore knowledge) over time, while highlighting missteps and wrong directions in the process, these scholars reveal how this collection of fossils led to current understandings of human origins.

In contrast to this approach, a series of intellectual histories of paleoanthropology have appeared, aiming to illuminate a different aspect of the science: the theoretical framework within which the fossils were interpreted.[24] In contrast to the discovery driven approach, these works have decentered the fossils from the narrative. This tactic is necessary, some historians of science have argued, because the fossils occasionally "had meaning only to the extent that they could be fitted into theories of how human evolution occurred."[25] Therefore, authors like Peter Bowler contend, "a comprehensive study of

---

[23] Bowler, *Theories*; Delisle, *Debating*.

[24] Bowler, *Theories*; Wiktor Stoczkowski, *Explaining Human Origins: Myth, Imagination and Conjecture* (Cambridge: Cambridge University Press, 2002); Misia Landau, *Narratives of Human Evolution* (New Haven: Yale University Press, 1993).

[25] Bowler, *Theories*, 5-6.

how understandings of human evolution has developed must focus on the theories, not on the fossils."[26]

While these existing histories are valuable for illuminating different aspects of the science, the divergent, incongruous portrayals of paleoanthropology leave us not only with a gap between how we think about theories and evidence, but also with a dilemma. Is paleoanthropology a theory-heavy enterprise within which fossil human ancestors were interpreted, or is it a series of hominin fossil discoveries that led to the construction of theories? Are ideas derived from the empirical evidence, as the fossil centered narratives suggest? Or is the empirical evidence negotiated into predetermined conceptions and preexisting theoretical commitments about human origins?[27] In other words, is the knowledge theory driven or fossil driven—which of these has led to the current hypotheses and understandings in the field of human origins? Emphasizing one or the other has potentially dramatic implications for our understandings of the science, shaping the questions we ask about who counts in the histories, where the science occurs, and more. A question that can be reframed in a way that is central to this dissertation: what role do the fossils play in knowledge production?

Another feature of this existing literature worth inspecting is the matter of scope. Many of the fossil driven and theory driven works share in common the feature of generally being wide scope—surveying paleoanthropology's history in its entirety, from the earliest recognized fossil discoveries to the present. The dominant intellectual histories, for example, span over a century.[28] Philosopher Richard Delisle has argued that

---

[26] Bowler, *Theories*, 5-6.
[27] As Stoczkowski and Bowler claim, see: Bowler, *Theories*; Stoczkowski, *Explaining*.
[28] Including Bowler, *Theories*; Delisle, *Debating*.

this wide lens has the "great advantage of permitting a synthetic view of the development of the field."[29] Many of the fossil driven narratives also utilize this wide span, suggesting that it is necessary to follow the accumulation of fossil specimens to understand what paleoanthropologist Ian Tattersall has termed the question of "how we know what we think we know about human evolution."[30]

While this approach certainly does provide advantages such as a synthetic view of the science, it also inherently has limitations. As Delisle admits, such a perspective has the "important disadvantage of overlooking small scale events."[31] Discussions of each fossil are often restricted solely to its discoverers and the major players in the field who commented on it, for example. The broad view lacks rich detail such as the full range of actors engaged in a fossil's discovery and examination, the scientific practices they employed to draw their conclusions, and the places in which they worked.[32]

There are certainly exceptions to this general historiographical trend; a subset of histories exist that focus on small scale episodes in paleoanthropology's history. These works often examine a single discovery or controversy, illuminating the particular features at stake in the controversy over that fossil.[33] While these close analyses help fill

---

29 Delisle, *Debating*, 42.

30 Tattersall, *How We Know*; Reader, *Missing Links*.

31 Delisle, *Debating*, 42.

32 This also does not fit modern historiographical standards that emphasize a more complex picture than simply discoverers and leading theories, for example James Secord argued in 1993, "Essentialist stories of science as the central actor in a drama of triumph or disaster, will be replaced by a focus on questions, debates and contests for authority. The most successful accounts will be those that hold these partial perspectives and situated knowledges…in tension," James A. Secord, "Introduction: The Big Picture." *The British Journal for the History of Science* 26, no. 4 (1993): 387-89.

33 For example, Frank Spencer, *Piltdown: A Scientific Forgery* (New York: Oxford University Press, 1990); Bert Theunissen, *Eugène Dubois and the Ape-Man from Java: The History of the First 'Missing Link' and Its Discoverer* (Dordrecht: Kluwer, 1988); Pat Shipman, *The Man Who Found the Missing Link: Eugène Dubois and His Lifelong Quest to Prove Darwin Righ*t (Cambridge, Mass: Harvard University Press, 2002); Thomas Gundling, *First in Line: Tracing our Ape Ancestry* (New Haven: Yale University Press, 2005).

in some of the rich detail missing in the broader views, they too are necessarily limited, as they struggle to place these moments firmly in the broader scientific and historical context.[34]

Taken together, this scholarship lays important groundwork for the history of paleoanthropology, providing a necessary base from which to build upon. There remain, however, gaps to be filled and inconsistences to be resolved. In addition to the disconnect between intellectual histories and fossil-driven narratives mentioned above, the image of paleoanthropology we are left with from these pieces is incomplete. The depiction of the science is painted in broad strokes, with certain pieces illuminated in detail, yet not well situated within the larger picture. As historian Matthew Goodrum has argued, "we have begun to acquire some fragments of the history of paleoanthropology, but what is needed is a more comprehensive view of what the history of paleoanthropology is."[35] That more comprehensive view, I argue, cannot be accomplished with another survey of the field in its entirety. Instead, a different approach is necessary, for example that of this dissertation, which combines a series of close examinations and draws them together.

The final—and most significant—aspect missing from this historiography is attention to the social, cultural, and political factors that shaped the science. As Goodrum has pointed out, "rarely" do histories "discuss the external social factors that helped shape the history of human origins research."[36] This omission is occasionally addressed explicitly, for example in Delisle's intellectual history, which admits there will be "no

---

34 Even the histories that are less narrow than a single fossil, for example (Gundling, *First in Line*), are still limited to focusing on one part of the world, while research was unfolding internationally.

35 Goodrum, "The History of Human Origins," 338.

36 Goodrum, "The History of Human Origins," 337.

attempt to evaluate the possible role of social factors on the development of paleoanthropology," claiming that it is "unclear if such factors ever had any significant impact on the field."[37] Bowler, too, rarely elaborated on social and political contexts, leaving the intellectual concerns as the central concern.[38] But, as historians of science have repeatedly shown, such social factors do play a role in knowledge construction.[39] This is not to assert that all science is entirely socially constructed, but instead to say that empirical facts are constructed in particular places and times—and are necessarily shaped by those factors to some extent. As playwright Michael Frayn reminds us, science—even down to the level of the simple act measurement—is "carried out from a specific point of view in time and space, from the one particular viewpoint of a possible observer," and is therefore not an entirely impersonal event.[40] Only very recently have some historians of science begun to turn to paleoanthropology with attention to social and cultural contexts and in doing so have begun to reveal the rich perspectives that can be obtained from attending to these dimensions.[41]

---

37 Delisle, *Debating*, 38.

38 David K. van Keuren, "Theories of Human Evolution: A Century of Debate, 1844–1944," *Isis* 78, no. 3 (1987): 293.

39 These arguments have been out there as early as Steven Shapin, "The History of Science and Its Sociological Reconstruction," *History of Science*, 20 (1982): 157-211; Steven Shapin and Simon Schaffer, *Leviathan and the Air Pump*, (Princeton: Princeton University Press, 1985), for example.

40 Frayn, *Copenhagen*, 71.

41 Matthew R. Goodrum, "The Idea of Human Prehistory: The Natural Sciences, the Human Sciences, and the Problem of Human Origins in Victorian Britain," *History and Philosophy of the Life Sciences* 34 (2012): 117-45; Marianne Sommer, "An Amusing Account of a Cave in Wales: William Buckland (1784–1856) and the Red Lady of Paviland," *British Journal for the History of Science* 37 (2004): 53–74; Manias, Chris. "*Sinanthropus* in Britain: Human Origins and International Science, 1920–1939." *The British Journal for the History of Science* 48, no. 2 (2014): 289-319; Peter C. Kjærgaard, "The Fossil Trade: Paying a Price for Human Origins," *Isis* 103, no. 2 (2012): 340-55; Erika Milam, *Creatures of Cain: The Hunt for Human Nature in Cold War America*, (Princeton: Princeton University Press, 2019); Sigrid Schmalzer, *The People's Peking Man: Popular Science and Human Identity in Twentieth-Century China* (Chicago: The University of Chicago Press, 2008).

How, then, to resolve these incongruent narratives and fill the gaps in the literature? How to tell a different kind of history—one that is neither too broad nor too narrow; one that bridges the intellectual and practice aspects of the science, do just that by examining, comparing, and contrasting three episodes in the history of paleoanthropology? Each episode, or case study, focused tightly around the fossil, while attending to the social, cultural, and practical worlds in which each object was situated. By looking closely at each of these objects—and still connecting them in space and time—I aim to construct a history that is broad in range and still focused in scope and rich in detail.

Road Map and Chapter Summaries

The story begins in the Neander Valley, Germany, in chapter two with the first case study of a surprising fossil. There, in a limestone quarry in 1856, the fossilized remains of a human-like individual unearthed from a cave and traveled to a nearby university, a series of scientific meetings, and ultimately into the center of a discussion about human origins. The naturalists studying this creature (the man from the Neander Valley) with its odd mixture of humanlike and apelike traits, were faced with a unique set of challenges at the birth of a new scientific discipline. Anatomists, paleontologists, and geologists struggled with a range of practical issues involved in understanding the specimen, including identifying the materials the specimen should be compared to, ascertaining its proper measurements and assigning significance to those measurements, and conceptualizing existing variation in the human species as well as definitions of "human" overall. Following the specimen through Germany and into scientific

publications for just a few short years, our story concludes with the fossil's controversial designation of a new species of human relative in 1864: *Homo neanderthalensis*.

Upon concluding this close examination of the early years of the Neanderthal debates, I will turn in chapter three to the developments that followed in the construction of paleoanthropology. This brief chapter links the story of the Neanderthal to the next case study, highlighting the broader themes and shifts that occurred in the science during intervening sixty years, as finds began to trickle in from more distant corners of the globe.

The fourth chapter examines the second case study, that of the South African fossil discovery known as the Taungs Baby. Tracing the path of the small skull from its 1924 detection in a mine to the center of debates about human origins, the fossil not only raised questions about patterns and locations of human origins, as we will see, but also about practical questions of proper methodology, circulation of specimens, and comparative collections. Though the discoverer declared the fossil a new, pre-human genus and species, *Australopithecus africanus*, the distant location from the large centers where comparative collections had accumulated and where principal intellectual centers were perceived to be located led many to doubt or dismiss the claim.

Leaving the story of the Taungs Baby at the height of its unresolved controversy in 1929, the fifth chapter looks ahead to the rest of the twentieth century, as the discipline became increasingly international, formalized, and complex. This brief chapter, which links the story of the Taungs Baby to the third and final case study, picks up on the themes raised in the previous chapters, namely the difficulty defining notions of humans and the role of fossil evidence in the construction of narratives.

Chapter six turns to the final case study, that of the Indonesian "Hobbit" find of 2003. Discovered during an archaeological dig on an oceanic island, the small human-looking specimen was suggested to be a previously unknown species of human relative, named *Homo floresiensis*. As with the other case studies in this work, that species designation, the validity of the specimen's interpretation, and the boundaries of the human species were intensely debated. Following the controversies as they developed in scientific journals and public debates for only a few years, we will see how cross-cultural encounters on the ground raised practical problems with understanding and interpreting the bones.

Each chapter investigates a slightly different aspect of the science. The Neanderthal, for example, provides insight into the emergence of a new discipline, revealing the ways diverse research methodologies shape understandings of the bones when no disciplinary framework exists. The story of Taung exposes the difficulties of discovering an object in a somewhat isolated geographical location, while the Hobbit provides a window into the ways local practices and ideologies can shape anthropological research in ways that cause conflict and tensions, as researchers operate within a complex web of cross-cultural relationships. While the case studies themselves do not address the resolution of the controversy each specimen instigated by the fossils (which would be the topic of another dissertation), these resolutions will be touched upon in the linking chapters alongside the overall themes they raise.

Conclusion

The story of paleoanthropology that emerges in the subsequent pages reveals a field that came to use a limited set of fragile material evidence to ask big questions about what it means to be human. By looking closely at the stories of the three most controversial objects in the discipline's history, we will come to see a clearer picture of a discipline that not only grappled with personal, emotional questions about origins and ancestry, but also with the challenges associated with examining a limited, fragile, fossil record that was spread across continents.

As the issues of understanding human origins became tied to the challenges of interpreting material evidence, practical questions of how knowledge is constructed, reproduced, and accessed shifted the question of "what does it mean to be human" to "how can we know?" In taking seriously the nuanced viewpoint of the "particular observers" in the story who made the measurements and constructed hypotheses, we can better understand how the fossils' meanings are erected, shaped, and altered in particular times and places.

CHAPTER 2

THE MOST BRUTAL OF HUMAN SKULLS: *HOMO NEANDERTHALENSIS*

Introduction: Discovery in the Neander Valley[42]

In August 1856, during a routine workday in a German limestone quarry, a fossilized skeleton was shoveled out of a cave mouth, and sent tumbling down a steep cliff, landing on the valley floor below.[43] Though few would have guessed this on the day of the discovery, the skeleton would later become the first scientifically recognized Neanderthal, and the focus of intense scientific interest.[44] From the roughly human sized partial skull that survived the fall to its accompanying limb and rib bones, it became clear that there was something distinctly different about this human. Several unusual aspects of the anatomy of the fossil skull and skeleton required explanation, but there was no procedural precedent for how the bones should be studied. It was unclear who was qualified to examine them, or what data should be used in formulating claims about them. Those naturalists who studied the Neanderthal came from a variety of disciplines and borrowed techniques and tools from geology, archaeology, and various branches of anthropology.

---

42 This chapter appears in *The British Journal for the History of Science* (Madison 2016).

43 Ralf W. Schmitz, David Serre, Georges Bonani, Susanne Feine, Felix Hillgruber, Heike Krainitzki, Svante Pääbo, and Fred H. Smith, "The Type Site Revisited: Interdisciplinary Investigations of Skeletal Remains from the Neander Valley, Germany," *Proceedings of the National Academy of Sciences* 99 (2002): 1342-47.

44 Historians who have discussed the Neanderthal include Peter J Bowler, *Theories of Human Evolution: A Century of Debate, 1844–1944* (Baltimore: Johns Hopkins University Press, 1986): 33-34; Richard Delisle, *Debating Humankind's Place in Nature, 1860–2000: The Nature of Paleoanthropology* (Upper Saddle River, N.J.; Pearson Prentice Hal, 2007): 70-84; Ian Tattersall, *The Fossil Trail: How We Know What We Think We Know about Human Evolution* (Oxford: Oxford University Press, 1997): 13-21; James Shreeve, *The Neanderthal Enigma: Solving the Mystery of Modern Human Origins* (New York: William Morrow and Company, 1995): 25-33.

In the years immediately following the discovery, the identity and significance of the fossilized skeleton was debated not just across disciplines but across nations, as scholars grappled with its potential for illuminating the ancient human past. This chapter will examine these studies of the fossilized skeleton from its discovery in 1856 until its classification as a distinct species in 1864.[45] During this time, as this paper will show, the naturalists who studied the bones might have come from different countries, social contexts, and political standpoints, but at the core of their disputes were questions relating to measurement, technique, comparative material, and scientific practice. I will examine the various approaches to the fossils, exploring how their backgrounds and methodologies of the researchers differed, and how those differences factored into debates about the Neanderthal. What techniques did naturalists use to study the bones? How did they measure them and what did they compare them to? What tools did they use? How did they visualize them? Diverse explanations were proposed to explain the skeleton's oddities: some called it a modern murder victim, others a diseased idiot, and still others wanted to define it as a new variety of ape. This paper will show how each of these interpretations was based in methodological practice, as different naturalists placed emphasis on different aspects of the fossil's anatomy, used different contexts for comparison, and disagreed about correct technique.

Tracing the story of the first Neanderthal, from its moment of discovery to its christening as a new human species will illuminate the methodological difficulties scientists faced in the nineteenth century when attempting to understand human fossils.

---

[45] William King, "The Reputed Fossil Man of the Neanderthal," *Quarterly Journal of Science* 1 (1864): 88-97.

At the center of debates over what the Neanderthal was and what it meant was one central question: how *could* they know? The fossils from the limestone quarry in the Neander Valley barely survived their fall: the bones were only saved because the quarry owner happened to pass by and thought they belonged to a cave bear. Following their recovery, the bones began to pass through a multitude of hands as people attempted to make sense of the skeleton's peculiarities, following a winding path from amateur naturalists to university professors. This paper will follow their journey.

Measuring the Fossils: Craniometry

The first naturalist to examine the Feldhofer fossils was Johann Karl Fuhlrott, a local schoolteacher. Though Fuhlrott was not a recognized expert of any sort, his interest in natural history had led him to the quarry before. He had built a friendship with quarry owner Friedrich Wilhelm Pieper and he was the naturalist Pieper called whenever interesting fossils were found.[46] Naturally, then, he was invited to inspect the alleged cave bear bones, but when the Pieper revealed the wooden box filled with the fossils, Fuhlrott immediately recognized them as "undoubtedly human."[47] This was news that alarmed Pieper, who questioned how a human body had ended up in his quarry, wondering if it was the victim of a murder and if the police should be informed. Fuhlrott reassured him: the bones appeared to be very old, so if this was a murder victim, the murder had occurred thousands of years ago.[48]

---

46 Martha B. Kendall, "Fuhlrott, Johann Karl," *Complete Dictionary of Scientific Biography*, vol. 5 (Detroit: Charles Scribner's Sons, 2008): 206-07.

47 Ralf W. Schmitz and Jürgen Thissen, *Neandertal: die Geschichte geht Weiter* (Oxford: Oxford University Press, 2000): 38.

48 Schmitz and Thissen, *Neandertal*, 39.

Having recognized the fossils as human, Fuhlrott set out to understand their oddities. He was not a trained anatomist, but the shape of the skull struck him; its forehead was low and flat, unlike the high, doming nature of most human crania.[49] Fuhlrott knew of human populations in the Americas who purposefully flattened skulls during growth, and he assumed this cranium had been similarly modified to take such an odd shape. Fuhlrott alerted the press of this "surprising find" and the local paper reported the discovery of a member of a "flathead" race.[50] This was not surprising: discussion of human 'races' had become common by the nineteenth century, as taxonomists tried to understand human variation.[51] The study of human-looking fossils was framed by this understanding of race, with the Feldhofer remains being no exception.[52] The press coverage sparked the interest of anatomists at the nearby University of Bonn, foreshadowing the important role press coverage would play in human origins research throughout the nineteenth and twentieth centuries.[53] Fuhlrott brought the fossils to professor of anatomy at Bonn, Hermann Schaaffhausen, who began a thorough analysis.[54] In their presentation of the fossils to the world, Schaaffhausen was to take over the job of

---

49 Schmitz and Thissen, *Neandertal*, 39.

50 Schmitz and Thissen, *Neandertal*, 42.

51 Matthew R. Goodrum, "Prolegomenon to a History of Palaeoanthropology: The Study of Human Origins as a Scientific Enterprise, Part 2, Eighteenth to the Twentieth century," *Evolutionary Anthropology: Issues, News, and Reviews* 13 (2004): 226.

52 Matthew R. Goodrum, "The Beginnings of Human Paleontology: Prehistory, Craniometry, and the 'Fossil Human Races,'" *The British Journal for the History of Science* (2016): 387-409; Jeffrey H. Schwartz, "Race and the Odd History of Human Paleontology," *The Anatomical Record* 289 (2006): 225-40.

53 Chris Manias, "Sinanthropus in Britain: Human Origins and International Science, 1920–1939," *The British Journal for the History of Science* 48 (2015): 289-319; Amanda Rees, "Stories of Stones and Bones: Interdisciplinarity, Narrative and Practice in British Popular Prehistory, 1911–1935," *The British Journal for the History of Science* (2016): 433-51.

54 Matthew Goodrum, "Hermann Schaaffhausen (1816–1893)," in Matthew Goodrum (ed) *Online Biographical Dictionary of the History of Palaeoanthropology*, 2013.

accounting for their anatomy: Fuhlrott would be responsible for describing the circumstances of the quarry and the discovery.[55]

The fossils had immediately impressed Schaaffhausen as unlike any human he had ever seen. His studies of the skull and skeleton (postcrania) began by placing them in the context of the University's large international collection of human skulls. In the first attempts to measure and understand the Feldhofer fossils, Schaaffhausen's anatomical background inspired him to quantify the fossils' features and compare them to the bones of known human populations. His comparisons with other human skulls soon led him to reject Fuhlrott's hypothesis of artificial flattening. He had seen the skulls of individuals subject to this practice, and he had noted that this process often resulted in a skull that was irregular and uneven.[56] The shape of the Feldhofer skull, in contrast, was perfectly symmetrical. This could, he felt only be the result of natural processes, and this fact made the bones much more interesting.

Through his use of the comparative method based on quantitative craniometry, Schaaffhausen was able to argue that certain aspects of the fossils were truly unusual and represented characters that did not appear on the bones of living humans. For example, the skull was of "unusual thickness" for a human, and the bony ridge above the eye sockets, known as a brow ridge, was "enormously great."[57] Schaaffhausen drew attention to the "long, elliptical form" of the braincase, which he argued was quite different than

---

[55] Hermann Schaaffhausen, "Zur Kenntnis der ältesten Rasseschädel," *Archiv für Anatomie, Physiologie und wissenschaftliche Medicine* (1858): 453-78.

[56] Schaaffhausen in George Busk, "Translation with Comments of 'On the Crania of the Most Ancient Races of Man by D. Schaaffhausen," *Natural History Review* (1861): 158.

[57] Charles Lyell, *The Geological Evidences of the Antiquity of Man: With Remarks on Theories of the Origin of Species by Variation* (London: John Murray, 1863): 78.

the braincase of a modern human.[58] He argued that this combination of features, which together produced the "extraordinary form of the skull," was unknown to exist in any human race, even "the most barbarous."[59] But it should be remembered that craniometry itself was at this point a relatively new, although rapidly growing, science.[60] Naturalists throughout Europe had become interested in the physical variation among human skulls, and were attempting to examine this variation in new ways. They were applying quantitative techniques to various skull features in order to, for example, identify differences associated with geographical location, or 'races.' A central focus of craniometry was quantifying brain size and intelligence, usually achieved by measuring of the inside of the cranium. Schaaffhausen applied this technique to the Feldhofer cranium, filling it first with water, and later with dried millet-seed to double check his measurements. He found that the skull held 1033.24 cubic centimeters of water, indicating that the Feldhofer individual had a large brain, one that fell within the range of brain sizes in modern humans.[61]

This brain size measurement was pivotal for Schaaffhausen and indeed, would go on to exert a vital influence over the developing debate.[62] Despite a large brow, flat forehead, and strange shape, the fossil's large brain indicated its human status beyond a shadow of a doubt.[63] But the postcranial material also stood out against the range of then-known human variation. Schaaffhausen's measurements of the rest of the skeleton, when

---

58 Busk, "Translation," 158.
59 Busk, "Translation," 159.
60 Ann Fabian, *The Skull Collectors: Race, Science, and America's Unburied Dead* (Chicago: University of Chicago Press, 2010).
61 Busk, "Translation," 156.
62 Busk, "Translation," 163.
63 Busk, "Translation," 162-63.

placed in comparative context, provided further evidence that the Feldhofer creature was an extraordinarily distinct type of human. Schaaffhausen pointed out that the ribs were "unusually rounded," giving the bones more resemblance to those of "a carnivorous animal than those of a man."[64] Additionally, the limb bones were "unusually thick," with large muscle attachments that suggested the Feldhofer individual had been powerfully muscled.[65] This strength was echoed in its skull as well; indeed, the robust features of the skeleton helped to explain why the brow ridge was so prominent. The large brow was merely a side effect of an expanded frontal sinus, Schaaffhausen argued. This sinus had been enlarged, so that a creature of "unusual force and power of endurance in the movements of the body" could obtain more oxygen.[66] For Schaaffhausen, the unusual elements of the skeleton all made sense when considered as a whole. His examination of the postcranial features verified that the Feldhofer individual was not a "pathological deformity" and explained why the skull was so distinct; this was a previously unknown human race characterized by "uncommon strength."[67]

It is also worth noting that in Schaaffhausen's extensive comparisons of the Feldhofer fossils with known human variations, there was one group noticeably absent: other living primates.[68] This is perhaps not surprising, as Schaaffhausen's training in medicine encouraged him to focus narrowly on humans. He did, however, note that features such as the low forehead gave the skull the *look* "of the large apes," but he

64 Busk, "Translation," 158.
65 Busk, "Translation," 158.
66 Busk, "Translation," 162.
67 Busk, "Translation," 162.
68 Julia Drell, "Neanderthals: A History of Interpretation," *Oxford Journal of Archaeology* 19 (2000): 1-24. The question of whether such collections were available, and what exactly they consisted of, to the previous European interpreters warrants further investigation.

dismissed this as unimportant since such features were also present in races of "living savages."[69] Drawing from prevailing ideas in craniometry, this fitted with Schaaffhausen's belief that some 'races', such as Australians and Negros, were more ape-like in their form than Europeans. While the Feldhofer fossils exceeded all living humans' "peculiarities of conformation," they nevertheless followed the same racial pattern and could be accommodated within the human spectrum.[70] Theoretically, Schaaffhausen himself was not opposed to transmutation, but he was not committed to a specific evolutionary framework. In a paper published a year before his Feldhofer study, he argued that species immutability was not proven.[71] But his decision to define the Feldhofer fossil as a member of a distinct human race was based firmly in his methodology. Fundamentally, comparative quantitative craniometry told him that skulls varied, but anything with a brain size over 1000 cubic centimeters was human. Moreover, the peculiar elements of the skull made sense when considered in the context of the other bones.

Schaaffhausen and Fuhlrott's conclusions were first presented in early 1857 at the Niederrheinische Gesellschaft für Natur und Heilkunde (Lower Rhine Medical and Natural History Society). At this meeting, Schaaffhausen discussed the methods he used to study the skull along with his findings, while Fuhlrott concentrated on the circumstances of discovery and the local geology. And what is notable about the questions raised at the meeting was that they focused on the age, rather than the humanity

69 Busk, "Translation," 160.
70 Busk, "Translation," 172.
71 Hermann Schaaffhausen, "Ueber Beständigkeit und Umwandlung der Arten," *Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westphalens* 10 (1853): 420-51.

of the remains.[72] If this was a never before seen race of humans, when had the race lived? Schaaffhausen claimed that these "remarkable human remains" were ancient, but how, other scientists asked, did he know? Schaaffhausen repeatedly argued that it was "beyond doubt" that the bones had been buried for an immense amount of time, going so far as to claim that the Feldhofer Cave should be "regarded as the most ancient memorial of the early inhabitants of Europe."[73] Other naturalists, however, were less convinced – and their critique focused on another element of prehistoric practice.

Tongue Tests and Excavation Techniques: Proving Antiquity

The fact that the pressing concern for German naturalists at this time was the age of these presumed human remains should not be surprising. Human antiquity was a highly contentious issue at this point, as scholars and savants sought ways of settling the debates over whether, and if so for how long, humans had had a prehistory.[74] Previously, human remains had been unearthed from only recent geological layers, which tended to confirm biblical accounts. But by the 1850s, the association between "man" and mammoth was becoming harder to deny.[75] With this shift in orientation came a greater

72 Lyell, *Geological Evidences*, 78.

73 Busk, "Translation," 172.

74 A. Bowdoin Van Riper, *Men Among the Mammoths: Victorian Science and the Discovery of Human Prehistory* (Chicago: University of Chicago Press, 1993); Donald Grayson, *The Establishment of Human Antiquity* (New York: Academic Press, 1983).

75 Martin Rudwick, *Worlds Before Adam: The Reconstruction of Geohistory in the Age of Reform* (Chicago: University of Chicago Press, 2010): 407-09; Martin Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* (Chicago: University of Chicago Press, 2005): 275-86; Matthew R. Goodrum, "The Idea of Human Prehistory: The Natural Sciences, the Human Sciences, and the Problem of Human Origins in Victorian Britain," *History and Philosophy of the Life Sciences* 34 (2012): 117-45; Marianne Sommer, "An Amusing Account of a Cave in Wales: William Buckland (1784–1856) and the Red Lady of Paviland," *British Journal for the History of Science* 37 (2004): 58-60.

interest by naturalists in developing a variety of techniques that could help determine a fossil's antiquity.

The primary methods for interpreting a bone's age involved examining the fossil itself; did it appear to have gone through the fossilization process—had the organic material of the bone been replaced by minerals? This was difficult to determine. Some naturalists saw the presence of "dendritic crystallizations," the formation of small branching crystals on the bone's surface, as evidence of fossilization, but others were less sure.[76] The appearance of the Feldhofer bones could be compared to specimens known to be fossilized. But this appeal to qualitative individual judgement of surface similarity was considered weak evidence at best.[77] A slightly stronger method for determining whether or not a bone was fossilized was to test the bone's surface directly in several ways, of which the most common was the tongue test. This age-old technique basically involved a naturalist licking a bone to see if it adhered to the tongue. If the bone stuck to the naturalists' tongue, then it was likely ancient and fossilized: if not, it was probably modern. Schaaffhausen found that the Feldhofer fossils passed the "tongue test," but he himself entertained great doubts about the reliability of both these methods.[78] He admitted that he had "long been convinced" that neither method was "sufficient to establish the great antiquity of the objects."[79] He cited, for example, the discovery of a recent dog skull in Bonn that was "in no way distinguishable" from fossils of extinct

---

76 Busk, "Translation," 159.

77 As Schaaffhausen admitted, in Busk, "Translation," 160; and Charles Carter Blake noted in "On the Occurrence of Human Remains Contemporaneous with Those of Extinct Animals," *The Geologist* 4 (1861): 395.

78 Busk, "Translation," 160.

79 Busk, "Translation," 160.

animals found in a nearby cave: the remains were all of the same color and the modern skull "adheres to the tongue just as [the fossils] do."[80] He still maintained that the Feldhofer fossils were ancient, but accepted that methods of dating that depended on the physical appearance of the object were "no longer of any value."[81]

Unable to glean evidence for antiquity from the fossils themselves, scholars turned to an examination of their geological context.[82] This fell into Fuhlrott's domain – but unfortunately, he was simply unable to answer many of the questions that were raised. Had the skeleton been found alongside the bones of extinct mammals? What was the age of the strata in which they had been discovered? Excavations in France and Britain had already shown that human remains could be found *near* the bones of mammoths and other long-gone creatures – but for that to provide an indication of age, investigators had to prove that remains were *associated*, that they had been deposited at the same time. The possibility of intrusive burials (the interment of a body in an earlier geological stratum) or of accidental deposit (by flood, for example) had to be excluded.[83] Eventually, in order to provide this information, detailed, systematic excavations were planned and undertaken – but this was now impossible for the Feldhofer bones. Valuable geological clues to antiquity had been lost the moment the quarry workers had shoveled the bones out of the cave opening. Fuhlrott had not been present, and so he was unable to say where the remains had come from, or what they might have been associated with. In

---

80 Busk, "Translation," 160.

81 Busk, "Translation," 160.

82 Van Riper, *Men Among*, 75-116; Goodrum, "The Idea," 133-34.

83 One example is the excavations of Kent's Cavern, discussed in Donald A. McFarlane and Joyce Lundberg, "The 19th Century Excavation of Kent's Cavern, England," *Journal of Cave and Karst Studies* 67 (2005): 39-47 and Sommer, *Bones and Ochre*, 83-87.

the hope of fleshing out the bare bones of discovery, Fuhlrott returned to the quarry in 1858, to meet with the discoverers, quarry workers Alessandro and Luigi.[84] Unfortunately, much time had passed since the discovery, and Fuhlrott did not conduct his visit in a manner that would encourage workers to recall details. He arrived with a lawyer, and failed to provide incentive for the workers to talk: it was customary to offer money or beer in exchange for cooperation, but Alessandro and Luigi received neither. In return, Fuhlrott learned nothing from the exchange.[85]

The emphasis Schaaffhausen, Fuhlrott, and their critics placed on Feldhofer's antiquity was – in the opinion of their audiences – not firmly grounded, and their difficulties illustrate the problems early naturalists faced when trying to understand the Feldhofer skeleton. Many refused to accept Feldhofer as a potentially illuminating piece of human prehistory because they remained unconvinced by the answers to practical questions about the evidence for its antiquity. The tongue test technique was falling out of favor, and the bones had been uncovered by casual workers, two among many factors that made it difficult for Schaaffhausen and Fuhlrott to substantiate their claims. As the problem persisted, Schaaffhausen and Fuhlrott turned to naturalists outside Germany to help them in the debate.

Comparing the Neanderthal to Living Apes

After his failure with the quarrymen, Fuhlrott sought the aid of the respected British geologist Charles Lyell, inviting him to visit the Neander Valley and examine the

84 Schmitz and Thissen, *Neandertal*, 40.
85 Schmitz and Thissen, *Neandertal*, 41.

quarry and the remains for himself.[86] Lyell's visit 1860 did indeed prove pivotal in the study of the fossils. But the consequences of his visit lay more in the evidence he brought back to London with him, than in the actions taken while there, which largely consisted of repeating observations and tests already carried out by Fuhlrott and Schaaffhausen.[87] Like Schaaffhausen, Lyell noticed the bones were covered in dendritic crystallizations. He admitted these crystallizations "afford no sure criterion of antiquity," but noted they do appear more often "in bones that have been long embedded in the Earth."[88] He then employed the tongue test as well, finding that the bones "adhere strongly to the tongue," much like "the ordinary condition of fossil remains."[89]

Based on what he saw, Lyell concluded the bones were likely—if not definitively—ancient.[90] Like the other German naturalists who examined the skull, Lyell lamented the intricate difficulties of cave geology and regretted the lack of other animal remains.[91] Though Lyell brought nothing new to the study of the fossils, his generally positively-disposed conclusions added credibility and authority to the claims of antiquity. It would take him a number of years to publish his findings, however, which meant his capacity to contribute directly to the debate was limited.[92] By that time, the fossils had become generally known as the Neanderthal Man, shorthand for the Man from the Neander Valley. Lyell's trip meant that not only were the remains better known by British naturalists by repute, but – crucially – by examination. Lyell had brought back

---

86 Charles Lyell, *Principles of Geology, Being an Attempt to Explain the Former Changes of the Earth's Surface by References to Causes Now in Operation*, 3 vols (London: John Murray, 1830).
87 Lyell, *Geological Evidences*, 75-77.
88 Lyell, *Geological Evidences*, 99.
89 Lyell, *Geological Evidences*, 78.
90 Lyell, *Geological Evidences*, 78.
91 Lyell, *Geological Evidences*, 78.
92 Lyell, *Geological Evidences*, 78.

with him a plaster cast of the skull. Now, naturalists from a range of backgrounds would be able to scrutinize it using a variety of new and varied methods.

But this replica of the skull, given him by Fuhlrott, did not just enable British scholars to become involved in the debate. It substantially shifted the emphasis of the evidence that was being deployed. Whereas in Germany the skull had been considered in the context of and alongside the postcranial (skeletal) material, in Britain, it became the focal point of discussion – understandably, since it was the only part of the fossil anatomy that these scholars could directly access. Initially, Lyell invited two anatomists, his friends and neighbors George Busk and Thomas Henry Huxley, to examine the skull replica.[93] Both men were prominent figures in Victorian science. At this point in time, Busk was the Hunterian Professor at the Royal College of Surgeons, a Fellow of the Royal Society, and the zoological secretary of the Linnean Society, while Huxley was a Professor of Natural History at the Royal School of Mines, and Fullerian Professor at the Royal Institution.[94] Their combined interests in human variation, prehistory, and other primates allowed them to approach the study of the Neanderthal in new ways. The Feldhofer fossils had certainly come a long way since they caught the eye of a schoolteacher and part-time naturalist.

---

93 Lyell, *Geological Evidences*, 79.

94 Gordon Cook, "George Busk FRS (1807–1886), Nineteenth-Century Polymath: Surgeon, Parasitologist, Zoologist and Palaeontologist," *Journal of Medical Biography* 5 (1997): 88-101; Adrian Desmond, *Huxley: From Devil's Disciple to Evolution's High Priest* (Reading, Mass: Addison-Wesley, 1997).

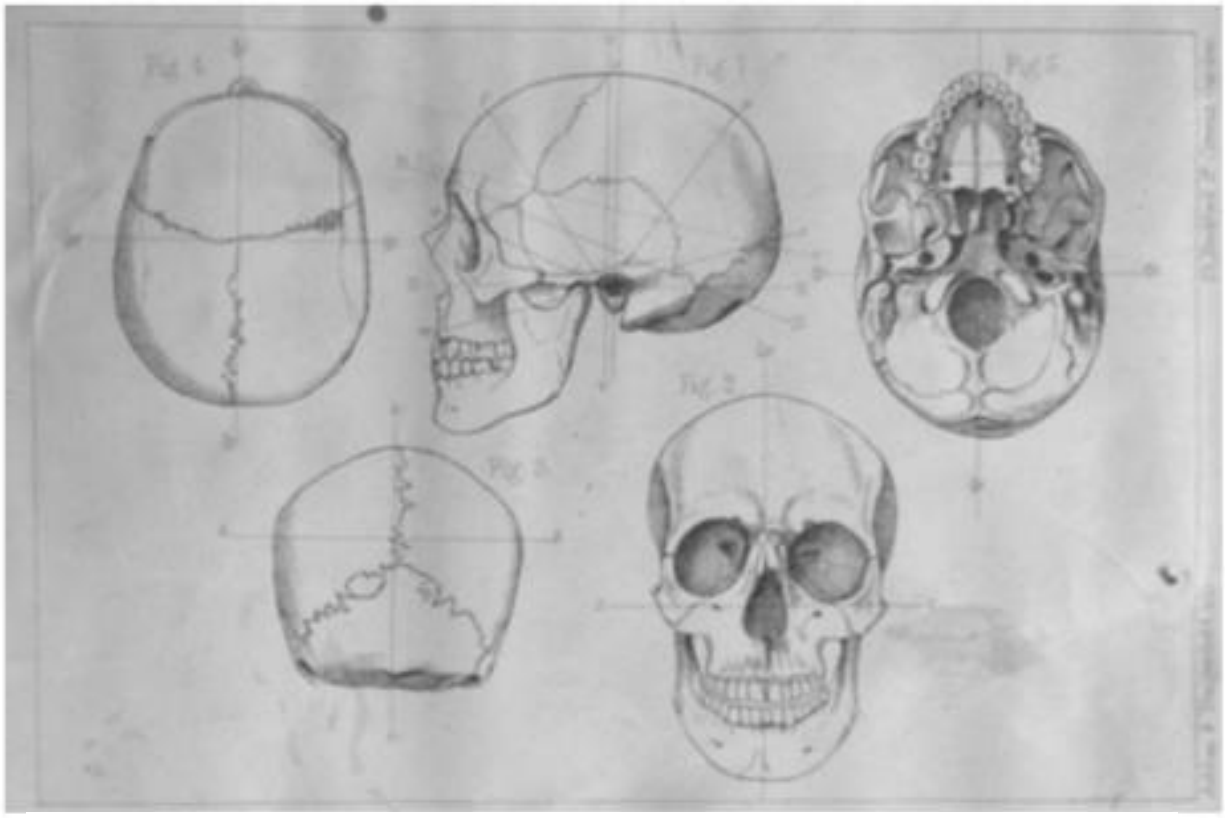


Figure 4: A plate from Busk's unprinted Crania Typica. Image courtesy of Busk Papers, Royal College of Surgeons London, Box 275, e1.

Busk and Huxley set out to measure, illustrate, and make sense of the Neanderthal. Working together, they began to ask questions about the Neanderthal not just in terms of human variation, but also in terms of the variation among all living primates. They had a vast amount of material against which they could compare their Neanderthal cast: the Royal College of Surgeons and its associated Hunterian Museum held a large collection of human and nonhuman primate skulls. Indeed, Busk was in fact already deeply involved in this collection, working on an extensive project that documented human variation. As was Schaaffhausen, Busk was interested in craniometry, and he examined a wide range of skulls to try to understand how human

skulls varied, as he worked on a book entitled *Crania Typica*. This was an effort to present the full range of quantified cranial variations, describing and picturing skulls from all corners of the world.[95]

Crania Typica was never published, but the unpublished plates preserved in Busk's papers document his attempts to understand variations in both recent and ancient human skulls.[96] He measured, traced, and compared skull features from foreheads to brain sizes for different populations, or 'races'. Busk's careful and meticulous nature found the lack of precision in craniometry frustrating, so while working on *Crania Typica* he developed a new tool to standardize the study of skulls. He complained that the science needed systematic, universal methods, and suggested that "precise numerical values should be employed in place of words" when describing a skull's features.[97] Quantification had to replace description, and Busk's instrument could take these measurements quickly, easily, and uniformly. The simple tool, a craniometer, was "constructed on the principle of a common shoemaker's gauge" and made it possible, he argued, for skull measurement to be standardized.[98] In order to encourage widespread use of his tool, he printed illustrations that served as instructions on how to use it, though like *Crania Typica*, they were never formally published or circulated.[99]

---

95 Samuel George Morton, *Crania Americana; Or, A Comparative View of the Skulls of Various Aboriginal Nations of North and South America* (Philadelphia: J. Dobson Press, 1839).

96 The plates for *Crania Typica* are in the Busk Papers, Royal College of Surgeons, London.

97 George Busk, "Observations on a Systematic Mode of Craniometry," *Transactions of the Ethnological Society of London* (1861): 342.

98 Busk, "Observations," 346.

99 Copies of this image are in Busk's papers, Royal College of Surgeons, London, Box 275.e.1, titled "Application of the Craniometer."

In addition to measuring skulls for *Crania Typica*, Busk also created tracings of them, using a tool called the camera lucida.[100] A widely used tool in the nineteenth century, the camera lucida reflected an object onto a piece of paper, allowing a naturalist to trace that object. It was a useful tool for skull comparisons, advocates argued, because the objects could be reproduced in "true perspective."[101] This ability to maintain perspective led many naturalists, Busk included, to employ the tool not simply for illustrations, but as a means of making direct comparisons in two dimensions of objects that existed in three.[102] The camera lucida allowed Busk to illustrate the Neanderthal by tracing the outline of the cast, which he could then superimpose onto other skull tracings for comparison.

When it came to studying the Neanderthal skull, however, Busk and Huxley were at a disadvantage: they had only the cast, rather than the original fossil, and so could not achieve the "precise numerical values" that Busk valued. This did not, however, stop them from measuring and filling anatomical tables with notations of the skull's breadth and length, or from using these as a basis for comparison with other "priscan" (ancient) skulls, and other 'races' from Central Europe.[103] Busk and Huxley's preliminary study appeared in 1861, when Busk produced a translation of Schaaffhausen's original paper, followed by his personal commentary on the skull.[104] As had Lyell, Busk agreed with

---

100 Thomas Henry Huxley, *Evidence as to Man's Place in Nature* (London: Williams and Norgate, 1863): 161.

101 Roland Barthes, *Camera Lucida: Reflections on Photography* (London: Macmillan Press, 1981): 13.

102 David Hockney, *Secret Knowledge: Rediscovering the Lost Techniques of the Old Masters* (New York: Viking Studio, 2001): 28.

103 Busk constructed tables that compared measurements of multiple features of skulls, labelling some as "priscan," in Busk papers, Royal College of Surgeons England, Box 275 Folder 2.

104 Busk, "Translation," 155-177.

Schaaffhausen in many respects, especially in terms of its antiquity and human status. He stated there was "no doubt of [the bones'] enormous antiquity," though this certainty probably came in part from extensive conversations with Lyell about his still unpublished impressions.[105] Given this antiquity, Busk suggested the Neanderthal could help answer the enormous question of "in what respects, the ancient race or races may have differed from those which at present inhabit the earth."[106]

But although both men agreed with Schaaffhausen that the Neanderthal represented a member of an ancient human race, from that point, Busk and Huxley's examinations and conclusions began to diverge from those of their German colleague. This was most striking in relation to the skull's most arresting feature: the brow ridge. While Busk and Huxley agreed with Schaaffhausen that this projection above the eye orbits was "remarkable," their methodology suggested a different origin for the feature.[107] Unlike Schaaffhausen, the British naturalists had compared the skull extensively to those of other living primates. Placing tracings of the skull alongside those of gorillas and chimpanzees, Busk noticed the projections were all similar.[108] He examined this similarity more closely by overlaying various primate skulls on top of a Neanderthal tracing, viewed from the side, an angle that displayed the projection of the brow ridges.[109] The fact that Busk saw the "remarkable" brow ridges as ape-like made sense in the context of the role of primates in the scientific culture of London at the time. Comparative anatomist Richard Owen had recently introduced the gorilla to the city,

105 Busk, "Translation," 172-175.
106 Busk, "Translation," 172-175.
107 Busk, "Translation," 172-175.
108 Busk, "Translation," 174.
109 One such illustration appeared in Huxley, *Evidence*, 179.

conducting a detailed analysis of its skull and skeleton. Owen, superintendent of the Natural History department of the British Museum, argued that gorillas were brutal apes, extraordinarily different from humans.[110] In this analysis, Owen had pointed to the gorilla's massive brow ridges as a defining factor of the brutish species.[111] Busk, familiar with Owen's work, drew a direct connection from the gorilla's brow ridges to the big brows of the Neanderthal.

Thus, Busk disagreed with Schaaffhausen's assertion that the brow ridge was the result of an expanded frontal sinus, a feature that enabled the Neanderthal to absorb the levels of oxygen necessary for such a robust, muscular frame. Instead, it was a feature suggestively parallel to those of apes. Busk made the link – specifically between the Neanderthal and chimpanzees – explicit in his 1861 article when he included comparative illustrations of their respective skulls. He argued that this image, produced by his camera lucida, should "render the apparent resemblance between the Neanderthal crania and that of the higher apes the more evident," by showing the "remarkable similarity in contour…between the two."[112]

Busk's 1861 paper was, however, only the translation of the original account with some preliminary conclusions. Together with Huxley, he prepared for even more intensive examinations of the fossil. Not content with the plaster cast of the skull, Huxley sought more detailed information, particularly pictures of the inner braincase, in hopes of

---

110 Christopher Ernest Cosans, *Owen's Ape & Darwin's Bulldog: Beyond Darwinism and Creationism* (Indianapolis: Indiana University Press, 2009): 37-50.

111 Richard Owen, "Osteological Contributions to the Natural History of the Chimpanzees (Troglodytes, Geoffroy) Including the Description of the Skull of a Large Species (*Troglodytes gorilla*, Savage) Discovered by Thomas S. Savage, MD in the Gabon Country, West Africa," *Transactions of the Zoological Society of London* 3 (1848): 416.

112 Busk, "Translation," 173.

shedding further light on the shape and function of the Neanderthal's sinus and brow ridge. Fuhlrott sent Huxley photographs of the cranium from different viewpoints, along with detailed notes explaining the appearance of the cranium's surface, allowing Huxley to fill in details within Busk's outlined tracings.[113] Exchanges between Huxley, Fuhlrott, and Schaaffhausen were to continue for many years as Huxley and Busk sought more information, measurements, and details from the German naturalists. Throughout these exchanges, however, neither Huxley nor Busk requested information about the rest of the skeleton, and they never saw casts or photographs of the Neanderthal's unusual ribs or thick limbs. Their focus was entirely on the skull.

Huxley's full study of the Neanderthal was presented in two books published in 1863. First came Lyell's *Antiquity of Man,* which included a section on the skull's anatomy, probably written by Busk and Huxley.[114] In it, Lyell argued "there can be no doubt that, as Professor Schaaffhausen and Mr. Busk have stated, this skull is the most brutal of all known human skulls."[115] The Neanderthal resembled the apes in multiple features, such as "the prodigious development" of the brow ridges and "the depressed form of the brain-case."[116] A more extensive discussion of the Neanderthal appeared just two weeks later with Huxley's own *Man's Place in Nature*.[117] This text, referred to affectionately by Charles Darwin as the "monkey book," was, among other things, the culmination of Huxley and Busk's extensive study. In this book, Huxley continued to

---

113 Karl Fuhlrott to Thomas Henry Huxley, 2 January 1862, Huxley Papers, Imperial College London, Vol. 121/70, Box Number 121, Series 20.

114 William Bynum, "Charles Lyell's *Antiquity of Man* and its Critics," *Journal of the History of Biology* 17 (1984): 155.

115 Lyell, *Geological Evidences*, 84.

116 Lyell, *Geological Evidences*, 84.

117 Huxley, *Evidence*,149-84.

stress the ape-like features of the Neanderthal, calling it "the most pithecoid [ape-like] of human crania yet discovered."[118] But crucially, he also provided a clear account of why such a pithecoid skull should still be considered human. Despite the fact that "under whatever aspect we view this cranium, we meet with ape-like characters," one clear feature made the difference.[119] As with Schaaffhausen and Busk, the size of the Neanderthal's brain meant that, for Huxley, it was human. Pointing to Schaaffhausen's measurements of brain volume, Huxley stressed that these fell well within the human range.[120] Thus, while Busk and Huxley placed more stress on the ape-like features of the specimen than Schaaffhausen did, they ultimately agreed with many of his conclusions. The apish elements were, after all, also characters that could be seen in the cranial structures of the "lower races," as well as the other primates.[121]

Measuring Brain Size: Not A Missing Link

But another question had to be considered. If the Neanderthal truly displayed a mixture of ape and human characters, was it a missing link—an evolutionary half-way point between the two groups? Darwin's *Origin* had, after all, been published only three years after the discoveries had been made in the Neander valley, and by the time the fossils reached Britain, the questions of evolution, species and the transition between apes and humans were being hotly debated. Discussions of human evolution were at the forefront of both science and public culture, with popular and learned journals joking that

118 Huxley, *Evidence*, 181.
119 Huxley, *Evidence*, 181.
120 Huxley, *Evidence*, 181.
121 Huxley, *Evidence*, 182.

"man probably lived a hundred thousand years ago, according to Lyell" and "probably had a hundred thousand apes for ancestors, according to Huxley."[122] But there were problems in treating this odd, big-brained but apparently apish creature as the missing link. Huxley rejected the notion outright, concluding definitively that "in no sense" can the Neanderthal "be regarded as the remains of a human being intermediate between men and apes."[123] Clearly, this position was not the result of his lack of acceptance of

122 *The Athenaeum*, 28, no. 1844 (February 1863): 287.
123 Huxley, *Evidence*, 183.

evolutionary ideas.[124] Instead, Huxley's conclusions, based on these extensive measurements, also centered on his conception of evolution as linear.[125]

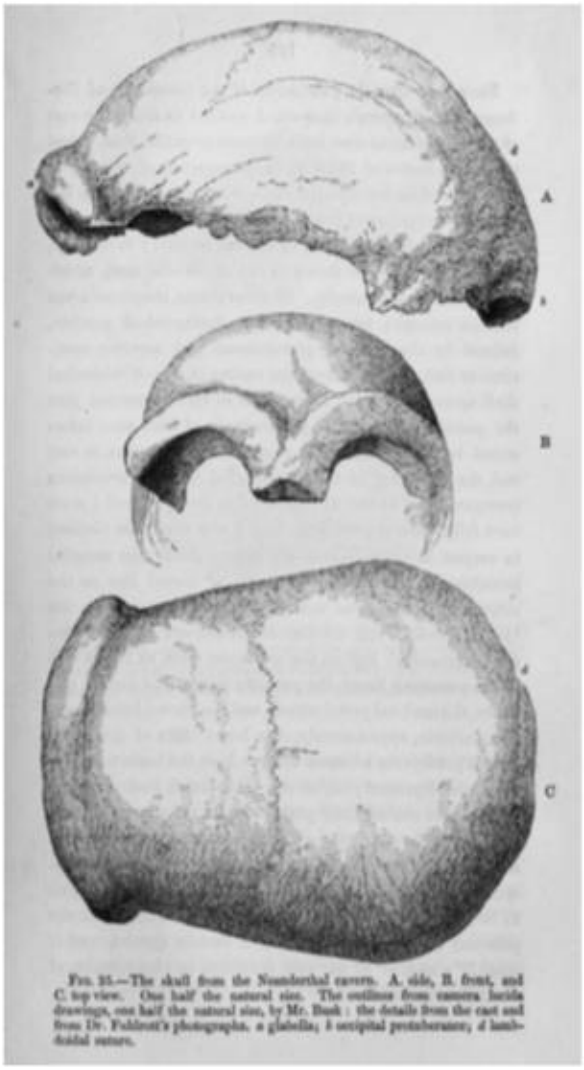


Figure 5 Neanderthal cranium, from Thomas Henry Huxley, Evidence as to Man's Place in Nature

Man's Place in Nature had demonstrated that apes and humans were remarkably similar. As such, the difference between them could be envisioned as a gradient, rather than a chasm – and the Neanderthal specimen had a clear place on that gradient. Rather

124 Desmond, *Huxley*, 276-335.
125 Bowler, *Theories*, 66.

than being a 'missing link,' for Huxley the Neanderthal discovery helped to "fill up…the structural interval which exists between Man and the man-like apes."[126] Again, the large brain was crucial here. While features such as brow ridges indicated that the Neanderthal resembled the living apes more closely than Europeans, the size of the brain kept it within human range. It must also be remembered in this context that incorporated into the notion of the 'missing link' was the question of human diversity. Scientists like Huxley viewed geographical variations among human crania as evidence that 'races' of humans existed, forming an eventual gradation into living apes that potentially mapped onto an evolutionary pattern.[127] The Neanderthal fitted neatly into this pattern. Initially accepted by Fuhlrott as human beyond doubt, the analyses of the anatomists subjected the skull – and implicitly, its large brain – to the techniques of craniometry and framed it within their discussions of race and human variation.

Importantly, however, these scholars had not only sparked wider interest in the skull but had provided the means by which other researchers could involve themselves in the debates. They had created tools, descriptions, careful measurements and drawings that characterized the skull in meticulous detail. This data allowed other naturalists to make 'virtual' examinations of the skull for themselves, on which they could develop their own hypotheses to account for its familiar strangeness.[128]

---

126 Huxley, *Evidence*, 166; Peter Kjærgaard, "'Hurrah for the Missing Link!': A History of Apes, Ancestors and a Crucial Piece of Evidence," *Notes and Records of the Royal Society* 65, (2011): 83–98.

127 George W. Stocking, *Victorian Anthropology* (London: Collier Macmillan, 1987).

128 Steven Shapin, Simon Schaffer, and Thomas Hobbes, *Leviathan and the Air-pump* (Princeton: Princeton University Press, 1985); Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations* (1992): 81-128.

Antiquity Methods Challenged

Charles Carter Blake, a lecturer on zoology at the London Institution, was the first to challenge Busk and Huxley's interpretation of the Neanderthal. As a member of the Geological Society, Blake did not think the Neanderthal was as ancient as had been claimed. In a paper published in *The Geologist*, Blake attacked Busk's claim of enormous antiquity for the fossils.[129] His critique focused on the use of the problematic tongue test, which he complained "is hardly precise enough to convince practice geologists of the antiquity of the skull."[130] "No English geologist," he pointed out, had "stepped forward to corroborate this theory" of antiquity, a critique which neatly combined national with disciplinary authority.[131] In fact, Lyell, just returned from the Neander Valley, *had* corroborated this theory, but he had not yet made this support clear in print. As part of his inner circle, Busk and Huxley knew this information while Blake did not.

Blake went on to attack the specific features of the skull, using the measurements and figures made by Schaaffhausen, Busk, and Huxley. He agreed that it was the brow ridge in particular that made the skull a "source of interest," especially because previously such a ridge had been assumed to be a character "peculiar in the highest apes."[132] He dismissed Schaaffhausen's suggestion that the feature was there to increase the oxygen supply to the muscles, since it was too difficult to infer the size of the frontal sinus by the "development" of the brow ridge.[133] But he also disagreed with Busk and

129 Blake, "Occurrence of Human Remains," 395-98.
130 Charles Carter Blake, "On the Crania of the Most Ancient Races of Men," *The Geologist* 5 (1862): 207.
131 Blake, "Occurrence of Human Remains," 395.
132 Blake, "Occurrence of Human Remains," 396.
133 Blake, "Occurrence of Human Remains," 397.

Huxley's claim that this was one of many ape-like features seen in the skull. Instead, Blake insisted, the brow ridge was the *sole* character that the skull shared with the gorilla,[134] A student of Richard Owen's, Blake took the opportunity to remind readers that brow ridges "greatly contribute to enhance the terrific appearance of the old male gorilla."[135] This skull, Blake argued, did not in fact share many ape-like characteristics – instead, apart from the brow, it was very similar to that of a human. But how, then, could one explain that brow? The following year, Blake published his solution: the Neanderthal was an idiot.[136] The famous skull Neanderthal was simply the remains of "some poor idiot or hermit, who died in the cave" deformed and confused.[137] To strengthen his argument, Blake brought the Neanderthal postcrania back into the discussion, arguing that Schaaffhausen's original description of features such as the peculiarly rounded ribs added evidence that this was an "idiot."[138] Blake, however, failed to specify *how* these features provided evidence for idiocy.

Blake's dismissal of the Neanderthal as an idiot has tended itself to be dismissed as evidence of his anti-evolutionary position.[139] Closer examination of Blake's argument, however, reveals that it was firmly based in his understanding of the methodological question of how to determine the degree of the skull's antiquity. He argued that "the apparent ape-like, but really maldeveloped idiot character of its conformation is so

---

134 Blake, "Occurrence of Human Remains," 398.

135 Blake, "Occurrence of Human Remains," 396.

136 Blake, "On the Crania," 206-07, it is worth noting that an anatomist in Germany was similarly arguing that the Neanderthal was pathological: Fredrich Mayer, "Über die Fossilen Überreste eines Menschlichen Schädels und Skeletes in einer Felsenhohle des Düssel-oder Neanderthales," *Mullers Archiv* (1864), discussed in Tattersall, *Fossil Trail,* 15-17.

137 Blake, "On the Crania," 207.

138 Blake, "On the Crania," 207.

139 Michael Hammond, "The Expulsion of the Neanderthals from Human Ancestry: Marcellin Boule and the Social Context of Scientific Research," *Social Studies of Science* 12 (1982): 1-36.

hideous…that every effort should be made to determine its probable date in time."[140] Notably, he left the question of how one might do this open. But Blake was explicit in his hope that his statements on the Neanderthal "would not be taken as throwing any doubt on the transmutation theory," a concept that he considered to be "a very rational hypothesis."[141] Human fossil ancestors would eventually be found, he argued, and those would prove transmutation. The Neanderthal skull, however, was not that fossil. This, for Blake, was proven outright by that one key element – the association between brain size and human status. Blake's position, put bluntly, was that the skull measurements provided evidence of a brain so large that it simply could not be that ancient. It *was* human, even if it was also 'diseased.'

More Than Volume: Classifying Brain Shape

Into this sea of anatomists and zoologists linking brain size with human status, came William King. In 1863, this professor of geology at Queen's College Galway (Ireland) brought an entirely different perspective to the discussion. King had spent much of his career studying Permian fossils and organizing museum collections, and brought his paleontological background of classifying and categorizing to the study of the Neanderthal fossil.[142] Where others saw human unity, he argued that there was actually distinct differences, and where others saw humanity, he did not.[143] For King, large brain

140 Blake, "On the Crania," 206.
141 Charles Carter Blake, "On the Alleged Peculiar Characters, and Assumed Antiquity of the Human Cranium from the Neanderthal," *Journal of the Anthropological Society of London* 2 (1864): clvii.
142 John Murray, Heinz Peter Nasheuer, Cathal Seoighe, Grace P. McCormack, D. Michael Williams, David A.T. Harper, "The Contribution of William King to the Early Development of Palaeoanthropology," *Irish Journal of Earth Sciences* (2015): 1-16.
143 William King, "The Neanderthal Skull," *Anthropological Rev*iew (1863): 393-94.

size was not enough to consider a creature human; the *shape* of the brain mattered as well. He pointed to the height of the brain case, which was low, as one of the features that separated the Neanderthal individual from humans. He was absolutely clear: a feature that "characterizes the whole human species," regardless of geographical location or race, was the "strongly arched form of [the] cranium."[144] This the Neanderthal did not possess.

Basing his conclusions on an examination of a cast, combined with Busk and Huxley's illustrations and Schaaffhausen's measurements, King argued that the Neanderthal was much more ape-like than any naturalist had recognized. He returned to Busk's presentation of his drawing of the fossil skull next to that of a chimpanzee, and emphasized the similarities of structure between the two. For King, the form and contours of the fossil were "abnormal to man, but normal to ape."[145] He specifically drew attention to the fossil's pronounced brow ridges and strong muscle attachments in order to make the point that the Feldhofer skull appeared to have closer "affinity to the apes" than to humans.[146] But interestingly, he concluded by suggesting the creature be named *Homo neanderthalensis*, distinct from, but still within the human genus. For King, the large brain still suggested that it was human enough to belong to the human genus. Indeed he accepted that they might have possessed some human traits, such as the capacity to build shelters and make crude tools.[147] The lack of a high, strongly arched cranium, however, was the key determining factor in King's conception of the Neanderthal: it could not be

144 William King, "On the Neanderthal Skull, or Reasons for Believing it to Belong to the Clydian Period and to a Species Different from that Represented by Man," *British Association for the Advancement of Science, Notices and Abstracts for 1863* (1864): 81.
145 King, "On the Neanderthal Skull," 81.
146 King, "The Reputed Fossil," 96.
147 King, "The Neanderthal Skull," 393.

fully human since this shape probably meant that the most important human characters – such as the ability to speak – had been absent from this species.[148]

King continued to expand on his argument that the skull "more closely approximates" the anthropoid apes than *Homo sapiens* in a paper published in 1864.[149] He was incredulous that "notwithstanding the strong simial [ape-like] tendencies" of the skull, there were still those who "do not appear to think otherwise than it belongs to an individual of our species."[150] Clearly, he now wanted to exclude the Neanderthal even from the genus *Homo* – but realizing that his evidence for such an expulsion was weak, he hid his assertion in a footnote. In that footnote, King wrote that he felt naming a new genus on only a partial cranium would be "clearly overstepping the limits of inductive reasoning."[151] But what about the rest of the skeleton, was that not enough to bolster a claim of his separate genus? King did mention the postcrania, repeating Schaaffhausen's general conclusions about the thickness and shape of the ribs. He stated that "these characters afforded some grounds for the belief that the Neanderthal fossil had not belonged to a human being," though there was difficulty in "resting a satisfactory argument" upon bone size and rib shape, he wrote.[152] For King, postcrania did not reveal as much information as a skull, which was fundamental. A large brain could classify a creature in the genus *Homo*, but for King, particular features of brain shape—primarily height—must also be taken into account in deciding whether something had human status.

148 King, "The Neanderthal Skull," 393.
149 King, "The Reputed Fossil," 90.
150 King, "The Reputed Fossil," 92.
151 King, "The Reputed Fossil," 92.
152 King, "The Reputed Fossil," 89.

Knowing Neanderthals: Before They Were Other

King's identification of a new human species further widened the diversity of opinions on the Neanderthal's significance and relationship to humans. The debate was certainly intense, as scholars took issue with not just opponents' theories, but with their methods, further developing their own positions as they did so. Features such as the emphasis placed on different cranial characteristics took on crucial roles in the debate, alongside the size and shape of skulls, with one eye (almost) always on the comparative craniometrical demonstration of the range of human variation. For example, in response to the idea that Neanderthal was an "idiot," Huxley argued that stupidity instead "lies with those who adopt the hypothesis," because there was no evidence demonstrating that the precise deformities of the Neanderthal matched any known syndrome.[153] "Idiocy is compatible with various forms of the cranium," he argued, but "none which present the least resemblance to the Neanderthal skull."[154] It was not enough to propose a hypothesis; that hypothesis must be supported by actual data. As the aggressive tone might lead one to expect, these debates over the Neanderthal were to last for decades. Many of these issues were not, and could not be resolved until more fossils were uncovered and new methods applied to their analyses in the twentieth century.[155] However, the study of this first Neanderthal from 1856–1864 illuminates a number of issues in the history of

153 Thomas Henry Huxley, "Further Remarks upon the Human Remains from the Neanderthal," *Natural History Review* (1864): 429-46.

154 Huxley in Lyell, *Geological Evidence*, 90.

155 Frank Spencer, "The Neandertals and Their Evolutionary Significance, a Brief Historical Survey," in Fred H. Smith and Frank Spencer (eds), *The Origins of Modern Humans: A World Survey of the Fossil Evidence* (New York: A.R. Liss, 1984): 1-49.

paleoanthropology. It provides historians with some insights into the discipline's inception, the ways in which different practitioners conceptualized human identity and how that related to their initial appraisal of the not quite human, and in particular, the significance of attending to the role of practice in paleoanthropological debates.

Historians of science have tended to focus on the ways Neanderthals have been constructed as an "other" during paleoanthropology's history.[156] As numerous studies have shown, this often emerges as humans define both themselves and Neanderthals by asking what aspects of humanness Neanderthals lack, imagining the lesser species in the mirror of the superior *Homo sapiens*. This scholarship illuminates Neanderthal analyses in the twentieth century, when discoveries began to accumulate and Neanderthals became increasingly conceptualized as a separate fossil species, a true "other."[157] Indeed, some scholars argue that this issue of defining ourselves in opposition to Neanderthals continues to the present day.[158] But what about the time period *before* Neanderthals became construed as other? This paper illuminates a period when the strict dichotomies between human and non-human, between us and them, were distinctly blurred. But while Neanderthals were not yet conceived as other in this period, their study then can still show us how "human" was defined.

The majority of naturalists who studied the Neanderthal in the period 1856-1864 concluded that it was human, and they based that conclusion on the fact that it possessed

---

156 Marianne Sommer, "Mirror, Mirror on the Wall: Neanderthal as Image and 'Distortion' in Early 20th Century French Science and Press," *Social Studies of Science* 36 (2006): 207-40; Michael Hammond, "The Expulsion"; Abigail Hackett and Robin Dennell, "Neanderthals as Fiction in Archaeological Narrative," *Antiquity* 77 (2003): 816-27.

157 Sommer, "Mirror," 210.

158 Hackett and Dennell, "Neanderthals," 826.

a large brain.[159] They studied the skull with the tools of craniometry and anthropometry – the science of human measurement – and assessed it against the quantified range of recorded human variation. Opinions about other, potentially ape-like characteristics depended on individual perspectives on the nature of that range – so, while for Huxley and Schaaffhausen, human variation was so wide that the skull could fit unproblematically within it, Blake and Fuhlrott needed to invoke pathology. King, on the other hand, with a background in classification privileged difference in shape over resemblance in size: the contours of the skull indicated that had belonged to a being that was not entirely human.

In light of the centrality of practice in the Neanderthal's story, it is significant to recognize that many of these scientists studied only a portion of the skeleton: the skull. While many of them reiterated Schaaffhausen's impressions of the postcrania, they did not conduct their own rigorous analyses of the limbs, ribs, and other bones. If Lyell had brought back casts of the Neanderthal's ribs and limb bones, would we perhaps have a different story to tell? How might those bones have influenced the debates on the Neanderthal's human status? This question is worth further exploration, especially as Neanderthal postcrania ultimately played an essential role in twentieth century constructions of the species, constructions that helped to label Neanderthals as other.[160]

Conclusion: Practice in Early Paleoanthropology

159 Bowler, *Theories*, 33-34.
160 Hammond, "The Expulsion," 1-36.

In their accounts of twentieth-century Neanderthal studies, historians of science have frequently focused on factors such as social and political context.[161] They have argued that Neanderthals were used as social and political "weapons," and that institutions, social context, and other factors shaped researchers' opinions of the fossils.[162] In contrast, this paper has argued that to understand the role that Neanderthals played in early debates about human prehistory, we need first to understand the tools – conceptual, instrumental, methodological – that were used in its interpretation. In addition to illuminating an early chapter in Neanderthal interpretations, this paper has focused closely on this aspect of scientific interpretation. It has examined their methods of replication, such as shared casts and camera lucida illustrations, and explored their data sets, from the skulls of Australians to those of chimpanzees. It has endeavored to show that larger claims hinged on these methods in ways that must be recognized. Social, political and institutional factors certainly had an important role to play, but practice equally influenced the study, and therefore the conceptions, of Neanderthals. Interpretations of the Feldhofer fossils were affected by the actions of the quarry workers, as well as by theories of evolution.

In addition to viewing the Neanderthal in light of politics and social issues, some histories of paleoanthropology, often produced by practitioners, have sought to understand the early Neanderthal debates largely in terms of evolutionary beliefs.[163] In

---

161 Hammond, "The Expulsion," 1-36; Michael Hammond, "Anthropology as a Weapon of Social Combat in Late-Nineteenth-century France," *Journal of the History of the Behavioral Sciences* 16 (1980): 118-32; David Van Reybrouck, "Boule's Error: On the Social Context of Scientific Knowledge," *Antiquity* 76 (2002): 158-64.

162 Hammond, "Anthropology," 118-132.

163 For example, Drell, "Neanderthals," 1; Erik Trinkaus and Pat Shipman, *The Neandertals: Changing the Image of Mankind* (Alfred a Knopf Inc, 1993): 46.

this framework, some accounts have dismissed the Neanderthal as uninteresting because looked too human, while others have called it a "beacon" of light, illuminating the hominin past.[164] This paper argues that neither of these interpretations fully represents naturalists' views at the time, since it argues that belief in evolution was at no time a critical factor in the overall interpretations made by participants in the debate. None of the naturalists who viewed the Neanderthal as human did so because they had doubts about evolution. Instead, the Neanderthal remains were subject to interpretation by naturalists who were struggling with methodological questions such as the quantification of variation, the evidence for antiquity and the range of comparative anatomy.[165]

The skeleton from the Feldhofer cave was the first non-human hominin fossil recognized by science.[166] Thus, the story of this Neanderthal is the story of the emergence of a new scientific discipline. As with any new field of inquiry, agreement had yet to be reached on research methodologies and conceptual frameworks, and individuals from a range of different disciplinary backgrounds brought their predispositions and training to bear on the bones. Historians of science have recently suggested that a more comprehensive view of paleoanthropology is one that recognizes that questions about hominin fossils lie at the intersection of biology, geology, paleontology, and archaeology.[167] In the case of the Neanderthal, this more comprehensive view reveals that the Neanderthal discussions were much more complex than debates over evolutionary ideas; that instead, larger questions about in the natural sciences and issues of scientific

164 Trinkaus and Shipman, *The Neandertals*, 46.
165 Goodrum, "The Idea," 141, argues that historical accounts have privileged evolution over issues like antiquity in human origins.
166 John Reader, *Missing Links: The Hunt for Earliest Man* (London: Collins, 1981): 65-79.
167 Goodrum, "History of Human Origins Research," 338.

method—such as excavation techniques—played a central role in interpretations of the Neanderthal.

As this paper has shown, in the nineteenth century, the Neanderthal skull was not yet playing the key role in defining human identity and evolution that it would be given in the twentieth century. It was, instead, the most brutal of all human skulls, a creature that blurred existing categories, raising new questions, and challenging old approaches. As naturalists attempted to make sense of the skull, borrowing approaches and applying various methods to its analysis, the biggest question that arose was not "what was it" but instead "how they could know?"

CHAPTER 3

FROM BRUTAL HUMANS TO MAN-APES: 1864-1924

The fossil specimen that emerged from the Neander Valley in 1856 was a new type of scientific object, one that had the potential to illuminate the deep human past. While it gave rise to disputes as scientist debated its meaning and place in the human family story, it was not controversial for the reasons that have often been assumed, for example solely from a perspective of evolution. By organizing the Feldhofer narrative around the fossil—following the object as it moved out of the cave, tumbled down to the valley below, and traveled in a box to the University—a perspective emerges that identifies questions about how scientists could know about humans and their past. This new vantage point reveals a wider range of actors who came together around the fossil, while contextualizing their divergent interpretations within their time period. Returning to the idea that the act of measurement is a human act, "carried out from a specific point of view in time and space, from the particular viewpoint" of the observer, this examination of the Feldhofer story helps illuminate who these observers were, what their views on scientific practice were, and how those views were situated in their social context.[168]

The novel, extraordinary nature of the object, its discovery later identified as the origin point of the science of paleoanthropology, meant there was no procedural precedent for who was qualified to examine it. Researchers surfaced from a range of backgrounds; Thomas Huxley, William King, and Charles Carter Blake specialized in anatomy, paleontology, and geology, respectively. The approach of following the fossils

[168] Frayn, *Copenhagen*, 71.

also brings into focus other actors involved in the Feldhofer story, beyond the traditional naturalist category. Johann Karl Fuhlrott, for example, emerges as not primarily a schoolteacher responsible for bringing the fossils from the quarry to an anatomist at the University of Bonn, but instead as an active participant in the construction of knowledge. By providing context and geological information, accommodating foreign researchers through visits and sending them photographs, while also presenting at conferences, Fuhlrott assumes a larger role.[169] So, too, do the original discoverers, the quarry workers Alessandro and Luigi, who, by removing the fossils from the matrix, shaped the antiquity debates and therefore the controversy over—and knowledge production around—the Neanderthal.

The Debatable Skull

Recognizing the backgrounds of these various actors provides a clearer picture of what, exactly, they disagreed over in regard to the object; a static object that is "always the same" yet "plastic in meaning."[170] While the object itself and the measurements of it were static, researchers from different backgrounds naturally approached the object in different ways, placing emphasis on various methods of analysis and lines of evidence. To some, the question of variation was central to the issue at hand, and therefore comparisons across living humans provided solid evidence with which to make claims about the past. But this approach drew criticism from those who emphasized that the first

169 The distinction between amateur and professional, particularly in the nineteenth century, has been explored extensively in the history of science, see for example: Susan Leigh Star and James R. Griesemer, "Institutional Ecology, Translations and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39," *Social Studies of Science* 19, no. 3 (1989): 387-420.

170 Daston, *Things That Talk*, 16.

condition was proof of geological antiquity. An ancient human relative, or "race," they argued, required the specimen to actually be ancient.

The fossil-focused view begins to reveal the social, political context that shaped aspects of the fossil's story as well—from its discovery and initial recognition to its analysis, and ultimately the implications of the claims that were drawn. Even the idea that this object is a "new" type of scientific object, the first of its kind, was determined by factors somewhat tangential to the fossil itself. It would later become clear that the partial cranium from the Neander Valley was not, in fact, the first ancient, odd-looking skull to surface, nor was it the most complete specimen, but instead the first widely circulated and *recognized* specimen. Indeed, the fossil was not even the first discovered in the group we would now recognize as "Neanderthal," but was preceded by discoveries in Belgium and Gibraltar, which went largely unnoticed as they remained in a "state of confusion and neglect" in private collections and library cabinets.[171] What made the Feldhofer fossil "first," then, was its circumstances of circulation and communication, including the hands it fell into and the venues in which it was shared.[172]

Moving beyond its discovery, the study of the Feldhofer fossil also occurred within a social, political framework that influenced the methods applied to it, as well as its interpretation. The most influential of these factors was the concern over living human "races" during the era of empire. As I have argued elsewhere, the Neanderthal's similarity to humans meant it was interpreted in a scientific racial framework that led it to

171 Menez, "The Gibraltar Skull," 92-110.
172 Madison, "The Forgotten Fossil," 268-270; Wood, "The 'Neanderthals,'" 385.

become entangled with "culturally and politically charged questions about human nature, race, intelligence, and extinction," which shaped the creatures' brutish conception.[173]

While this view of the Feldhofer's story provides insights into these facets of practice and social context, it does not yet directly address the driving question of this work. In forcing new examinations of the human past, the fossil did something else as well: it confronted and challenged the central concept "human" itself. In this next section, I explicitly explore the question of: how did this discovery challenge contemporary understandings of humans and their place in nature?

Understanding and Diagnosing Humans

The Feldhofer individual outstripped "expectations and imaginations framed by the current way of thinking" in distinctive ways that challenged contemporary understandings of what it meant to be human.[174] The specimen combined characteristics thought to be uniquely human (including a large brain) with those thought to be distinctly nonhuman (like a robust brow ridge). The Neanderthal's arrival in nineteenth century science confronted naturalists with a glaring problem: the conventional understanding of what constituted "human" (*Homo sapiens*), might no longer hold up. While Carl Linnaeus had introduced our genus and species in *Systema Naturae* 1758, he had simply written "Nosce te ipsum," or know thyself—a concept that provided little clarity. And while there was no detailed, fully agreed upon diagnosis of what constituted a "human,"

---

173 Paige Madison, "Characterized by Darkness: Reconsidering the Origins of the Brutish Neanderthal;" *Journal of the History of Biology*, 53, no. 3.

174 Daston, *Things That* Talk, 16.

the Neanderthal debates reveal there were a set of conventional assumptions based largely on comparisons with other living apes.

By appearing so close to the human form, Neanderthal challenged those assumptions, pushing for clarification or reconfiguration and allowing us to see a little more clearly what was involved in thinking through the diagnosis of "human" in the process. This was true at both the genus and the species level, as King said he felt the fossil's characteristics indicated perhaps a different genus, though he needed a more complete fossil to make sure of such a large claim. Some naturalists were explicit about what human meant to them in their interpretation of the Feldhofer fossil. Brain size was clearly an important factor for everyone, but for researchers like Schaaffhausen its large volume was pivotal, indicating a human status beyond a shadow of doubt. For others, however, brain shape factored in as well. Brain shape and size could indicate behavioral traits for these researchers, and multiple authors identified those traits as the marks of *H. sapiens* uniquely—for example language and capacity for morality.

The challenge the Feldhofer Neanderthal imposed to notions of "human" forced naturalists to either 1) clarify the concept 2) reconfigure it or 3) discard the fossil entirely in order to maintain the concept and boundaries.[175] Identifying what, precisely, the Feldhofer represented required addressing the dilemma of the combination of assuming that a large brain was uniquely human. Thus, it was precisely from the different conceptions of "human" that the range of different explanations of the fossil arose,

---

175 Scholars have examined this boundary work, including: Raymond Corbey, *The Metaphysics of Apes: Negotiating the Animal-Human Boundary* (New York: Cambridge University Press, 2005); Matt Cartmill, "Human Uniqueness and Theoretical Content in Paleoanthropology," *International Journal of Primatology* 11, no. 3 (1990): 173-192.

causing the "most brutal of human skulls" to speak differently to different people. Huxley, refusing to see the paradox of a large brain and primitive features as a major issue, claimed that the answer was simply that humans varied. Alternatively, King chose to maintain the concept of human as not only big in brain size, but particular in brain shape, and the answer was it had to be a different, humanlike species. To others, it was easier to throw out the fossil than to throw out or vastly reconfigure their ideas about uniquely human features.

As we have seen, the answers to these problems of what counts as humanness lay in practices. At issue were, researchers like Huxley thought, scientific questions of measurement, variation, and antiquity. It was simply a matter of identifying and locating "human" in a scientific manner, addressed through the tools of anthropometry and geology. The question of natural variation within a species was important, as it could determine whether the Feldhofer fit within that spectrum of variation (as Huxley thought it did) or whether it did not (as King argued). Thirty years later, a leading scientist would claim, "I am convinced that the promulgation of so many and so various theories has been largely due to an under-estimation of the variation in structure amongst individual men and anthropoids, and to an exaggeration of the structural interval that separates the two groups of primates."[176]

The question of how to explain the Neanderthal was therefore as much a question of how to understand humans, which was perceived as a practical problem that could be

[176] Arthur Keith, "*Pithecanthropus erectus*—A Brief Review of Human Fossil Remains," *Science Progress (1894-1898)* 3, no. 17 (1895): 352

solved by measuring variation. As we will see, this question remained open for some time, remerging throughout the discipline's development.

The Emergence of the Neanderthals

When we left the Feldhofer Neanderthal debates in 1864, the main sides had been outlined, all of which sought to explain the problem of challenging of the human concept in different ways. In July of that year, Thomas Huxley summarized the positions, remarking that one end of the scale had been claimed in the fossil's declaration of a new species, while the other end had scientists proposing the skull as entirely human, though diseased or deformed in some way. Disagreeing with both these perspectives, Huxley continued to hypothesize a third alternative, that features of the Neanderthal skull are not those of disease or deformity, but "simple exaggerations of characters…in other human skulls."[177] He mocked the alternatives, especially scoffing at the claim that the individual was "that of a rickety Mongolian Cossack belonging to one of the hordes drive by Russia in 1814," while dismissing the hypothesis of the Neanderthal Man was a deformed "idiot."[178] His view about natural variation meant he saw no need to explain away the primitive features. The stage had been set, and the battle lines drawn, yet no agreement between the three sides—nor the concept of human—had been reached.

There was one side of the debate, naturalists pointed out, that was conceivably easier to rule out than the others: the idea that the Neanderthal was simply an odd, deformed individual like a Cossack or a diseased idiot. In his remarks on the Feldhofer

177 Huxley, "Further Remarks," 438.
178 Huxley, "Further Remarks," 430.

skull published in 1861, Huxley's friend George Busk had argued that it is "of the deepest importance" for future discoveries to "determine whether the conformation in question be merely an individual peculiarity, or a typical character."[179] Busk's call was answered when a skull was shipped to him from Gibraltar. The same month that Huxley summarized the debate, then, Busk published a notice declaring that this one side of the debate had been eliminated. The Gibraltar skull, he claimed, had exactly the same features, only this specimen was more complete. The Feldhofer fossil, therefore "did not represent, as many have hitherto supposed, a mere individual peculiarity," but instead "it may have been characteristic of a race extending from the Rhine to the Pillars of Hercules."[180]

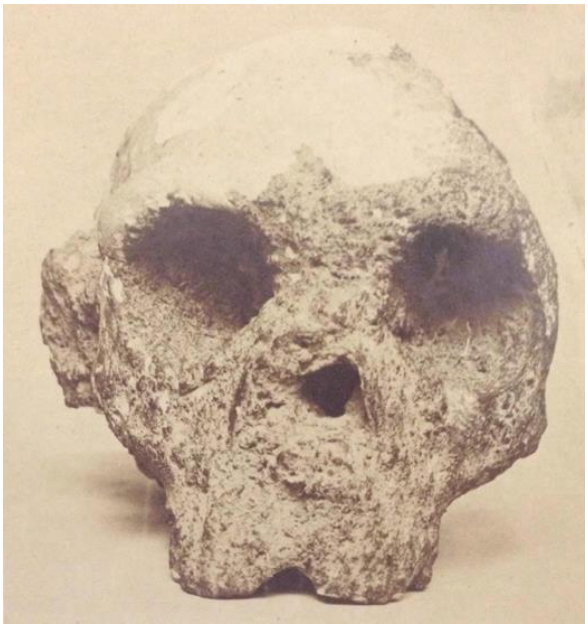


Figure 6 Gibraltar Neanderthal. Busk Papers. Image courtesy of Royal College of Surgeons London.

By demonstrating that the Feldhofer Neanderthal was not an "individual peculiarity," Busk confirmed it was some sort of group, "race," or species. But which of

179 Busk, "Translation," 173.
180 George Busk, "Pithecoid Priscan Man from Gibraltar," *The Reader* 4 (1864): 110.

these was left open; the skull from Gibraltar would ultimately not provide the answer. "This cranium will shortly, I hope, be fully described and figured," Busk wrote, shortly before his researcher partner died from a sickness he suffered from during their joint trip to Gibraltar.[181] The manuscript went unpublished and the announcement paper, lacking in detail, went largely unnoticed. The fossil, which Busk claimed had "been allowed to fall into a state of confusion and neglect" in Gibraltar, once again slid into neglect, this time in London, as I have written about elsewhere.[182] Thus, the Neanderthal debate had yet to be resolved.

Neanderthals continued to play an important role, as we will see, with discoveries from the Spy Cave Belgium in 1886 and elsewhere across Europe in the following decades eventually weighing into this debate. While many questions about Neanderthals and the human evolutionary story more broadly remained unanswered, the early study of the Neanderthal had set the discipline in motion. Importantly, it gave naturalists a specific set of problems to pursue. If, as Huxley had claimed, "in no sense" can the Neanderthal "be regarded as the remains of a human being intermediate between men and apes" then what such an intermediate would look like—and where would it be found?

It is Useless to Speculate

Over the next two decades, hypotheses began to proliferate about the humans evolutionary past. I will briefly cover the most influential ideas and discoveries insofar as they relate to the themes of this dissertation. Naturalists were interested in "transitional"

181 Busk, "Pithecoid," 110.
182 Madison, "Forgotten."

forms, ancestors that had begun acquiring some uniquely human features but not yet as many as the Neanderthal. Searching for knowledge of something more primitive or transitional than a Neanderthal, these scientists envisioned a missing link, a "crucial piece of evidence once and for all linking humanity to the rest of nature."[183] Given that there was no real fossil record of such a link, many of the ideas surrounding these transitional forms were purely conjectural. The most well known examples included German naturalist Ernst Haeckel's hypothetical speechless ape-man: *Pithecanthropus alalus*, or Charles Darwin's image of a tool-using upright walking ape.[184]

A big question during this period, one that Darwin and Haeckel both explored, was: where had human origins originated? Where was the center of origins, the cradle of humankind? With humans spread throughout the globe, there was no obvious answer. Many scientists began to hypothesize that such a cradle had been somewhere in Asia, drawing from ape fossil discoveries from northern India's Siwalik Hills and assumptions that Asia's high temperature zone was most suitable for human breeding. Additionally, some scientists suggested that this central location would have allowed human ancestors to easily migrate out in many directions to occupy other continents.[185] Within Asia, origins centers were put forward ranging from the highlands of Tibet to the Malay Archipelago, and beyond. Inspired by the diversity of lemurs of Madagascar, Haeckel even proposed that humans had evolved nearby, potentially on an imagined continent

183 Kjærgaard, Peter C. "'Hurrah for the Missing Link!': A History of Apes, Ancestors and a Crucial Piece of Evidence." *Notes and Records of the Royal Society* 65, no. 1 (2011): 83-98.
184 Haeckel, *The History of Creation*.
185 Davidson Black, "Asia and the Dispersal of Primates," *Bulletin of the Geological Society of China* 4, no. 2 (1925): 133-83; Haeckel, *The History of Creation*.

named Lemuria that was now lost, sunken in the Indian Ocean but once been connected by a land bridge to India.[186]

A consensus was far from forming, however. Darwin, for example, disagreed with the Asian origin hypotheses. In his 1871 book, *Descent of Man*, he argued that "it is somewhat more probable that our early progenitors lived on the African continent than elsewhere."[187] Darwin reached this conclusion because apes that resemble humans, for example gorillas and chimpanzees, live there. Importantly, however, Darwin said that "it is useless to speculate on the subject."[188] Historians and paleoanthropologists have pointed out that the social and political dimensions of the questions led to hesitance that Africa, the "black continent," could be the cradle.[189] This anti-African bias certainly played a role, though it is worth mentioning that the fossil evidence was also just not present at the time, compared to the discoveries that were unfolding in Europe and Asia.[190]

While some naturalists hypothesized about missing links, others went out searching for fossil evidence. Inspired by Haeckel's *Pithecanthropus alalus*, along with the theories of other leading scientists about Asian origins, Dutch physician Eugene Dubois set out in search of a missing link in the 1880s. Traveling to the Dutch East Indies (known locally as Nusantara), Dubois embarked on a search that resulted in the most important discovery since the Neanderthal. From 1891–93, while digging on a riverbank

---

186 Haeckel, *The History of Creation*; Ramaswamy, *The Lost Land of Lemuria*.

187 Darwin, *Descent*, 193.

188 Darwin, *Descent*, 193.

189 Robin Dennell and Will Roebroeks, "An Asian Perspective on Early Human Dispersal from Africa," *Nature* 438 (2005): 1099-04.

190 Other discoveries not mentioned here played a role as well, for example *Dryopithecus*, see: Winfried Henke, "Historical Overview of Paleoanthropological Research," *Handbook of Paleoanthropology. Heidelberg: Springer-Verlag* (2007).

on the island of Java, his team of local, forced laborers discovered a fossil tooth, partial cranium, and femur. Dubois named the creature *Pithecanthropus erectus*.[191]

Man in the Making: The Fossil Record Grows

Convinced he had found the sought-after missing link, Dubois carried his fossils back to Europe and presented them to the scientific community in 1896. Debate once again erupted over the validity and significance of the fossilized potential human relative. *Pithecanthropus,* Dubois claimed, had a brain approximately ¾ the size of modern humans, yet its femur indicated a creature that walked on two legs (bipedally) as humans do.

This time, the antiquity of the fossil was not in question because its context had been clearly documented. Instead, practical questions emerged over whether the bones could have belonged to a single individual. The two specimens were found meters apart during different excavation seasons, and the primitive features of the skull appeared to some at odds with the modern form of the femur. The brain size and shape were once again a major focus, particularly because the brain size of *Pithecanthropus* was much smaller than that of the Neanderthals or modern humans, measuring at about 900 cubic centimeters. Pathological explanations once again reemerged to explain this brain size, including the explanation of the skull belonging to a modern human who suffered from pathology as a "microcephalic idiot."[192] Microcephaly, which emerged in the Neanderthal

---

191 Eugene Dubois, *Pithecanthropus Erectus: Eine Menschenaehnliche Uebergangsform* (Batavia: Landesdruckerei, 1894).

192 As discussed in Eugene Dubois, "On Pithecanthropus Erectus: A Transitional Form Between Man and the Apes," *The Journal of the Anthropological Institute of Great Britain and Ireland* 25 (1896): 245.

conversation as well, is a condition of small headedness and abnormal brain development that changes not only brain size but shape. In the case of *Pithecanthropus*, researchers saw it as a way to explain the small brain size yet human-like posture.[193]

While Dubois himself took the microcephalic argument seriously, acquiring the skull of a modern human microcephalic to make comparisons, other researchers were less convinced of this pathological explanation that once again dismissed a skull rather than facing the ways in which it challenged ideas of what it means to be human. "Although idiot skulls manifest a great variety of forms," a researcher countered, "there has never been one recorded that even approximates the conformation of the [*Pithecanthropus*] skull."[194]

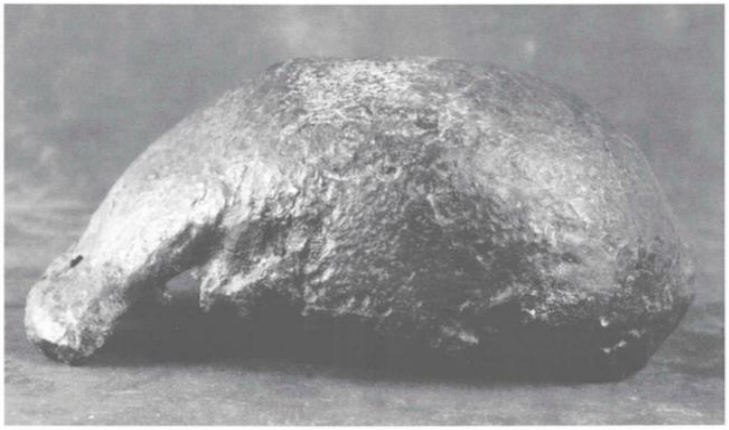


Figure 7 Pithecanthropus skullcap. Image courtesy of John de Vois

These scientists were now familiar with fossil debates. "History repeats itself," Arthur Keith, an anatomist at Busk's institution, the Royal College of Surgeons in London, claimed.[195] "When Fuhlrott brought forth the Neanderthal calvaria from the

193 George Humphry, "The Microcephalic or Idiot Skull, and the Macrocephalic or Hydrocephalic Skull," *Journal of Anatomy and Physiology* 29, no. 2 (1895): 304.
194 Arthur Keith, "Pithecanthropus Erectus—A Brief Overview of Human Fossil Remains," *Science Progress (1894-1898)* 3, no. 17 (1895): 363.
195 Keith, "Pithecanthropus," 351.

Feldhofer cave," he continued, "nearly as many speculations arose concerning the nature of the individual to which it belonged as there were anthropologists in Europe."[196] The implication being that debates over *Pithecanthropus* were to be expected and would resolve in time like those surrounding the Feldhofer specimen. Once again, scientists hoping to settle at least one aspect of the debate (the diseased side) wished for more fossils, just as with the Neanderthal. Just as the Neanderthal skull had been "established" valid "by the discoveries at Spy [Belgium]," they recalled, "so it may be hoped that in the future other specimens will be forthcoming which will establish the value of these as bringing before us a distant stage in the phylogeny of Man."[197] They needed more fossils.

While in 1895, Keith could claim that "all fossil human remains hitherto discovered could be placed within a museum cupboard of very limited dimensions," that began to change in the early twentieth century.[198] The most significant of these were the Mauer Jaw found in Heidelberg, Germany, in 1907, designated *Homo heidelbergensis*, and the cranial and dental fragments from Piltdown found in 1912 named *Eoanthropus dawsoni*.[199] The fossils seemed to raise more questions than answers, however, as they often contradicted each other in terms of what they suggested about the human evolutionary story. For example, *Pithecanthropus* and *Eoanthropus* implied that human ancestors acquired their uniquely human features in entirely opposing manners. *Pithecanthropus* suggested that brain growth occurred later in the human story, preceded

196 Keith, "Pithecanthropus," 351.
197 Dubois, "On Pithecanthropus," 245.
198 Keith, "Pithecanthropus," 353.
199 Otto Schoetensack, "Der Unterkiefer des *Homo Heidelbergensis* aus den Sanden von Mauer bei Heidelberg: Ein Beitrag zur Palaeontologie des Menschen," *Zeitschrift für induktive Abstammungs- und Vererbungslehre* 1 (1908): 408-410; Charles Dawson and Arthur Smith Woodward, "On the Discovery of a Palaeolithic Human Skull and Mandible in a Flint-bearing Gravel Overlying the Wealden (Hastings Beds) at Piltdown, Fletching (Sussex)," *Quarterly Journal of the Geological Society* 69, no. 1-4 (1913): 117-123.

by bipedal locomotion (an inference based on the femur's humanlike form) and a slow transition of ape-like cranial features, while *Eoanthropus* suggested that brain expansion had actually occurred first, followed by a later adoption of other humanlike features in the teeth, jaws, and face.[200]

Figure 8 La Chapelle Neanderthal, from Boule 1913

Also, Neanderthal specimens continued to accumulate in Europe, and a consensus began to form about what they were and where they fit in the family tree. While theories did exist about humans passing through a Neanderthal "phase" before becoming modern

[200] Rachel Caspari and Milford Wolpoff, "The Dubois Syndrome," *History and Philosophy of the Life Sciences* 34, no. 1/2 (2012): 33-42.

humans, French paleontologist Marcellin Boule's detailed analysis of the specimen known as the Old Man of La Chapelle from 1913-15 convinced many that Neanderthals were instead a side branch of human evolution. In hypothesizing this position of Neanderthals, Boule made human evolution appear a little less linear, which would be an increasing trend in the coming decades. By 1915, it could be claimed that "our present concept" of Neanderthals was as a "separate and peculiar species of man, which died out during, or soon after, the Mousterian period."[201] This perspective recognized William King's species name, which had previously largely been ignored.[202]

By 1914, Keith, who had emerged as a leading expert in fossil human ancestors, could claim that "in recent years discoveries of fossil man have crowded in upon us, yielding such an abundance of new evidence that we have had to reconsider and recast our estimates of the antiquity of man."[203] In addition to the new Neanderthal specimens, researchers were intensely focused on "the small fragments of these three most primitive members of the human family," which "afford us tantalizingly imperfect glimpses of man in the making."[204] That human being "intermediate between men and apes" that Huxley had sought was beginning to come into focus, if only through small bits of evidence. Importantly, these pieces of evidence emerged from very different locations and displayed different suites of characteristics. Therefore, the evidence suggested conflicting hypotheses for how, when, and where human origins unfolded.

---

201 Arthur Keith, *The Antiquity of Man* (London: Williams and Norgate, 1915): 200.
202 Arthur Keith, "Discovery of Neanderthal Man in Malta," *Nature* 101, no. 2543 (1918): 404-405.
203 Keith, *Antiquity*, xxii.
204 Grafton Elliot Smith, *The Evolution of Man: Essays* (Oxford: Oxford University Press, 1924): 58.

History Repeats Itself

With each new specimen, researchers saw similar patterns arise, both in terms of debate and the types of questions the fossils raised. "Almost every new discovery has started afresh such disputes as followed the finding of the Neanderthal skull," a leading British anthropologist claimed in 1915, adding "history has repeated itself with remarkable consistency."[205] Microcephaly continued to pop up to explain different brain shapes and sizes, for example when, in 1923, Boule claimed that "the simplicity and coarse appearance of the convolutions" of the brain of Neanderthal Man, as read through the imprints on the skull, "more resembles the brains of the great anthropoid apes or of a microcephalic man" than a healthy modern human.[206]

Figure 9 Skull of a microcephalic man that Dubois acquired and used to compare with Pithecanthropus. Image courtesy of John de Vos.

Divergent perspectives were not quickly settled, for example the more than three decades of open questions about the Feldhofer Neanderthal. Researchers became

---

[205] Grafton Elliot Smith, "Men of the Old Stone Age," *The American Museum Journal* XV (1915): 319-325.

[206] Marcellin Boule, *Fossil Men Elements of Human Palaeontology* (Edinburgh, Eng.: Oliver and Boyd, Tweeddale Court, 1923): 232.

comfortable with the fact that "there are still wide divergencies of opinion in respect to almost every aspect of the problems raised for discussion by these relics."[207] Scientists began even preparing for divergent perspectives in their arguments. When paleontologist Robert Broom put forward a "new species of primitive man" from southern Africa, in 1916, he acknowledged that "there is *always* a tendency to consider that any new and unexpected type of human skull must be abnormal or pathological" (emphasis mine).[208]

So, too, did the problems of understanding modern humans' uniqueness, pinpointing their evolutionary history, and understanding the line between human and non-human continue. When the Java man was presented at a meeting of the Anthropological Institute of Great Britain, for example, Keith explicitly declared that the "chief question" at hand was "whether the skull was human or not."[209] He asked, "What was the criterion of a human skull? What was the criterion of an ape's skull? How were they to be distinguished?"[210] Instead of clarifying the issues, the fossils often disrupted them; and the more fossils there were, the more they seemed to contradict themselves and the narrative. Depending on the age and ancestral status a given researcher was willing to assign to *Eoanthropus* or *Pithecanthropus*, for example, the story of human evolution they constructed (for example the order in which features evolved or the location of human origins) looked very different.[211]

---

207 Elliot Smith, "Men," 320.

208 Robert Broom, "The Evidence Afforded by the Boskop Skull of a New Species of Primitive Man (Homo capensis)," *Anthropological Papers of the AMNH*; 23, no 2 (1918): 76.

209 In Dubois, "On Pithecanthropus," 253.

210 In Dubois, "On Pithecanthropus," 253.

211 In the coming decades, however, the *Eoanthropus* remains would be revealed as fraudulent, see chapter 5.

Darwin had anticipated that the problem of drawing lines would become increasingly difficult the more scientists knew about the past. "In a series of forms graduating insensibly from some ape-like creature to Man as he now exists," he claimed, "it would be impossible to fix any definite point where the term 'Man' ought to be used."[212] While many naturalists operated under the idea that species do not have fixed definitions and Darwin himself tried to emphasize that "this is a matter of very little importance," broader efforts to fix a definite point nevertheless continued.[213] Such lines were brought into question by the Neanderthal but increasingly challenged by more primitive looking specimens like *Pithecanthropus*, as will become increasingly clear in the following chapters.

Another question that was emerging (and was about to become central) was in the realm of hypothesizing about human origins, who has the authority to lay claims? And where do those experts draw their evidence come from? The fossils themselves were sometimes "annoyingly imperfect," as paleontologist Robert Broom claimed in 1918, and those who examined them hailed from a variety of different backgrounds.[214] The particular training of these naturalists from different backgrounds was sometimes called into question. Evidence for human origins "does not come to the man who sits in his study and reads books," Keith argued for example, "it is to be found only in the jungles of the tropics, and in the rocks and the strata, where there are found fossil remains of animals which lived in tropical forests when the earth was much younger than it is

212 Darwin, *Descent*, 212.
213 Darwin, *Descent*, 212.
214 Broom, "The Evidence," 71.

now."[215] He cited his own time in the "hot, moist, malarious, and thickly covered with forest and jungle" Malay Peninsula, studying monkeys.[216] As the field continued to grow and professionalize, the training, education, and general background of each expert became increasingly important factors in the debates over the objects.

Into the 1920s

The era of fossil discovery picked up speed into the 1920s, as exploration increased across the globe and circulation of objects intensified. The discoveries created an increasingly complex picture of human evolution, as each find seemed to confuse the question of where origins had occurred and what each stage of human evolution looked like. Hints of potential origins began to emerge out of Africa, for example, the Kabwe specimen, from what was then Rhodesia, found in 1921.[217] Additionally, a "new species of primitive man," *Homo capensis,* was put forward from South Africa, based on the Boskop skull.[218] While this partial skull—which was argued to be a primitive species by paleontologist Robert Broom and young anatomist Raymond Dart in what would later be a major foreshadowing event—turned out to simply be that of a modern human, it did draw some attention to South Africa.

Almost seventy years after the fateful strike of shovels against fossils in the Neander Valley, a dynamite blast in a limestone quarry over 12,000 kilometers to the south revealed an object that reignited debates in a manner more aggressive than anything

215 Arthur Keith, *Man, a History of the Human Body* (London: H. Holt, 1912): 73.
216 Keith, *Man*, 72.
217 Arthur Smith Woodward "A New Cave Man from Rhodesia, South Africa," *Nature* (1921): 371.
218 Broom, "The Evidence," 71.

since the Feldhofer Neanderthal. In the next case study, we will examine once again a fossil that challenged—and unlike the Neanderthal, reconfigured—notions of what makes us human. As we will see, the science was developing into an increasingly global endeavor, and researchers were about to encounter new practical problems in their hunt for human origins.

CHAPTER 4

ALL THINGS BLEAK AND BARE: *AUSTRALOPITHECUS AFRICANUS*

Introduction[219]

The "missing link" had finally been discovered, international headlines exclaimed in February of 1925. The link—a small fossilized skull—had emerged from a limestone quarry in South Africa, the headlines contended, to become the definitive piece of evidence that "joins us to the apes."[220] However, the fossil was entirely unlike scientists' expectations for such a link—both in its combination of non-human features and its location of discovery. Could this small fossil, nicknamed the Taungs Baby, truly be an important link in the human story, an early human ancestor?[221] Or, some scientists wondered, was it possible that the discoverer had made a mistake, misidentifying an infant gorilla for "one of the most dramatic discoveries in the history of mankind?"[222] After headlines broke the shocking news, a fierce controversy erupted over the creature's true place in the primate family tree.

While the fossil's discoverer, a young anatomist working in South Africa named Raymond Dart, argued that the Taungs skull indeed represented an important evolutionary link to humans, other experts were more skeptical.[223] Anatomists were not ready to rule out other, less fantastic hypotheses that could explain the fossil's odd

---

219 This chapter appears in *History and Philosophy of the Life Sciences* (Madison 2019).

220 "Taungs Man-ape: World Keenly Interested in News from Johannesburg," *The Star*, February 5, 1925, in Raymond Dart Papers, University of Witwatersrand.

221 More recently, the fossil has become known as the Taung Child, but I am using the nickname that was used at the time.

222 Oscar Lazar, "South Africa Believed the Cradle of Mankind," *The Star*, 1925, Raymond Dart Papers, University of Witwatersrand.

223 Raymond Dart, "Australopithecus africanus: The Man-Ape of South Africa," *Nature* 115, (1925): 195-99; Arthur Keith, "The Fossil Anthropoid Ape from Taungs," *Nature* 115 (1925): 234; Grafton Elliot Smith, "The Fossil Anthropoid Ape from Taungs," *Nature* 115 (1925): 235.

medley of features, from its tiny brain to its human-like teeth. The debates raged across continents and experts' assessments of the fossil's significance were "wildly divergent."[224] What was it about the fossil that divided opinions so drastically? Historians have argued that the Taungs Baby controversy resulted from its failure to fit within prevailing theories regarding the deep human past, specifically ideas about the pattern of emergence human-like features and as the location of human origins.[225]

This article examines the Taungs Baby controversy from a different perspective, one focused on material objects and the practices that surround them.[226] I approach the fossil's story from the viewpoint of the circulation of objects, drawing from a perspective that examines the processes involved in the movement of objects and knowledge across various borders and frontiers.[227] Recent scholarship has shown that the practice of circulating specimens from distant parts of the world to collect them in metropolitan centers of accumulation has long been a fundamental—if often contested and varied—practice in paleontology.[228] This accumulation has been crucial in making sense of

---

224 Jesse Richmond, "Experts and Australopithecines: Credibility and Controversy in the Science of Human Evolution, 1924–1959" (PhD diss., UC San Diego, 2009).

225 Peter Bowler, *Theories of Human Evolution: A Century of Debate, 1844–1944* (Baltimore: Johns Hopkins University Press, 1986); Dean Falk, *The Fossil Chronicles: How Two Controversial Discoveries Changed our View of Human Evolution* (Oakland: University of California Press, 2011); Gundling, *First in Line*.

226 There is a growing body of literature on this topic, including: Lorraine Daston ed., *Biographies of Scientific Objects* (Chicago: University of Chicago Press, 2005); Samuel Alberti, "Objects and the Museum," *Isis* 96 no. 4 (2005): 559-71; Marianne Sommer, *Bones and Ochre: The Curious Afterlife of the Red Lady of Paviland* (Cambridge: Harvard University Press, 2007).

227 James Secord, "Knowledge in Transit," *Isis* 95 no. 4 (2004): 654-72; Fa-ti Fan, "Circulating Material Objects: The International Controversy over Antiquities and Fossils in Twentieth-century China," in *The Circulation of Knowledge Between Britain, India and China: The Early-Modern World to the Twentieth Century*, eds. Lightman & Stewart (Leiden: Brill, 2013): 209-36; Kapil Raj, *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650–1900*, (New York: Palgrave Macmillan, 2007).

228 Chris Manias, "Jesuit Scientists and Mongolian Fossils: The French Paleontological Missions in China, 1923–1928," *Isis* 108 no. 3 (2015): 307-32; Irina Podgorny, "Fossil Dealers, the Practices of Comparative Anatomy and British Diplomacy in Latin America, 1820–1840," *The British Journal for the History of Science* 46 no. 4 (2013): 647-74; Savithri Preetha Nair, "Eyes and No Eyes: Siwalik Fossil

fossils, as Martin Rudwick has argued, for "the assembly of specimens in one central location…made possible their identification and classification" and therefore rendered the specimens "truly scientific."[229] "Centers of calculation" or accumulation, a concept introduced by Bruno Latour, can be defined as a location—usually a museum or university—located in a metropolitan center that contains many physical specimens.[230] Attention to the centrality of accumulation as a paleontological practice, I argue, illumines an important divergence that the Taungs fossil took in the history of hominin paleontology.

The Taungs Baby is an interesting case for studying circulation because, during the first few years of its life as a scientific object, it did not, in fact, circulate. In the five years following its emergence from the quarry, the fossil remained firmly rooted in its home country of South Africa—far from an established scientific center of accumulation. At the time, South Africa was largely devoid of the resources typically used to study potential human ancestors, including comparative anatomical collections and vast libraries.[231] The fossil's prolonged stay there created practical difficulties for studying the specimen, challenged assumptions about the way hominin paleontology should be conducted, and shaped interpretations of the fossil.

Collecting and the Crafting of Indian Palaeontology (1830–1847)," *Science in Context* 18 no. 3 (2005): 359-92.

[229] Martin Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution*, (Chicago: University of Chicago Press, 2005): 41.

[230] Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society*, (Cambridge: Harvard University Press, 1987).

[231] The Taungs Baby was the first major fossil contender for a "missing link" that failed to circulate in such a way, I argue. Other fossils, like the Java Man, traveled from their remote locations to be analyzed, as discussed in Ian Tattersall, *The Fossil Trail: How we Know what we Think we Know about Human Evolution*, (New York: Oxford University Press, 2005).

As historians have shown, tracing the movement and circulation of objects requires attention to both "the local," which is the place where the objects and knowledge originate, and the larger global networks that transfer and shape that knowledge.[232] By not moving from a relatively remote location for a number of years, the Taungs Baby provides a unique opportunity to examine the tensions between these two worlds. I first focus on the local character of the science in South Africa, specifically the resources available there, before connecting that local situation to the larger network of international scientists who analyzed the fossil. In the process, I draw attention to the asymmetrical dynamics at play in exchanges between those two worlds.

Importantly, centers of accumulation followed channels and networks established by imperialism, with specimens often moving from colonial "peripheries" to imperial centers.[233] A perspective of the movement of objects thus has been useful in thinking about colonial science and overturning traditional narratives of a diffusion from a scientific center to a "periphery."[234] The Taungs fossil's story illuminates an attempt to break with this imperialist practice, but ultimately one that failed, thus revealing the strength of imperial assumptions inherent in conducting hominin paleontology in the early twentieth century. Researchers had come to expect that important hominin fossils

---

232 Steven Shapin, "Placing the View from Nowhere: Historical and Sociological Problems in the Location of Science," *Transactions of the Institute of British Geographers* 23, no. 1 (1998): 5-12; Lissa Roberts, "Situating Science in Global History: Local Exchanges and Networks of Circulation," *Itinerario* 33 no. 1 (2009), 9-30.

233 Fa-ti Fan, "Science in Cultural Borderlands: Methodological Reflections on the Study of Science, European Imperialism, and Cultural Encounter, *East Asian Science, Technology and Society* 1 no. 2 (2007): 213–231; Manias, "Jesuit Scientists," 307-32.

234 Londa Schiebinger, "Forum Introduction: The European Colonial Science Complex," *Isis* 96, no. 1 (2005): 52-55; Lightman et. al, *The Circulation*.

would circulate from peripheries to imperial centers of accumulation, and in failing to follow this pattern the Taungs Baby became uniquely controversial.

In order to contemplate the practical circumstances involved in the Taungs Baby's analysis, this essay follows the fossil from its discovery through its first five years as a scientific object, from 1924—1929. I first "zoom in on the local," tracing the methodological attempts to study the fossil that were employed on the ground in South Africa, as well as the criticisms that arose around that methodology.[235] I then trace the relatively weak attempts to circulate reproductions of the fossil and the negative response that arose as a result. This essay concerns a narrow sliver of time and a small collection of actors, in order to examine closely the early chapter of the Taungs Baby's story. The few researchers in my story, located in either South Africa or London, highlight the most polarized positions in the Taungs debate, as well as the complex, imperially-based assumptions that lay beneath their positions. This limited focus compliments existing broader scholarship on the Taungs fossil, while zeroing in on a new dimension of the debate.[236]

Discovery in an Uninviting Countryside

The small skull saw light for the first time as a scientific object in early November of 1924, when it was partially blasted from its rocky tomb in a limestone cave. The blast

235 Roberts, "Situating Science," 9-30.

236 Gundling, *First*; Falk, *Fossil Chronicles*; Tattersall, *How We Know*; Roger Lewin, *Bones of Contention: Controversies in the Search for Human Origins* (Chicago, Ill: University of Chicago Press, 1997); Richmond, "Experts"; Richard G. Delisle, *Debating Humankind's Place in Nature, 1860-2000: the Nature of Paleoanthropology* (Upper Saddle River, NJ: Pearson Prentice Hall, 2007); John Reader, *Missing Links: the Hunt for Earliest Man* (Harmondsworth, England: Penguin Books, 1990).

occurred at a quarry operated by the Northern Lime Company and located in Buxton, Bechuanaland, seven miles south-west of the Taungs railway station.[237] The landscape of Bechuanaland was desolate, characterized by open, uncultivated country known as the "veld," a place where only a few small plants managed to "survive by some miracle in the arid soil, under the scorching glare of the African sun."[238] It was an entirely unimpressive location for the discovery of an important fossil, one journalist mused, containing nothing but "bare veld, lime quarries, and a few corrugated iron sheds: all things bleak and bare beneath a brazen sky."[239] While such a locale may seem like an unlikely place for such a discovery, it was precisely the bleak nature of the region that had inspired a search for a specimen of the sort.

The bleak, bare quality of the region had triggered one foreign researcher's interest in the quarry earlier that year. The researcher was Raymond Dart, a newly appointed anatomy professor at the University of Witwatersrand in Johannesburg, located 400 kilometers from Taungs. Originally from Australia, Dart had come to South Africa by way of London, where he had received his medical training.[240] When Dart began his professorship in 1923, South Africa was a newly formed nation undergoing significant change. Having become partially independent in 1910 from the British colonial grip, South Africa was functioning as a new Union under the British Commonwealth.[241] The Union was in the midst of an economic boom due to the diamond and gold industry in the

---

237 Young, Robert B. "The Calcareous Tufa Deposits of the Campbell Rand, from Boetsap to Taungs Native Reserve." *South African Journal of Geology* 28 (1925): 55-67.

238 Lazar, "South Africa Believed."

239 Lazar, "South Africa Believed."

240 Matthew Goodrum, "Dart, Raymond Arthur," in *Complete Dictionary of Scientific Biography* (20): 237-242.

241 Carolyn Hamilton, Bernard Mbenga, and Robert Ross, *The Cambridge History of South Africa* (Cambridge: Cambridge University Press, 2010).

area. Despite the economic gains since the turn of the century, the place Dart arrived after the long journey from London—a three-week voyage to Cape Town followed by a multiday ride north, across the veld—was a far cry from the imperial center from which he came. The University was struggling to find funding, and Dart found that his anatomy department lacked many of the resources necessary for a medical school, including a complete library and anatomical specimens.[242]

Figure 10: Quarry site, with an X to mark where the Taungs Baby was thought to be blasted from. Courtesy of the Dart Papers, University of Witwatersrand Archives

[242] Raymond A. Dart and Dennis R. Craig, *Adventures with the Missing Link* (London: H. Hamilton, 1959); Indeed, Dart's advisor, Sir Grafton Elliot Smith, later tried to help with library resources by donating his own library to Dart: Letter Dart to Elliot Smith, 15 April 1936, Raymond Dart Papers, University of Witwatersrand (hereafter RDP).

The young anatomist had moved to South Africa at the suggestion of his advisor at University College London, Sir Grafton Elliot Smith.[243] Elliot Smith's placement of students like Dart in distant corners of the globe was common practice to promote "the dispersal of institutions based on metropolitan precedents" and spread European models—a practice that has been labeled the construction of an "empire of scholars."[244] As Dart soon discovered, scholars working in these settler universities found themselves in a unique position as both local and global actors. They were "rooted in specific social and political communities" while also serving as "wayfarers on international routes of scholarship," a position that occasionally caused tension."[245] This tension was especially prevalent in the Union of South Africa as notions of independence and self-determination grew throughout the early twentieth century, with citizens setting their sights set on establishing further autonomy for their burgeoning nation.

To ameliorate the problem of scarce resources in Johannesburg, Dart attempted to amass some of the objects he was accustomed to having in London—including a museum collection of fossil specimens. South Africa was known to contain plenty of fossils, and thus Dart wanted to accumulate a collection. He asked the students of his 1924 medical-school class to help, inviting them to bring in any specimens they came across. He even offered a reward to the student who gathered the most interesting relic of ancient life. Josephine Salmons rose to the challenge, bringing in a baboon skull she had spotted mounted on a mantelpiece of a friend's house.[246] Intrigued by the baboon, Dart learned it

243 Dart and Craig, *Adventures*.
244 Tamson Pietsch, *Empire of Scholars: Universities, Networks and the British Academic World, 1850-1939* (Manchester: Manchester University Press, 2015).
245 Pietsch *Empire*, 3.
246 Dart, "Australopithecus," 195-99.

had been found at the Buxton quarry near Taungs and he began working with a geologist at the University, Robert Young, to ensure that any interesting fossils discovered in the future would be set aside.

Figure 11: Raymond Dart. Courtesy of the Dart Papers, University of Witwatersrand Archives.

This system of actively seeking fossils amidst the bare veld resulted in Dart receiving one particularly interesting specimen in November of 1924, collected from the quarry by Professor Young.[247] As Dart was soon to learn, however, the problem of resources extended beyond the fossil itself, to the tools required to properly study it. The skull was almost entirely encased in rock, and Dart lacked experience preparing fossils, as well as tools to accomplish the task or local experts to consult. Thus, Dart embarked on a trial-and-error-based method to carefully wrest the fossil from its rocky tomb. He struggled to find the proper tools in Johannesburg, eventually purchasing a hammer and

[247] Young, "The Calcareous," 55-67; Tobias, Phillip V. "The Discovery of the Taung Skull of Australopithecus africanus, Dart and the Neglected Role of Professor R.B. Young." *Transactions of the Royal Society of South Africa* 61, no. 2 (2006): 131-38.

chisel from the local hardware store and borrowing a knitting needle from his wife, sharpening it for the task.[248] In the weeks that Dart undertook the fossil preparation the rock began to crumble away, revealing the face of a primate that had the potential, he thought, to change South Africa's scientific status from bleak to central in the human story.

Dart announced his fossil to the world in February of 1925, in the London-based journal *Nature*. Dart's choice of a leading British journal, rather than a local South African journal, reflected his desire to share his important find with the imperial center. Though he refrained from using the specific words 'missing link' in this paper, Dart wrote "it is obvious", that the fossil belongs to "an extinct race of *apes intermediate between living anthropoids and man*" (emphasis his).[249] The Taungs Baby had a relatively flat, vertical forehead, much like humans, he argued, with a human-like brain that formed a rounded shape. Additionally, the head was arranged in a way that suggested the Taungs Baby had an upright posture, like humans. Despite the fact that his baby was a child of about six years, Dart claimed, it already displayed a number of "essential human" characters in its young age.[250]

Dart was quick to tie the significance of his discovery to its location. Far from being a bleak locale, he argued, the Taungs Baby demonstrated that the South African veld had once been the "cradle of mankind."[251] Reinforcing the importance of place in his

---

248 Dart and Craig, *Adventures*, 8.

249 Dart, "Australopithecus africanus," 195. Dart did "tentatively" propose a new family be created for this group of individuals, *Homo-simiadae*, which essentially denoted his perception of it as a missing link, but he did refrain from using the colloquial term, see Dart, "Australopithecus africanus," 196.

250 Dart, "Australopithecus africanus," 198.

251 Dart, "Australopithecus africanus," 198.

find, Dart named the Taungs Baby a new species of human relative: *Australopithecus africanus*, meaning the southern ape from Africa. At a time when science was closely tied to patriotic achievement, Dart saw his Taungs Baby as an object that could further South Africa's position within the commonwealth and throughout the world more broadly.[252]

Figure 12: The Taungs Baby. Courtesy of the Dart Papers, University of Witwatersrand Archives.

An Unfair Advantage: Collections and Comparisons

How were other scientists to assess Dart's stunning claim? No leading experts in hominin paleontology—many of whom were based in London—had seen the specimen for themselves. Additionally, the evidence available to evaluate Dart's claim consisted of only a short paper, a line drawing, and a couple of rough photographs. Was this enough to uphold such an enormous hypothesis? Dart's declaration of his man-ape from South

252 Saul Dubow, *A Commonwealth of Knowledge: Science, Sensibility, and White South Africa, 1820-2000* (New York: Oxford Univ. Press, 2006).

Africa was not a claim that would be evaluated lightly, because if the fossil was truly a primitive link situated halfway between humans and our ape ancestors, it could be arguably one of the first ever discovered. Of the hominins discovered prior to the Taungs Baby, many were either imperfectly preserved or considered to be too human-like to be a deep ancestral link. Therefore, questions of what the missing link looked like, and where it came from, remained open.[253]

Among the other contenders for such a link, there was a growing collection of Neanderthal fossils and a small collection of scattered, imperfectly preserved individuals. The Neanderthals were overall too large-brained to be considered a distant ancestor; instead they were generally interpreted as either a variety of humans or a closely related species.[254] The *Pithecanthropus* fossils from Java looked more ape-like, but this creature's missing link status was subject to debate given the questionable association between its ape-like cranium and human-like femur.[255] The Piltdown find from England, announced in 1912, was problematic as well, with scientists wondering if the two parts of the skull discovered had in fact come from two separate animals.[256] So far, a fossil that convinced a majority of scientists that it was an ancient link between humans and our archaic ancestors had failed to emerge.[257]

---

253 Tattersall, *How We Know*; Reader, *Missing*.

254 Frank Spencer, "The Neanderthals and Their Evolutionary Significance: A Brief Historical Survey," in *Origins of Modern Humans: A World Survey of the Fossil Evidence.* (New York: Alan Liss, 1984): 1-49.; Julia R. R. Drell, "Neanderthals: A History of Interpretation," *Oxford Journal of Archaeology* 19, no. 1 (2000): 1-24; Paige Madison, "The Most Brutal of Human Skulls: Measuring and Knowing the First Neanderthal," *The British Journal for the History of Science* 49, no. 3 (2016): 411-432.

255 Bert Theunissen, *Eugène Dubois and the Ape-Man from Java: the History of the First 'Missing Link' and Its Discoverer* (Dordrecht: Kluwer, 1988); Pat Shipman, *The Man Who Found the Missing Link: Eugène Dubois and His Lifelong Quest to Prove Darwin Right* (Cambridge, Mass: Harvard University Press, 2002).

256 Frank Spencer, *Piltdown: A Scientific Forgery* (New York: Oxford University Press, 1990).

257 Interpretations varied dramatically, especially across national borders. For example, the Piltdown fossils failed to hold as much confidence in France or the United States as in England, as seen in Aleš

Despite the scattered, still somewhat fragmentary fossil evidence, many scientists had rather specific expectations about what a deep primitive ancestor would look like once it was found. Scholars steered by Dart's mentor, Elliot Smith, along with anatomist Sir Arthur Keith, asserted that the brain was the first distinctively human trait to have evolved, and therefore the leading feature in human evolution, preceding other defining characteristics such as upright walking.[258] Indeed, the Piltdown fossil seemed to support this view.[259] According to Elliot Smith, "it was not the adoption of the erect attitude that made Man from an Ape, but the gradual perfecting of the brain."[260] Some scientists also had fairly specific ideas about the location where human evolution had occurred, with many suspecting that early humans had first evolved in Asia.[261] Thus, in multiple theoretical realms, Taung was entirely unexpected, and would therefore be scrutinized heavily.

Shortly after Dart's paper appeared, reviews from four leading anatomists, Keith, Elliot Smith, Sir Arthur Smith Woodward and Wynfrid Laurence Henry Duckworth, were published together in *Nature*.[262] The scientists—all of whom were based in London—were cautious about the Taungs Baby's hominin status. While they agreed Dart's discovery was important, they wondered whether he had misinterpreted the find

---

Hardlička, "Variation in the Dimensions of Lower Molars in Man and Anthropoid Apes," *American Journal of Physical Anthropology* 6, no. 4 (1923): 423-438. In fact, Richard Delisle has argued that the modern assumption of the big impact of Piltdown is not historically accurate, and that historians should perhaps rethink Piltdown's impact, see Richard G. Delisle, *Debating Humankind's Place in Nature, 1860-2000: the Nature of Paleoanthropology* (Upper Saddle River, NJ: Pearson Prentice Hall, 2007): 142-46.

258 Elliot Smith, *The Evolution*; Gundling *First*; Lewin, *Bones*.

259 Which, of course, was by design, as the fossil was a fraud, discussed in Frank Spencer, *Piltdown: A Scientific Forgery* (New York: Oxford University Press, 1990).

260 Elliot Smith, *The Evolution*, 39.

261 Emily Kern, "Out of Asia: A Global History of the Scientific Search for the Origins of Humankind, 1800-1965," (PhD Diss, Princeton University, 2018)

262 Arthur Keith, Elliot Smith, Sir Arthur Smith Woodward and Wynfrid Laurence Henry Duckworth, *Nature* 1925.

and perhaps instead had an infant relative of a chimpanzee.[263] Given the challenges that the Taungs Baby presented to leading theories of human evolution, it is perhaps not surprising that the fossil was received with caution. However, these theories were not at the heart of the criticisms the authors cited in these reviews.

Comments regarding theoretical issues like the fossil's location—and therefore the location of human evolution—were actually quite minimal in both the reviews as well as the scientists' comments to the press. Elliot Smith and Keith both appeared happy to consider Africa as a candidate for the cradle of humankind, for example. Keeping in mind previous discoveries like the primitive-looking human known as the Rhodesian Man, Keith stated that the Taungs Baby's location "should not come in the nature of a shock," because "it is rather in keeping with developments which have been going on in South Africa."[264] Keith expected the area to continue to produce "valuable evidence of the march from monkeydom to mandom," he added.[265] Elliot Smith agreed, stating the discovery's location was "only a real surprise to those who do not know their Charles Darwin," alluding to Darwin's often overlooked claim that Africa was likely the cradle of humankind.[266] Indeed, throughout the 1920s, Elliot Smith maintained that "the issue" of

263 Interestingly, this was not the first time Broom and Dart had suggested a primitive species of human had been found in South Africa, there was a discussion around "*Homo capensis*" a few years earlier that may have made Keith, Elliot Smith, and others additionally skeptical, though no one explicitly mentioned this in their publications. See Robert Broom, "The Evidence Afforded by the Boskop Skull of a New Species of Primitive Man (Homo capensis)," *American Museum of Natural History*, 32 no. 2 (1918); Raymond Dart, "Boskop Remains from the South-east African Coast," *Nature*, 112, (1923): 623-25.

264 "The Taungs Skull," *The Star*, February 7, 1925.

265 "The Taungs Skull," *The Star*, February 7, 1925.

266 Elliot Smith, "The Fossil Anthropoid Ape from Taungs," *Nature, 11* (1925): 235; Darwin, *Descent*, 158.

where "man's immediate simian ancestor" had wandered from continued to be "left open."[267]

The reviewers also refrained from explicitly dismissing the fossil due to implications for the theoretical pattern of human evolution. Instead, all four scientists discussed issues of practice. The London scientists identified a number of the shortcomings in Dart's method of analysis, limitations they traced back his location in Johannesburg. They were particularly concerned about Dart's lack of resources, both in terms of the dearth of primate skulls there for comparison with the Taungs Baby, as well as the lack of texts for reference. Paleontology is a science that depends heavily on comparison. Evaluating the similarities and differences of characteristics across specimens has long been considered necessary for scientists to understand the range of biological variation, organize specimens, and understand evolutionary relationships.[268] Knowledge is therefore derived from—and dependent on—collections of objects, places where scientists could measure variations, compare features, and create knowledge. Historians of science have shown how this drive for comparative materials led to the consolidation of specimens in metropolitan centers following imperial channels during the nineteenth and twentieth centuries.[269]

---

267 Grafton Elliot Smith, "Man's Early Ancestors- Epoch in Human History Unveiled by Peking Discovery," *Telegraph*, December 17, 1929.

268 Chris Manias, "Reconstructing an Incomparable Organism: The Chalicothere in Nineteenth and Early-twentieth Century Palaeontology," *History and Philosophy of the Life Sciences, 40*, no. 1 (2018): 1-21, Lukas Rieppel, "Plaster Cast Publishing in Nineteenth-century Paleontology," *History of Science, 53* no. 4 (2015): 456-61, Martin Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* (Chicago: University of Chicago Press, 2005).

269 Manias, "Jesuit Scientists"; Pietsch, *Empire*; Irina Podgorny, "Fossil Dealers, the Practices of Comparative Anatomy and British Diplomacy in Latin America, 1820–1840," *The British Journal for the History of Science* 46, no. 4 (2012): 647-74; Jim Endersby, *Imperial Nature: Joseph Hooker and the Practices of Victorian Science* (Chicago: University of Chicago Press, 2010).

The practical reality of consolidating specimens in one place had the effect of consolidating power in a few institutions. One such institution was the Hunterian Museum at the Royal College of Surgeons, which was curated by Keith. By the twentieth century, "the standards of the discipline" meant that "material could only be truly understood" in places like the Hunterian, where a specimen could be compared to many other similar varieties.[270] There was no Hunterian equivalent in South Africa at the time, no true comparative collection in Dart's nascent medical school. This was a central problem with Dart's claims, as the London scientists saw it—the Taungs Baby had not come anywhere near a place where proper comparisons could be made to provide evidence for Dart's claims.

The issue of access to comparative material was particularly important for the Taungs Baby, critics pointed out, because the skull was that of an infant. Primate features change as individuals mature, and young primates often exhibit more human-like features than adults. A humanlike feature of a juvenile skull, then, might reflect an ape's immature development, rather than its close evolutionary relationship with humans. Thus, the Taungs Baby's juvenile age magnified the need for a large comparative sample, as it was especially prone to suggesting a false positive human ancestor. It was important to compare the Taungs Baby to chimpanzees and gorillas that ranged in age, making the need for large collection increasingly important. As Keith stated, "It must not be forgotten that the fossil ape [from Taungs] is a mere infant, perhaps only three or four

270 Manias, "Jesuit Scientists," 322.

years of age…and that at such a stage of development there is a much closer likeness of the apes one to the other, as well as to the human child, than there is later."[271]

The reviewers speculated that Dart had made a mistake as a result of his lack of comparative collections. Keith admitted—almost guiltily—that "those who have charge of much larger collections…have a somewhat unfair advantage."[272] Elliot Smith agreed, declaring that Dart was insisting "unduly" upon certain traits as evidence for humanness that are "merely signs of simian youthfulness."[273] His former student would have realized this, Elliot Smith explained, if he "had access to collections such as are available in London."[274] Duckworth also chimed in, stating that he felt "fairly certain" the characters Dart labeled as human are actually a reflection of "the youthfulness of the specimen."[275]

One feature of the fossil that the critics focused on to illustrate this point was the Taungs Baby's forehead. Dart had been impressed by the fossil's steep forehead as a human-like feature, but Elliot Smith pointed out that a high forehead is a ubiquitous feature of infant primates—a fact Dart would have known if he had the proper collections. "It is unfortunate that Dart *had no access to skulls of infant chimpanzees, gorillas or orangs* of an age corresponding to that of the Taungs skull," Elliot Smith argued "for had such material been available he would have realized that the [characters] upon which he relied for proof of his contention that *Australopithecus* was nearly akin to man, were essentially identical with the conditions met in the infant gorilla and

---

271 Keith, "The Fossil Anthropoid Ape from Taungs," 234.
272 Keith, "The Fossil Anthropoid Ape from Taungs," 234.
273 Grafton Elliot Smith, "Taungs Fossil Skull: More Manlike than Any Known Ape" *The Times*. In Grafton Elliot Smith Papers, University College London Archives.
274 Elliot Smith, "More Manlike."
275 Wynfrid Lawrence Henry Duckworth, "The Fossil Anthropoid Ape from Taungs," *Nature*, 115 (1925): 236.

chimpanzee" (emphasis mine).[276] Without such collections, Dart could not truly "realize" that the features of his Taungs Baby did not differ significantly from other infant primates.

Thus, Elliot Smith, Keith, and others initially reacted hesitantly towards Dart's claims, due to his failure to follow standard practice and directly compare the fossil against a wide range of variation. Dart had likely confused a baby gorilla for the missing link because he lacked the proper resources in Johannesburg. Dart found this response disheartening, especially insofar as it was related to place. These were the same men who had facilitated his move to South Africa, and there he felt that he had already battled the odds in his bleak environment, getting creative with tools and undertaking his analysis alone—only to have his find criticized. As historian Jesse Richmond argued, "the

276 Elliot Smith, "More Manlike."

situation that had allowed [Dart] to come into possession of the fossil also undermined his ability to interpret it credibly."[277]

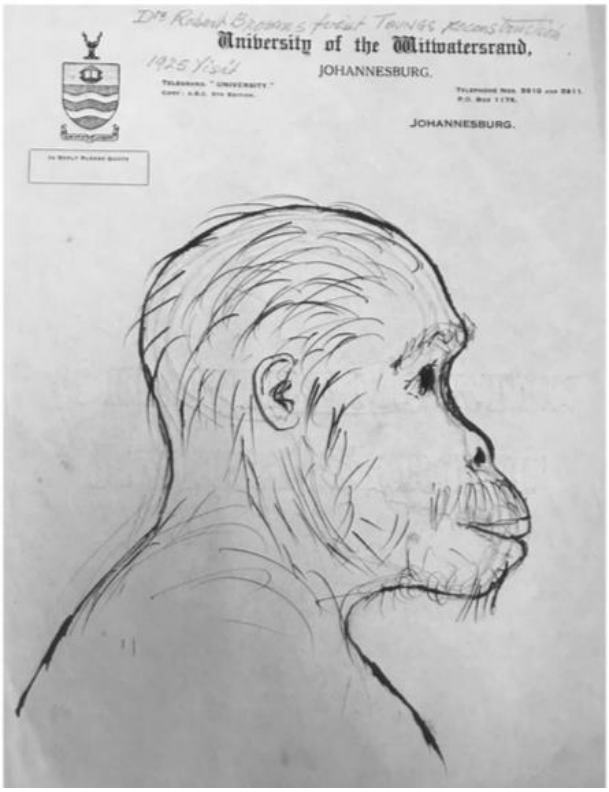


Figure 13: Sketch of Taungs by Robert Broom.. Courtesy of the Ditsong National Museum.

Don't Let the Skull Out of Your Hands

While it would have been impossible to amass the vast collections in Johannesburg necessary to properly study the Taungs Baby in a short amount of time, there was another possible approach to obtaining direct comparisons: take the fossil to a center of accumulation. This had been common practice in past hominin discoveries—particularly when the hominin fossils had been discovered in colonial outposts. Neanderthal fossils were commonly sent to imperial centers like the Hunterian Collection

277 Richmond, "Experts," 40.

in London or the Natural History Museum in Paris, examined by experts and then kept in the collections indefinitely.[278] The Java Man travelled to Europe all the way from the Dutch East Indies in the late nineteenth century, as soon as its discoverer was able to arrange its safe passage.[279] The Rhodesian Man, discovered a few years before the Taungs Baby in Africa, had been sent directly to London to be examined by Keith and others.[280] While no rules or regulations existed to enforce the custom, this had been the standard practice for hominin paleontology. By 1925, no major fossil contender for a distant human ancestor had failed to travel to a scientific center to be directly compared to the collections—until the Taungs Baby.[281]

But Dart's mindset—and indeed his setting—was different than that of the Dutch East Indies in the nineteenth century, for example. South Africa was becoming increasingly autonomous. Since the first World War had come to a close, the process of nation building was a major focus of South African citizens, with settlers increasingly striving towards a more independent position within the Commonwealth. As Saul Dubow has shown, science played a big role in this ethos, often being identified as a pillar of South African achievement and autonomy.[282] While sending the skull to London would have complied with paleontological practice and expectations of Dart's colleagues, it would have gone against the evolving local ethos.

---

278 For example, the Neanderthal Gibraltar skull, which traveled to London, as well as the Old Man from La Chapelle-aux-Saints, which made its way to Paris.

279 Theunissen, *Eugène Dubois*.

280 Hrdlička Aleš, *The Skeletal Remains of Early Man* (City of Washington: The Smithsonian institution, 1930).

281 Even the first *Sinanthropus* tooth went on tour around the United States and Europe, brought by Davidson Black, though this practice ceased with later *Sinanthropus* discoveries, see Reader, *Missing*, 216-18.

282 Dubow, *Commonwealth*.

The underlying South African attitude of self-determination was expressed explicitly by Dart's colleague and scientific ally Robert Broom, a Scottish paleontologist working in South Africa.[283] Broom, an expert in mammal-like reptiles, had quickly became an avid supporter of Dart's Taungs Baby and he agreed that Dart should keep the skull there. When Broom heard an incorrect rumor that Dart was considering sending the fossil to London, he wrote him a letter strongly advising against it. "What are you doing," Broom accused Dart, "are you, as is rumored, sending it to London—to the Lions!"[284] He urged Dart not to, saying "send a cast if you like but don't let the skull out of your hands," adding "I really think you should not send it to London at all."[285] Broom argued that anything other than casts or photographs would be "favoring" the British, which he envisioned as unfair. "Lie low and do a fine big paper here with all details," he told Dart. "You have the goods—stick to them."[286] For Broom, "the goods" were confined to the fossil, not the collections, and a "fine paper" could be completed in South Africa.

Instead of simply mailing off his fossil, one alternative was for Dart to accompany the skull to London—or another center of accumulation—and make direct comparisons at collections himself. Dart had an opportunity to undertake this trip in 1925, when the University of Witwatersrand offered to fund his travels. In return, however, the University asked to obtain ownership of the fossil—a deal Dart was not willing to make. Dart later admitted in a letter that he "did not want to give up the fossil" as well as was

283 Despite the fact that they themselves were foreigners.
284 Letter from Robert Broom to Raymond Dart, 3 June 1925, RDP.
285 Letter from Robert Broom to Raymond Dart, 3 June 1925, RDP.
286 Letter from Robert Broom to Raymond Dart, 3 June 1925, RDP.

not "prepared to absent myself for so long a time from the young department and my newly established home."[287]

Due to Dart's resistance to travel or send the fossil away, the Taungs Baby did not circulate during the 1920s, instead remaining in South Africa, far from collections and other resources. In return, no British researchers made the journey to South Africa to visit the fossil, either during that decade or the next. Indeed, only Aleš Hrdlička paid Dart a visit from the United States in 1925.[288] Elliot Smith considered traveling to Johannesburg to evaluate the evidence and visit his former student but cancelled the trip.[289] While he claimed that he could not step away from his own responsibilities at University College London, it is worth noting that, a few years later, he traveled to China to see the Peking Man fossils—a journey he referred to as "my mission of ancestor worship."[290] Perhaps the London anatomists failed to visit because they could not have brought adequate comparative collections with them. Whatever the reason, they preferred to anxiously wait for the next best things to the fossil itself: replicas and a full monograph with all the measurements and details that had not fit into the two-page *Nature* announcement, the "big fine paper" Broom was confident could be accomplished in South Africa.[291]

This Year Has Been a Staggerer: Circulating Reproductions

---

287 Letter from Raymond Dart to Phillip Tobias, 26 December 1972, RDP.

288 Aleš Hrdlička, "The Taungs Ape," *American Journal of Physical Anthropology* 8, no. 4 (1925): 379-392.

289 Letter from Grafton Elliot Smith to Raymond Dart, 28 November 1928, RDP.

290 Letter from Grafton Elliot Smith to Arthur Woodword, 28 December 1930, Elliot Smith Papers, MS 56303, British Library.

291 Letter from Robert Broom to Raymond Dart, 3 June 1925, RDP.

In paleontology more broadly, beyond hominin paleontology, it is not uncommon for fossils to be too large, too fragile, or too protected to properly circulate. As historian Lukas Rieppel has discussed, paleontology has found itself awkwardly "embracing two epistemic ideals that effectively pulled in opposite directions," given that "knowledge claims were conventionally established via circulation," yet the "objects of paleontological knowledge—fossils—did not travel easily."[292] Due to fossils' fragile nature, replicas and reproductions have been crucial to the circulation of knowledge. Historians have shown the importance of developing reproductions that served as "proxies," which could circulate freely in place of the specimens. These reproductions range from illustrations to plaster casts.[293] In some cases, the reproductions were treated "much like an original fossil itself," viewed as "authoritative and trustworthy objects of knowledge."[294] However, the case of the Taungs Baby reminds us that creating quality "proxies" is a task that also requires resources.

Confronted with the reality that the Taungs Baby would not be leaving South Africa soon, scientists began inquiring about proxies. In the summer of 1925, Keith wrote to Dart inquiring about purchasing a cast of the Taungs Baby.[295] Dart responded with a series of excuses, telling Keith "I will certainly do what can be done" about getting casts made, "but this year has been a staggerer."[296] He explained that he was understaffed in

---

292 Lukas Rieppel, "Plaster Cast Publishing in Nineteenth-Century Paleontology," *History of Science* 53, no. 4 (2015): 482.

293 Martin Rudwick, "Georges Cuvier's Paper Museum of Fossil Bones," *Archives of Natural History* 27, no. 1 (2000): 51-68; Rieppel "Plaster Cast"; Chris Manias, "Robert Broom's Prehistoric Sketches: Conveying Objects through Illustration in the Early-twentieth Century," *Museum History Journal*, 10 no. 2 (2017): 162-82.

294 Rieppel "Plaster Cast," 456.

295 Letter from Arthur Keith to Raymond Dart, 13 May 1925.

296 Letter from Raymond Dart to Arthur Keith, 3 June 1925, Royal College of Surgeons Library, MS0018/1/4/2.

his department and weighed down by other university responsibilities. There was another reason why Dart struggled to send a cast, beyond the year being a "staggerer," but it was a reason he failed to explicitly mention to Keith.[297] Producing a cast in South Africa that was anatomically accurate and properly replicating the fossil's unique features without distorting them was quite difficult. In making casts of the fossil, Dart faced a similar hurdle to those he had encountered when initially studying and cleaning the fossil: resources. In London, companies specializing in cast making were at scientists' fingertips. In Johannesburg, however, there was no easy solution. Instead, Dart turned to a local artist to create a sculpture of the fossil that, although not entirely anatomically accurate, could at least communicate his ideas about his Southern man-ape's place in evolutionary history. This replica might not be accurate enough to send to Keith at the Hunterian for scientific study, but it would at least be sufficient for public display.

Thus, Dart had this artistic reconstruction prepared for the upcoming Wembley Empire Exhibition in London, which was to showcase "the diversity of cultures in the empire."[298] The exhibit, which Dart planned meticulously, included a replica of the skull, along with sculptures that illustrated Dart's imagination of what the Taungs Baby would have looked like, and diagrams specifying the place of *Australopithecus* in the human

---

297 Though, interestingly he seems to have mentioned it to Davidson Black, who responded in a letter "I hope you will be successful in arranging to have casts made. This certainly would be a very laborious undertaking if you had to do it yourself." Davidson Black to Raymond Dart, 3 March 1925, RDP.

298 Donald R. Knight and Alan D. Sabey, *The Lion Roars at Wembley: British Empire Exhibition 60th Anniversary 1924-1925* (London: Barnard & Westwood, 1984): 1.

family tree.[299] Dart's plan to exhibit this imperial treasure quickly went astray, however, weakening relationships between him and the London scientists in the process.

Figure 14: An artistic sculpture of the Taungs Baby, for the Wembley Empire Exhibition. Courtesy of the Dart Papers, University of Witwatersrand Archives

The Taungs Baby's display at the Wembley Exhibition infuriated Keith. "For some reason," Keith complained publicly, "which has not been made clear, students of fossil man have not been given an opportunity of purchasing these casts."[300] Given that Keith had asked Dart for casts, he could not understand why he must instead "visit Wembley and peer at them in a glass case."[301] To Keith, this move diverged from standard practice in a manner that was unacceptable. Not only had Dart refused to send the fossil to the scientific center, but he had failed to circulate a cast as well. The least Dart could have done, as Keith saw it, would have been to donate a cast to the Hunterian, properly placing a replica within the collections of the metropolitan center of accumulation.

299 Diagram sketch housed in RDP.
300 Arthur Keith, "The Taungs Skull," *Nature* 116 (July 1925): 11.
301 Keith, "The Taungs Skull" July, 11.

Keith attempted to maintain a cordial relationship with Dart at that time, writing that summer to please give his love to Mrs. Dart, "for if we quarrel about fossil apes we shall not quarrel over our wives."[302] By that autumn, however, relations had deteriorated and Keith had become increasingly critical of the fossil, beginning to argue that Dart's claim of the fossil's hominin status was "preposterous."[303] Though the cast was not enough to satisfy imperial tradition—it was apparently enough to make at least provisional, dismissive claims. Keith examined the replica through the glass case and determined that the position Dart assigned the Taungs fossil in the "tree of man…has no foundation in fact."[304] Dart, too, was becoming exasperated. He responded to Keith's claims by asserting his authority derived from the original fossil. Keith's evaluation was simply incorrect, Dart argued, and his analysis "illustrates how unsatisfactory the study of the replica can be in the absence of the original."[305]

The Material at Your Disposal

By the end of 1925, Dart withdrew from the public debate, ceasing to argue in the pages of *Nature* or, for the time being, to make any further replicas. Beyond the replica in a glass case at Wembley, no casts circulated for the remainder of the decade.[306] Instead, Dart turned to writing the detailed manuscript that he hoped would settle the dispute. Between finishing the difficult task of separating the jaws of the Taungs Baby and

302 Arthur Keith to Raymond Dart, 30 June 1925. RDP.
303 Arthur Keith, "The Taungs Skull," *Nature* 116 (September 1925): 462.
304 Arthur Keith, "The Taungs Skull" *Nature, 116* (September 1925): 462.
305 Raymond Dart, "The Taungs Skull" *Nature, 116* (September 1925): 462.
306 Though in the 1930s casts were made and circulated internationally, see Lydia V. Pyne, *Seven Skeletons: The Evolution of the World's Most Famous Human Fossils* (New York: Viking, 2016): 92-93.

writing up the manuscript, this task ultimately took several years. With each passing year, the idea that the Taungs Baby was a hominin continued to lose what little ground it had started with among the scientific community.[307]

Dart had left Broom alone to argue for the Taungs Baby's place in the human family tree. Though Broom continued to claim in scientific papers and in the press that the world owed much to South Africa—in part because "man himself" had evolved there—his voice was largely alone, coming from a still underdeveloped scientific outpost.[308] Broom recognized that he and Dart were losing ground, writing "I much regret that Prof. Dart has published nothing further in connection with this remarkable fossil form."[309] Meanwhile, those in the metropolitan centers mounted their counterattack.

Using what little information they had about the Taungs Baby, and their power derived from their collections in the center of accumulation, scientists in London all but extinguished claims of the Taungs fossil's place in human ancestry. Solly Zuckerman, for example, another student of Elliot Smith's, published an extensive study that looked more closely at comparisons between the Taungs Baby and chimpanzee juveniles.[310] Though Elliot Smith told Dart that he asked Zuckerman to undertake this study to provide Dart with the data he needed to prove his claims, Zuckerman's conclusions were damning.[311] Continuing in the vein of Keith, Zuckerman argued that many of the human like

---

307 This was the impression of Dart and Broom, at least, as discussed in Dart's unpublished manuscript "Australopithecus africanus: And his place in human origins," 1929, p 7, RDP; Robert Broom, "Note on the Milk Dentition of *Australopithecus*," *Journal of Zoology*, 99 no. 1 (1929), 85.

308 Robert Broom, "What the World Owes to South Africa," *Scientific American, 141* (1929): 119. An exception, however, is W.J. Sollas, "The Taungs Skull," *Nature* 115, no. 2902 (1925): 908-909.

309 Broom, "Note on the Milk Dentition," 85.

310 Solly Zuckerman, "Age-changes in the Chimpanzee, with Special Reference to Growth of Brain, Eruption of Teeth, and Estimation of Age; with a Note on the Taungs Ape," *Journal of Zoology, 98* no. 1 (1928): 1-4.

311 Letter from Grafton Elliot Smith to Raymond Dart, 25 February 1925, RDP.

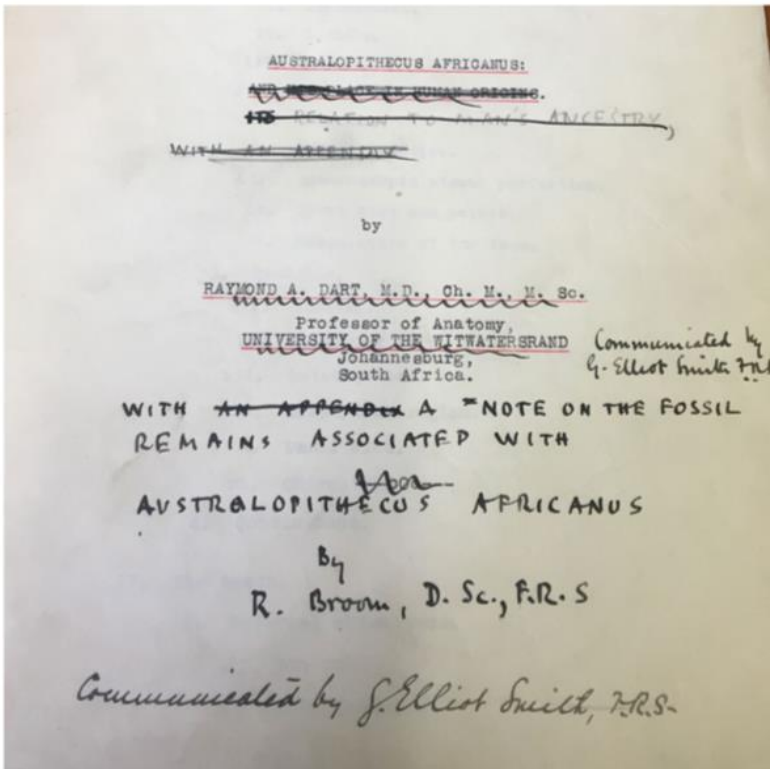
characters Dart had identified were actually infantile. The canine teeth, for example, "in no way differ from those of any of the young anthropoids."[312] By the end of the decade, Broom captured the scientific general scientific consensus when he wrote with exasperation, "the scientific world has apparently quietly dismissed any claims the Taungs Ape might have been near to the point of the origin of Man."[313]

At the end of the 1929, however, Dart finished the long-awaited manuscript, a two hundred page "magnum opus," as Elliot Smith called it, complete with over twenty photographs and countless measurements, detailing the reasons he believed his southern man-ape was a true human ancestor.[314] Dart believed he had triumphed, and that soon his fossil would be rightfully accepted as a human ancestor. "The science of anthropology was conceived, born and reared in an atmosphere of bitter controversy," Dart opened the manuscript by claiming, "from which it has not yet been able to free itself, time only can liberate it."[315]

While Dart's manuscript put forward an elaborately argued theory about the evolution of *Australopithecus*, the reality was that he had not addressed the single largest concern of the British researchers—Dart had still failed to directly compare the Taungs Baby against any collections. Dart admitted this early in the manuscript, lamenting "I have lacked the resources of large and varied museum collections."[316] However, he argued, he had made small steps towards better comparisons, stating that the problem

312 Zuckerman "Age-changes," 38.
313 Broom, "Note on the Milk Dentition," 85.
314 Letter from Elliot Smith to Raymond Dart, 8 April 1930, RDP.
315 Unpublished manuscript "*Australopithecus africanus*: And his Place in Human Origins," Raymond Dart 1929, 2, RDP.
316 Dart, "Australopithecus africanus, Unpublished," 4.

"has been remedied to some extent by the kindness of Mr. S. Zuckerman, who sent me numerous measured drawings…and various photographs" of juvenile chimpanzee and gorillas.[317]


AUSTRALOPITHECUS AFRICANUS:

by

RAYMOND A. DART, M.D., Ch. M., M. Sc.
Professor of Anatomy,
UNIVERSITY OF THE WITWATERSRAND
Johannesburg,
South Africa.

Communicated by G. Elliot Smith, F.R.S.

WITH A NOTE ON THE FOSSIL REMAINS ASSOCIATED WITH

AUSTRALOPITHECUS AFRICANUS

By
R. Broom, D. Sc., F.R.S.

Communicated by G. Elliot Smith, F.R.S.

Figure 15: The first page of Dart's unpublished manuscript on the Taungs Baby, a version annotated by G.E. Smith. Courtesy of the Dart Papers, University of Witwatersrand Archives

Dart soon learned that "numerous measured drawings and various photographs" were not enough to solve the problem of direct comparison. The manuscript, which he submitted to the Royal Society through his "chief" Elliot Smith, was rejected in the summer of 1930.[318] Despite the rejection, Elliot Smith hoped that the paper might eventually be accepted if it was vastly revised. He thus provided Dart with a list of suggestions, pointing primarily to the same complaint he had been making for years: "the critics repeatedly referred to the fact, which of course you are only too aware of

317 Dart, "Australopithecus africanus, Unpublished," 4.
318 Letter from the Royal Society to Grafton Elliot Smith, 4 July 1930, RDP.

yourself," he told Dart, "that the anthropoid material at your disposal was too small to justify adequate comparison with the Taungs material."[319] This methodological flaw continued to be the chief criticism in the analysis of the Taungs Baby.

Dart received the news of his paper's rejection during a critical moment in 1930. Elliot Smith told him about the rejection when Dart finally made the journey to London with his Taungs Baby. Disheartened, Dart did present his fossil at a scientific meeting in London for the first time, but it was too little, too late. It was not enough to simply show off the skull, and despite the time he spent in London, Dart did not visit the collections to make any comparisons.[320]

After returning to South Africa, Dart slipped into a depression.[321] He left the fossil behind in London temporarily, allowing casts to be made and finally circulated, but he largely stopped arguing that the Taungs Baby was a human ancestor. Defeated, Dart told a friend that now that "casts are available" and "the essential facts are known," the "remains can speak for themselves," adding that he regretted "having spent so much time" on the fossil.[322] The society had agreed to publish one single chapter from his magnum opus—the chapter on the dentition—pending a few edits, but Dart never made the edits or resubmitted the paper.[323] Instead, Dart published the single chapter in an

---

319 Letter Elliot Smith to Raymond Dart, 25 February 1931, RDP.

320 Davidson Black was also in London presenting the *Sinanthropus* fossils and these quite overshadowed Dart's find, discussed in Gundling, *First*.

321 Raymond Dart, *Adventures with the Missing Link*, (New York: Harper, 1959).

322 Raymond Dart to William King Gregory, 17 June 1930, William King Gregory Papers, American Museum of Natural History.

323 Letter from Grafton Elliot Smith to Raymond Dart, 25 February 1931, RDP.

obscure Japanese journal years later, before retreating from the study of *Australopithecus* for the next decade, turning instead to primatology and racial anthropology.[324]

While Dart and Broom had sought a more autonomous position for South African science, they were unable to overcome the deep methodological history of hominin paleontology: a history of circulation to such centers of accumulation, where knowledge claims could be made and supported. Additionally, Dart failed to create a proxy for his fossil that could be properly circulated for over five years after his discovery. As a result, his man-ape from South Africa was largely dismissed.

Discussion: Conditions the World Cannot Conceive

In 1972, almost half a century after the Taungs Baby first emerged from the cliffside, paleoanthropologist Phillip Tobias, a former student of Dart's, wrote to him with a special request. By this time, decades after Dart had removed himself from his research on the Taungs Baby, the tide had turned regarding the hominin status of *Australopithecus* and many of his initial claims had become widely accepted.[325] In 1947, Keith had even issued a retraction in *Nature*, admitting that "I am now convinced…Prof. Dart was right and I was wrong."[326] Given this turn of events, Tobias asked his mentor if he would be willing to finally publish the Taungs Baby manuscript, the piece he had worked so hard on in the 1920s.

---

[324] Raymond Dart, "The Dentition of *Australopithecus africanus*," *Folia Anatomica Japonica, 12* no. 4 (1934) 207-21; Goran Štrkalj and Phillip Tobias, "Raymond Dart as a Pioneering Primatologist," *HOMO Journal of Comparative Human Biology*, 59 no. 4 (2008), 271-86; Saul Dubow, "Human Origins, Race Typology and the Other Raymond Dart," *African Studies, 55* no. 1 (1996): 1-30.

[325] Gundling, *First*; Falk, *Fossil Chronicles*.

[326] Arthur Keith, "Australopithecinæ or Dartians," *Nature* 159, no. 4037 (1947): 377.

After receiving the rejection of his manuscript, Dart had hidden the document away, a time capsule from 1929, still splattered with the extensive handwritten edits from Elliot Smith's red and black pens. It would be great, Tobias told Dart, if the manuscript could finally see the light of day, as an important historical document from the scientist who was right all along.[327] Dart's response to Tobias' suggestion is revealing. He rejected the idea, opening his refusal by saying that "The world cannot conceive nor can we reconstruct verbally the conditions under which we lived, trained doctors and simultaneously conducted physical anthropological research in Johannesburg and the Witwatersrand of the 1925-29 period."[328]

Dart then tried to explain the practical challenges he had faced during that time, recounting the problems of resources and circulation to his student. Despite the fact that Tobias had been raised in South Africa, Dart felt that, as thirty years his junior, Tobias could not even begin to imagine the conditions of analysis and circulation. "Today of course a scientist can travel anywhere to see the originals before writing anything authoritative," Dart told Tobias, "but then it took three weeks to reach Cape Town and another two days to arrive in Johannesburg while letters took equally long to travel one-way."[329] The Taungs Baby was relatively isolated, he tried to explain, making it difficult to produce an accurate analysis of the fossil. He recalled his resistance to leave South Africa with the fossil, admitting that he had not wanted to give up the skull.[330]

---

327 Letter from Phillip Tobias to Raymond Dart, 1 December 1972, RDP.
328 Letter from Raymond Dart to Phillip Tobias, 26 December 1972.
329 Letter from Raymond Dart to Phillip Tobias, 26 December 1972.
330 Letter from Raymond Dart to Phillip Tobias, 26 December 1972.

The fact that Dart provided these reasons for not wanting to publish the manuscript—despite his recently vindicated position—illustrates just how strongly location and resources shaped his analysis. He may have been correct all along, but he had still not had the proper resources to circulate the fossil or study it correctly. In his refusal to publish his magnum opus, Dart was naming the same criticism scientists had cited in their rejection of the fossil almost fifty years earlier. The fossil's failure to circulate, and the conditions under which it was studied in South Africa, made the analysis too incomplete to see the light of day.

Thus, focusing on the practical challenges of studying the Taungs Baby has shed light on a new aspect of the fossil controversy. Previous histories of the Taungs fossil debate have primarily concentrated on the theoretical problems raised by the fossil, privileging the theories concerning brain evolution and location of human origins, while paying minimal attention to the practical aspects of conducting science.[331] Some scholarship has explained the divisive debates by accusing the British scientists of being overly "competitive [and] cliquish," driven by ego, and prone to "paleopolitics."[332] One historian even nicknamed the British anatomists the "paleointelligentsia."[333] These scientists have been accused of allowing their own "personal, emotionally charged connection" to the object as a potential human ancestor, which ultimately "inhibited their ability to dispassionately consider" the Taungs fossil as a human ancestor.[334] While these factors—theory, ego, or perceived authority—certainly played some role in the debates, I

331 Bowler, *Theories*; Falk, *Fossil Chronicles*; Pyne, *Seven Skeletons*.
332 Falk, *Fossil Chronicles*, 59.
333 Pyne, *Seven Skeletons*, 55
334 Richmond, *Experts*, 2.

have shown that the concerns of these "cliquish" scientists were grounded in deeply embedded historical practice of circulating a hominin fossil to a scientific center.

This perception of British arrogance has a long history; indeed, Broom and Dart both interpreted the Taung fossil's rejection to egotism. Broom later speculated that, while he "was never able to discover" Dart's offenses, he guessed that "the most serious was…he did not immediately send [the Taungs Baby] off to the British Museum."[335] Dart too felt he had been treated unfairly in a climate shaped by ego, so much so that when British anatomist W.E. Le Gros Clark wrote to him in the 1940s to tell him the consensus had shifted, he replied, "I am not any more greatly concerned today than I was over twenty years ago either in earning or maintaining so fickle a thing as a reputation amongst anatomists in Great Britain."[336] I have attempted to show, however, that reactions to the Taungs Baby were not solely driven by arrogance, but instead grounded in larger issues of established paleontological practice. To interpret the reaction of Keith and others as grounded in methodology rather than ego and "paleopolitics" might seem like a slight shift, but it is one that better illuminates the broader assumptions of proper scientific practice at that time.

This particular aspect of the methodology was not, of course, the sole concern in the Taungs fossil controversy, nor was it the sole determining factor in the specimen's dismissal of the 1920s. There were many competing factors that contributed to the debates, from the personalities of the researchers, to the discoveries of other fossils, the cultural ideas about race and Africa as the "black continent," and other practical concerns

335 Robert Broom, *Finding the Missing Link* (London: Watts, 1950): 27.
336 Letter Dart to W.E. Le Gros Clark ,10 March 1948, RDP.

about geologic age.[337] I argue, however, that the practice of comparison should not be overlooked, as it was a frequent, persistent feature of the discussions. Dart's failure to follow standard paleontological practice and circulate his fossil, I have shown, had severe effects on the reception of the Taungs Baby. Through this lens, we see that the practice was silently assumed by many researchers and built on imperial ideas about accumulation and knowledge creation.

Conclusion: Crafting Knowledge Through Networks

A view of the Taungs fossil from the perspective of the circulation of objects allows us to begin asking new questions about hominin paleontology's history. In the years since the small skull's emergence from the quarry, many hominin fossils have been discovered and aspects of the practice have changed as long-distance travel became easier and resources became slightly more broadly distribute. It is worthwhile, then, to examine other hominin fossil in this light, asking how the trajectories and receptions of the specimens differed, how these practices have shifted over time, and how they were shaped by individual factors of location, resources, and time period.[338]

The importance of collections and physical locations, while recognized in the history of paleontology, has not yet been explored in hominin paleontology. This essay is,

---

337 Examples of other factors include: a discussion of Dart's personality and perceived authority in Reader, *Missing*. A discussion of the possible distraction of Piltdown in Falk, *Fossil Chronicles*; Roger Lewin, *Bones of Contention: Controversies in the Search for Human Origins*, (Chicago: University of Chicago Press, 1997). A mention of the issue of the geologic age of the Taung fossil in Delisle, *Debating*. The impact of racial ideas has only begun to be explored, for example in Christa Kuljian, *Darwin's Hunch: Science, Race and the Search for Human Origins*, (South Africa: Jacana Media, 2016).

338 The Peking Man fossils (*Sinanthropus*), for example, are a good case to explore in future research, as the initial findings from 1927 were circulated, but the later findings from 1929 on remained in Peking, where a scientific center was constructed, see Reader, *Missing*, 216-18.

in part, an experiment in bringing human paleontology into conversation with histories of paleontology that frequently point out that paleontology is "a science is based on the ability to craft knowledge from…problems encountered during field work."[339] More than sciences like physics, which can replicate experiments in laboratories, paleontology is a science that involves rare, fragile objects that are located in particular locations—making the practices shaped by those locations a crucial aspect of the discipline.[340]

However, in comparing this particular hominin fossil's story to the histories of non-hominin specimens, interesting differences emerge. For example, multiple scholars have emphasized the importance of cooperative networks in a fossil's circulation and analysis.[341] These histories identify instances of collaboration and exchange, which allow scientists to communicate and construct knowledge even when faced with objects that were spread across distant locations and unable to circulate.[342] This is a far cry from the story of Dart, Keith, and others—where no such network existed. Perhaps, then, it is worth further exploring the breakdown of these international networks in hominin paleontology.

The Taungs Baby's story also complicates, as well as adds nuance to, understandings of the center and the periphery in the discussion of colonial science. Overturning the old idea that power and authority were always derived from a scientific center, both Jeremy Vetter and Savithri Nair have identified instances in which

---

339 Savithri Preetha Nair, "'Eyes and No Eyes': Siwalik Fossil Collecting and the Crafting of Indian Palaeontology (1830–1847)," *Science in Context* 18, no. 3 (2005): 360.

340 Jeremy Vetter, *Field Life: Science in the American West during the Railroad Era* (Pittsburgh: University of Pittsburgh Press, 2016).

341 Chris Manias, "Building *Baluchitherium* and *Indricotherium*: Imperial and International Networks in Early-Twentieth Century Paleontology," *Journal of the History of Biology* 48, no. 2 (2014): 237-78; Nair, "Eyes"; Podgorny, "Fossil Dealers."

342 Manias, "Jesuit Scientists."

peripheries triumphed due to their unique local knowledge.[343] This was not the case for Dart in the 1920s, however, no matter how often he tried to argue that this access to the site and the fossil made it so.[344] What makes other cases different from the Taungs Baby, then—and what can these different examples teach us about colonial and scientific relationships, the construction of networks, and ultimately scientific knowledge? Our understanding of global science and exchange must take into account the differing global dynamics, and in this case imperial imbalances of resources.

In the ninety years since the Taungs fossil was discovered, South Africa has constructed its own center of accumulation. The University of Witwatersrand now houses extensive collections of humans and other primates for comparison with hominin fossils, specimens that are kept in a vault alongside the Taungs Baby. Not every hominin fossil locale has built such a collection, however, and issues of circulation and access continue to be some of the biggest problems of the discipline. There is no formal, overarching rule about where hominin fossils should be located and whether or not they should circulate.[345] Even today, a fossil's location determines its proximity to resources, its analysis, and its significance.

Despite Dart's warning that "the world cannot conceive nor reconstruct" the scientific conditions at that time, in this article I have attempted to reconstruct just that, in order to reveal the challenges of studying a missing link that was discovered in a place that was "nothing but bare veld, lime quarries, and a few corrugated iron sheds, all things

343 Jeremy Vetter, "Cowboys, Scientists, and Fossils," *Isis* 99, no. 2 (2008): 273-303; Nair, "Eyes."
344 Dart, "The Taungs Skull," 462.
345 Though there is an informal rule that researchers should visit the fossils' country of origin to study them, see Phillip Tobias, "Into the Past: A Memoir," (2005) Johannesburg.

bleak and bare beneath a brazen sky." Embedded at the center of the deeply personal, social, and political controversies surrounding fossil human ancestors were practical scientific challenges involved in knowing and categorizing the fossil. This reconstruction paints the picture of a place that struggled for self-determination, but, at the time, was ultimately bleak in terms of resources and therefore methodology.

CHAPTER 5

FROM SOUTHERN APES TO ISLAND HOBBITS: 1930-2003

The Taungs skull discovered in the Buxton Limeworks in 1924 was another example of an unexpected scientific object that instigated debates and challenged existing notions of what it means to be human. Far from being the "definitive piece of evidence that joins us to the apes," as discoverer Raymond Dart had hoped, the fossil's interpretation was heavily debated and even dismissed by many researchers.[346] Like the Feldhofer Neanderthal, this particular skull, with its unique combination of features, was not the sort of fossil scientists anticipated. The object once again outstripped expectations and imaginations framed by contemporary ways of thinking. The Taungs controversy differed from the Neanderthal, however, in both its context, as well as the precise ways in which it challenged notions of humanness and ancestry.

As we saw, the Taungs fossil's unique combination of features did not meet expectations about what a missing link should look like, where it should be found, or how it should be studied. Many researchers' explicit complaints were focused on the latter of these three matters, tied to issues of scientific practice. They were especially concerned with the juvenile nature of the fossil and its antiquity. The limits and delineations of anatomical variation was once again at stake and of heightened importance, given the juvenile nature of the fossil. Proper comparisons with a range of primates of various ages was necessary, many anatomists argued, for Dart to make such big claims. Additionally, as with the Feldhofer Neanderthal, the fossil's accidental discovery resulted in its

346 "Taungs Man-ape: World Keenly Interested," *The Star*.

removal from its geological context before proper analysis could occur, meaning that ascertaining its age was mere guesswork—a big concern for many researchers.

The snapshot of the growing field of hominin paleontology obtained from the Taungs controversy paints a very different picture from that of the Feldhofer Neanderthal at the discipline's emergence, almost seventy years earlier. The field was increasingly professionalized, though many of its practitioners continued to specialize in different areas, for example human anatomy (Grafton Elliot Smith and Raymond Dart) or primate anatomy more broadly (Arthur Keith). Much like before, different specializations tended to place weight on different pieces of evidence, for example contending that the fossil's antiquity was a crucial aspect to its missing link status, rather than anatomy alone.[347] More overlap between these areas existed than before, however, as researchers had emerged who specialized in the intersection of the many issues at stake in the analysis of the fossil human past.

The glimpse of the social aspects that shaped the fossil's early analysis obtained from this perspective is also very different than that of the Neanderthal. Instead of cooperative networks of exchange across Europe, we see an increasingly global field that is grappling with questions of empire and national pride—a theme that is further explored in the conclusion.

Settling the *Australopithecus* Debate

[347] Hrdlička, for example, claimed that the deposits could be ignored; Hrdlička, "The Taungs Ape," 392.

When we left the Taungs fossil debate in 1930, Dart had become frustrated. His manuscript had been rejected by the Royal Society, and he felt that his specimen was all but ignored. Other excavations had turned scientists' gaze once again to the east. While Dart had been working on his big manuscript throughout the late 1920s, fossils began to accumulate from a site known at Chou K'ou Tien (later Zhoukoudian), China. The numerous primitive-looking specimens that emerged and began garnering significant attention, including teeth and numerous skullcaps, were named *Sinanthropus pekinensis* (also known as the Peking Man). Even Dart's mentor G.E. Smith, who had consistently made excuses to postpone a visit to Johannesburg, was so interested in the fossils that he traveled to China himself, writing to a friend in 1930 "I have just returned from my mission of ancestor worship in China. The material is much more wonderful than even I had realized before I went east."[348]

Through the *Sinanthropus* discoveries and others, the fossil record continued growing and it became an increasingly important and difficult task by the early 1930s to make sense of the various fossil discoveries in relation to one another. Taken together, what narrative could be drawn from the finds in Java, China, England, and South Africa? What did they imply about not only the place of human origins, but also the pattern of emergence of human-like features? In the vague image of the hominin past that was emerging, some fossils seemed to line up in a more cohesive narrative, while others did not. In this sense, *Australopithecus* and *Eoanthropus* (Piltdown) were at a disadvantage,

[348] Letter from Grafton Elliot Smith to Arthur Woodword, 28 December 1930, Elliot Smith Papers, MS 56303, British Library.

as *Sinanthropus* and *Pithecanthropus* closely agreed with each other. The fossils from England and Africa did not fit within this picture.

At the end of the last chapter we also saw that, more than a decade after Dart's 1930 rejection, a reversal occurred, causing his student to ask if his manuscript should be published. How did this reversal come about and what effect did it have on the field? Much of the credit falls on paleontologist Robert Broom, who dove into the debates just as Dart took a step back. A paleontologist, Broom seemed to recognize that more fossils—rather than close inspection of this one juvenile fossil's anatomy—were necessary. The situation was similar to the Feldhofer Neanderthal in that more evidence would help determine whether this was something worth paying attention to, although the pathological explanations from the Feldhofer story were here replaced by questions of morphological change during growth and development.

Developing partnerships with miners who had previously worked at Taungs, Broom began searching the underground caverns of Sterkfontein, hoping to find adult specimens that could confirm Dart's claims. Precisely one such fossil came into his possession in 1936, then again in 1938, leading him to repeatedly announce additional evidence that the South African fossil man-apes were valid.[349] A visit to South Africa by American paleontologist William King Gregory and Milo Hellman around that time also began to turn the tide on scientific opinion on *Australopithecus*. Their analysis of the dentition helped convince the majority of the scientific community and the combination

[349] Robert Broom, "New Fossil Anthropoid Skull from South Africa," *Nature* 138, no. 3490 (1936): 486-488; Robert Broom and G. W. H. Schepers, *The South African Fossil Ape-Men: the Australopithecinae* (Pretoria: Transvaal Museum, 1946).

of these new analyses and new discoveries effectively settling the issue of *Australopithecus'* hominin status by 1947.[350]

Figure 16: STS 5 fossil, discovered by Robert Broom. Image courtesy of Ditsong National Museum.

Continued Struggles in Understanding Humans

During the decades in which scientists debated the Taungs specimen—and indeed *Australopithecus* more broadly—the fossils again raised the issue of what it means to be human, though in a different manner than the Neanderthal. While the Feldhofer specimen challenged the concept of human by being appearing so similar to it, the Taungs specimen mounted a challenge to clarify accepted notions with its dissimilarity. With its

350 Gregory, William K., and Milo Hellman, "Evidence of the Australopithecine Man-apes on the Origin of Man," *Science* 88, no. 2296 (1938): 615-16; although Solly Zuckerman never accepted Australopiths, see: Jesse Richmond, "Discipline and Credibility in the Post-war Australopithecine Controversy: Le Gros Clark versus Zuckerman," *History and Philosophy of the Life Sciences* (2012): 43-78.

vaguely human characters and indications that the creature had the ability to walk upright, the Taungs fossil taunted scientists to define not only what a human ancestor was supposed to look like, but once they had found such an ancestor, should it be considered "human" or not? Upon accepting the *Australopithecus*, Keith immediately asked "are we, then, to regard these extinct races of South African beings as men or apes?"[351] The fossils "bring us face to face with a situation which Darwin had foreseen…how are we to distinguish ape from man?"[352]

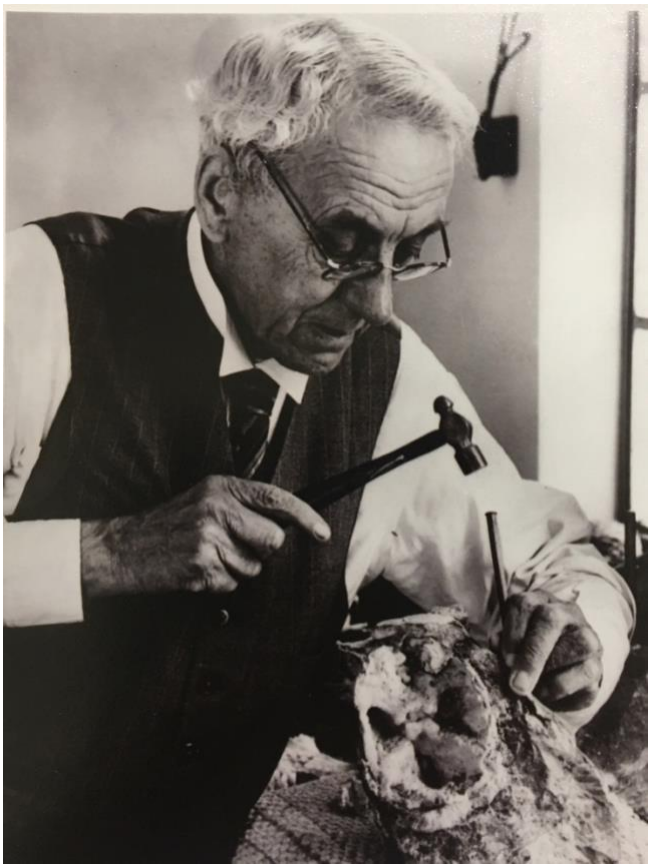


Figure 17 Robert Broom. Courtesy of Ditsong Natural History Museum

351 Arthur Keith, *A New Theory of Human Evolution* (London: Watts, 1948): 204.
352 Keith, *New Theory*, 204.

The question of where and how to draw boundaries had re-emerged; in a series of progressively human-looking ancestors, at what point in the evolutionary process should they be called humans? "As Darwin knew," Dart argued, "the time would come when the term 'Man' would have no real meaning, its use or otherwise would be of little importance."[353] Unbothered by the difficulty the Taungs fossil placed on boundaries through its blurring of the space between humans and other living primates, Dart claimed "*Australopithecus* exhibits the artificiality of separating man zoologically from the apes."[354] After all, that was precisely what a missing link was supposed to do, bridge the zoological and morphological gap. Keith agreed, writing that "it seems immaterial where we draw the line and whether we regard the Australopithecines as sub-human or human."[355] The important issue at hand instead, Broom argued, was that "the group, if not quite worthy of being called men, were nearly men, and were certainly closely allied to mankind, and not at all nearly related to the living anthropoids."[356]

353 Dart, "*Australopithecus africanus* Unpublished Manuscript," 232.
354 Dart, "*Australopithecus africanus* Unpublished Manuscript," 232.
355 Keith, New Theory, 204.
356 Keith, New Theory, 204.

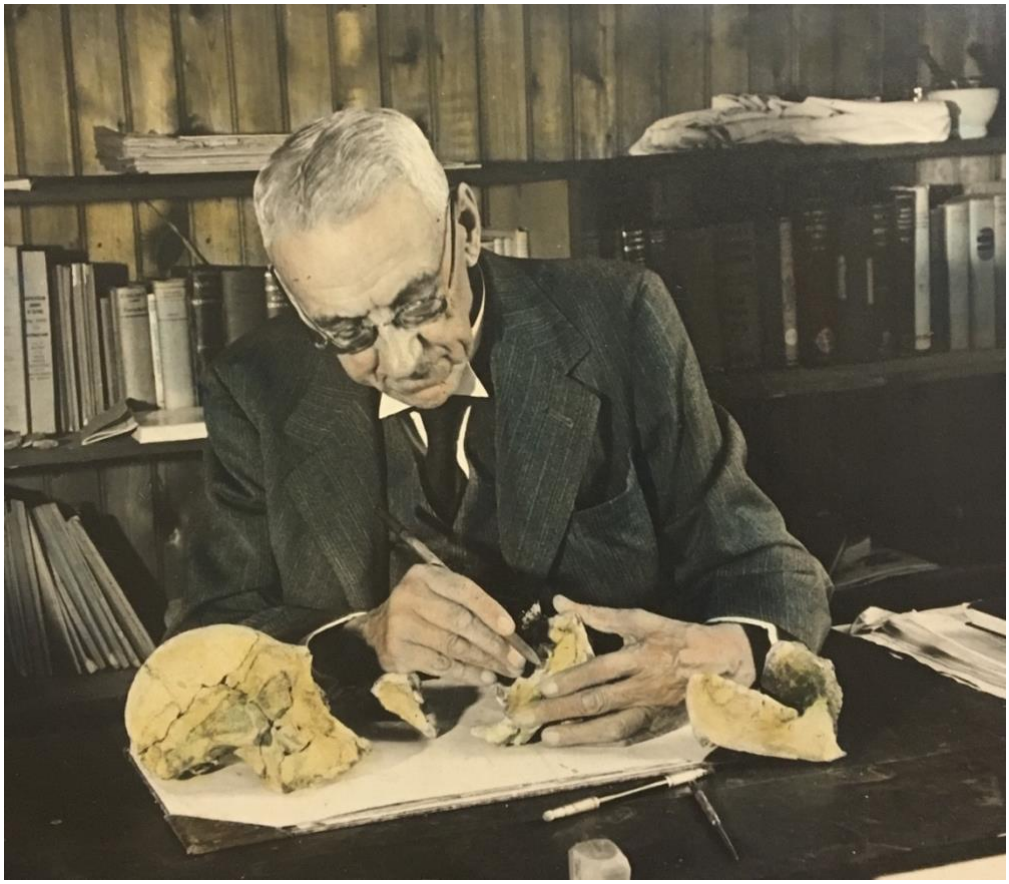


Figure 18 Robert Broom. Courtesy of Ditsong Natural History Museum

Not all researchers were as comfortable with this ambiguity as were Dart and Broom, however. Some sought to identify particular defining features of humans, envisioning them as boundary features, the "mark" of humans' emergence. Was that boundary marked by the adoption of erect posture? Or the occurrence of humanlike teeth?[357] Where, in the fossils' anatomy, was the first glimmer of "human" to be recognized? One researcher argued that "if missing links are to be traced with complete success, the foot, far more than the skull…will mark them as Monkey or Man," a

[357] Corbey, *Metaphysics*.

statement Dart considered "preposterous."[358] But more often, scientists pointed to the brain as the defining feature of humans, a position long held by Elliot Smith. Even before the discovery of the Taungs Baby, he stated that "it was not the adoption of the erect attitude that made Man from an Ape," he argued, "but the gradual perfecting of the brain."[359]

The most elaborate boundary attempt was Keith's creation of the "cerebral Rubicon." A measurement of overall brain size, Keith argued, was the boundary that marked "the end of apehood and the beginning of manhood."[360] He set the boundary as a brain volume of 750 cubic centimeters, halfway between the "highest gorilla (650 cc) and the lowest aborigine (855 cc)."[361] Any group that had an average brain size higher than 750 had crossed the Rubicon much like Julius Caesar did, passing the point of no return. These creatures "should no longer be regarded as anthropoid, but as human."[362] This concept helped Keith explain the humanlike features of *Australopithecus* without admitting them into his notion of "human," maintaining a boundary. *Pithecanthropus* had crossed the Rubicon but *Australopithecus* had fallen short, he claimed. The essential mark of man lies neither in his teeth, nor in his postural adaptations," Keith claimed, "but in his brain, the organ of his mentality."[363] The Rubicon was also adopted and slightly modified by other scientists, including Henri Victor Vallois, but it was Keith's number that persisted in scientific discourse.[364]

---

358 F. Wood Jones quoted in Dart, "*Australopithecus africanus* Unpublished Manuscript," 58.

359 Grafton Elliot Smith, *The Evolution of Man; Essays by G. Elliot Smith* (London: H. Milford, Oxford University Press, 1924): 39.

360 Keith, New Theory, 205.

361 Keith, New Theory, 206.

362 Keith, New Theory, 206.

363 Keith, New Theory, 205.

364 Phillip V. Tobias, *The Brain in Hominid Evolution* (New York: Columbia University Press, 1971).

Keith hypothesized that significant "changes in mentality" had occurred at the crossing of the Rubicon, namely changes of behavior including "mating, maternity, and social behavior."[365] Morality became codified at a brain size of 750cc, Keith claimed, and primates gained "control over inborn urges, impulses," and instincts.[366] That was the true mark of humans.

It is worth recognizing that many of the claims about these fossils did not hinge on the hominins being strictly ancestral to humans, but merely as *possible* ancestors, a set of primitive relatives located somewhere on the branch of hominin evolution. Dart claimed that "time will show whether or not [*Australopithecus*] were the actual Fathers of Men," but he drew from Dubois' earlier statement, "if *Pithecanthropus* is, so to speak, only our Grand-Uncle instead of our Grandfather, he is not the less an Ape-Man."[367] Overall, this discussion reveals that, even though *Australopithecus* was quite distinct from humans—much more so than Neanderthals—they further challenged and instigated clarification to the concept of "human" nonetheless.

Fossil Record and Theoretical Revolutions Through the 1950s

As *Australopithecus* came to be accepted as a human ancestor and Keith pondered his cerebral Rubicon, the discipline continued to develop at a rapid rate. In the 1950s, paleoanthropology expanded in terms of institutions and number of experts. As the developments, discoveries, and theories were so numerous, I will focus only on major themes here.

365 Keith, New Theory, 207.
366 Keith, New Theory, 207.
367 Dart, "*Australopithecus africanus* Unpublished Manuscript," 231.

Studies of human evolution were beginning to reveal it as a process "infinitely more complex than was suspected in Darwin's time."[368] Reflecting on the state of the science, Keith argued that "our older and discarded conception of man's transformation…depicted in that well-known diagram which showed a single file of skeletons," now appeared crude.[369] "In our original simplicity," he claimed "we expected, as we traced man backwards in time, that we should encounter a graded series of fossil forms—a series which would carry him in a straight line towards an anthropoid ancestor."[370] By the mid twentieth century, it was clear this was not the case. In contrast, "as we go backwards in time, we discover that mankind becomes broken up…into numerous and separated species," and further back still, different genera, Keith claimed.[371] Unraveling the human story, then, must involve following tracing the "meshes of a complicated network" and the "zigzag" of human descent rather than "links of a chain."[372] Given this complexity, he asked, "do you wonder why we sometimes falter and follow false clues?"[373]

And there were certainly false clues. While fossil discoveries continued to accumulate, it also became clear that some earlier finds could stand up to scrutiny. In North America, the tooth that was briefly celebrated as Nebraska Man," a possible

368 Arthur Keith, *Concerning Man's Origin: Being the Presidential Address Given at the Meeting of the British Association Held in Leeds on August 31, 1927, and Recent Essays on Darwinian Subjects* (London: Watts, 1928): 16.
369 Keith, *Concerning*, 16.
370 Keith, *Concerning*, 16.
371 Keith, *Concerning*, 16.
372 Keith, *Concerning*, 17.
373 Keith, *Concerning*, 18.

ancestor, "turned out to be simply the misinterpreted tooth of a pig.[374] More significantly, it was revealed in 1953 that the Piltdown fossils, *Eoanthropus*, had been a fraudulent amalgamation of a human cranium and ape jaw with its canine teeth filed down.[375] In addition to these false clues, however, there were plenty of new discoveries and developments.


STRANGEST STORIES

The skull that never was

...AND AN EMINENT HOAXER IS UNMASKED AT LAST

FOR a dying man, his voice was clear and strong.

The group around the tape recorder leaned forward with concentration.

They had gathered to hear the final unravelling of a mystery that had baffled the world of science for more than

In honour of his discovery, a solicitor and amateur palaeontologist called Charles Dawson, he was given the scientific name, Eoanthropus dawsoni—Dawson's Dawn Man.

As befitted the earliest truly human creature on earth, the dawn man was feted throughout the world.

His skull was reproduced in hundreds of museums, and studied by hordes of schoolchildren as the greatest anthropological find of the

Half man, half monkey, the Piltdown Skull designed

Figure 19: Piltdown newspaper, courtesy of NHM London Library.

In Asia, further finds from Java and China continued to add detail to the *Pithecanthropus* and *Sinanthropus* stories. Additionally, international attention shifted to East Africa in the late 1950s when Louis and Mary Leakey's search of the deposits in Olduvai Gorge in the Great Rift Valley began to yield fossils.[376] Neanderthal fossils also

374 Henry Fairfield Osborn, "Hesperopithecus, the Anthropoid Primate of Western Nebraska," *Nature* 110, no. 2756 (1922): 281-283; W. K. Gregory, "Hesperopithecus Apparently Not an Ape Nor a Man," *Science* 66, no. 1720 (1927): 579-81.

375 Joseph Sidney Weiner, Kenneth Page Oakley, and Wilfred E. Le Gros Clark, "The Solution of the Piltdown Problem," In *Bulletin of the British Museum (Natural History), Geology*. 2, no. 3 (1953): 139-46; Kenneth Oakley and Joseph Sidney Weiner, "Piltdown Man," *American Scientist* 43, no. 4 (1955): 573-83.

376 Virginia Morell, *Ancestral Passions: The Leakey Family and the Quest for Humankind's Beginnings* (New York: Simon & Schuster, 1996).

continued to accumulate rapidly and debates about them continued.[377] Overall, however, the controversies that arose during this time looked very different from the debates over the Feldhofer Neanderthal or the Taungs Baby. Disputes over a fossil's geologic age and position in the human family tree continued to be frequent, but rarely was there a group arguing for complete dismissal of a specimen. It was almost as if the general contours of the evolutionary story were beginning to emerge and new discoveries were not quite as shocking.

In addition to fossil discoveries, however, shifts in theoretical frameworks at this time altered the field tremendously.[378] In 1950, a conference at Cold Spring Harbor Laboratory, New York, examined the Evolutionary Synthesis and its implications for paleoanthropology. This event, one scientist later declared, made 1950 "the most momentous year in the history of paleoanthropology."[379] A major development from the conference was an idea derived not from a paleoanthropologist, but instead from biologist Ernst Mayr, who declared that the science of human origins had constructed so many new genera and species that the hominin fossil record had dissolved into "bewildering diversity of names."[380] Mayr, along with Theodosius Dobzhansky, claimed that the importance of morphological differences had been overestimated, that biological

---

377 Franz Weidenreich, "The 'Neanderthal Man' and The Ancestors Of '*Homo sapiens*,'" *American Anthropologist* 45, no. 1 (March 1943): 39-48; F. Clark Howell, "The Place of Neanderthal Man in Human Evolution," *American Journal of Physical Anthropology* 9, no. 4 (1951): 379-416; C. Loring Brace, "Refocusing on the Neanderthal Problem," *American Anthropologist* 64, no. 4 (1962): 729-41; Spencer, "The Neanderthals," 1-49.; Drell, "Neanderthals," 1-24.

378 Goodrum, "History of Human Origins Research," 327; Richard Delisle, "Human Palaeontology and the Evolutionary Synthesis During the Decade 1950–1960," in *Ape, Man, Apeman: Changing Views since 1600: Evaluative Proceedings of the Symposium, Leide, 28 June-1 July 1993* (Leiden: Dept. of Prehistory, Leiden University, 1995): 217-28.

379 Ian Tattersall, "Most Momentous Year in the History of Paleoanthropology," *Scientific American* June 12, 2015.

380 Ernt Mayr, "Taxonomic Categories in Fossil Hominids," *Cold Spring Harbor Symposia on Quantitative Biology* 15 (1950): 109.

variation had been underestimated and that "no more than a single hominin species existed at any one time"[381]

Some of the changes that resulted from this theoretical development, led by Mayr, were fairly straightforward, *Pithecanthropus* was collapsed into *Homo*, for example, and many of Robert Broom's many genus and species names dissolved in *Australopithecus*. The changes instigated by Mayr, Dobzhansky, and other participants in the Synthesis had far reaching effects on how scientists understood the fossil record, primarily in regard to the picture of diversity. Debates emerged between researchers who recognized species diversity and those who advocated a "single-species hypothesis," which argued that multiple species of culture-wielding hominins could not co-exist while overlapping in the same geographical area, given their ability to adapt to, and compete in, a wide range of ecological niches. Therefore, all hominin fossils should be interpreted as representing a single, evolving lineage, they suggested.[382]

Throughout these shifts, the issue of where evidence should come from, and where authority should lie, continued to reappear. For example, some paleoanthropologists who disagreed with Mayr and Dobzhansky's advocacy for a less speciose hominin phylogenetic tree later highlighted that they had made these claims despite the fact that they had "quite likely had never seen an original hominid fossil".[383]

---

381 Theodosius Dobzhansky, "On Species and Races of Living and Fossil Man," *American Journal of Physical Anthropology* 2, no. 3 (1944): 261.

382 Clifford J. Jolly, "The Seed-Eaters: A New Model of Hominid Differentiation Based on a Baboon Analogy," *Man* 5, no. 1 (1970): 5-26; Milford H. Wolpoff, "Competitive Exclusion Among Lower Pleistocene Hominids: The Single Species Hypothesis," *Man* 6, no. 4 (1971): 601-614.

383 Ian Tattersall, "Paleoanthropology: The Last Half-Century," *Evolutionary Anthropology: Issues, News, and Reviews* 9, no. 1 (2000): 3.

Into the Twenty-first Century

Other developments in the field, which was by this time known as paleoanthropology, helped shape understandings of human origins, particularly the introduction of a range of dating methods from radiocarbon to potassium-argon dating, the latter vastly expanding the timescale for human evolution.[384]

Though the discoveries in the latter half of the twentieth century were numerous and significant, one find is particularly relevant to this dissertation: the announcement of *Homo habilis* in 1964. Based on the discovery of a mandible, cranial fragments, and hand bones found near stone tools, a team led by Louis and Mary Leakey named the most primitive species of the human genus yet to be discovered. To include the fossils within *Homo*, the team claimed, "it becomes necessary to revise the diagnosis of this genus."[385] Referring to the cerebral Rubicon "variably set at 700 cc (Weidenreich), 750 cc (Keith) and 800 cc (Vallios)," the team proposed it be relaxed to 600cc in order to include their latest finds. In the midst of debates about hominin diversity, which revolved around human ancestors' ability to use culture to dominate numerous ecological niches, the team claimed that the relaxing of the Rubicon was warranted because *H. habilis* had been found alongside stone tools.

Continued exploration in the Rift Valley into the 1970s and 1980s began revealing vast hominin fossils, filling in the story of *Australopithecus* in increasing

---

384 Louis Leakey, Jack Evernden, and Garniss Curtis, "Age of Bed I, Olduvai Gorge, Tanganyika," *Nature* 191, no. 4787 (1961): 478-479; Emily Kern, "Archaeology Enters the 'Atomic Age': A Short History of Radiocarbon, 1946–1960," *The British Journal for the History of Science* (2020): 1-21.

385 Louis S. B. Leakey, Phillip V. Tobias, and John R. Napier, "A New Species of The Genus *Homo* from Olduvai Gorge," *Nature* 202, no. 4927 (1964): 7.

detail.[386] As the paleoanthropological focus increasingly narrowed to East Africa, the early evolution of hominins during the last few millions years began to become more clear, bringing increasing agreement about the overall human story.[387] An overall narrative of a human lineage that emerged from eastern Africa, adopted bipedal locomotion, and later developed large brains and stone-tool technology, dominated. Cladistic approaches also emerge to examine and establish phylogenetic relationships between hominin species, an important development in the discipline's methodology despite numerous difficulties.[388]

Plenty of disagreement continued to occur in various aspects of paleoanthropology, however, particularly in the 1980s on the topic of modern-human origins (*H. sapiens*). As the single-species hypothesis evolved into a multiregional hypothesis, an Out of Africa hypothesis emerged as an alternative. Multi-regionalism hypothesized that a single lineage of geographically diverse hominins had emerged in the last two million years, continuously interbreeding along the way, while Out of Africa emphasized the replacement of archaic populations by modern humans who migrated from Africa.[389]

---

386 Don Johanson, Tim White, and Yves Coppens, "A New Species of the Genus *Australopithecus* (Primates: Hominidae) from the Pliocene of East Africa," *Kirtlandia* 28 (1978): 1-14; Mary Leakey and Richard L. Hay. "Pliocene footprints in the Laetolil Beds at Laetoli, northern Tanzania." *Nature* 278, no. 5702 (1979): 317-323.

387 See for example William Kimbel and Lucas K. Delezene, "'Lucy" Redux: A Review of Research on *Australopithecus afarensis*," *American Journal of Physical Anthropology* 140, no. S49 (2009): 2-48.

388 Eric Delson, Niles Eldredge, and Ian Tattersall, "Reconstruction of Hominid Phylogeny: A Testable Framework Based on Cladistic Analysis," *Journal of Human Evolution* 6, no. 3 (1977): 263-278; Erik Trinkaus, "Cladistics and the Hominid Fossil Record," *American Journal of Physical Anthropology*, 83 (1990) 1-11.

389 Milford Wolpoff, Wu Xinzhi, and Alan Thorne, "Modern *Homo sapiens* Origins: A General Theory of Hominid Evolution Involving the Fossil Evidence from east Asia," in *The Origins of Modern Humans*, (Liss: New York, 1984): 411-83; Milford Wolpoff et al., "Modern Human Origins" *Science*. 241 no. 4867 (1988): 772-74; Chris Stringer; Peter Andrews, "Genetic and Fossil Evidence for the Origin of Modern Humans," *Science*. 239 (1988): 1263-68; Chris Stringer, "Replacement, Continuity and

By the end of the twentieth century, then, the outline of human origins was coming into focus. In the last few years of the century, older, more primitive fossils emerged from eastern and central Africa; some even became candidates for the last common ancestor between humans and chimpanzees.[390] Discoveries across multiple continents had proliferated. The time when "all fossil human remains hitherto discovered" could be described as fitting " within a museum cupboard of very limited dimensions" had become a distant memory[391] The rough outlines to some of the major questions that had plagued scientists at the beginning of the century, for example where the cradle was located, had begun to emerge. Controversy continued to swirl around new discoveries, geologic dating, and the diversity of the human family tree, but these controversies rarely mimic the magnitude of that of Feldhofer and Taungs, in that many sought to dismiss those specimens from the hominin story entirely.

In September of 2003, however, almost 80 years after the limestone blast in Taungs, and a century and a half since the shoveling of the Neanderthal out the mouth of the Feldhofer cave, an excavation tool struck a skull on an Indonesian island. In the chapter that follows, I offer the first major review of *Homo floresiensis* that uses primary sources and oral histories and is written by someone not directly involved in the controversy. As this chapter argues, the new discovery challenged understandings of what it means to be human in a different way, not from within as was the case in the

---

the Origin of *Homo sapiens*," in: *Continuity or Replacement? Controversies in Homo sapiens Evolution*. Fred Smith (ed). (Rotterdam: Balkema, 1992): 9-24.

390 Tim D. White, Gen Suwa, and Berhane Asfaw, "*Australopithecus ramidus*, a New Species of Early Hominid from Aramis, Ethiopia," *Nature* 371, no. 6495 (1994): 306-12; Pickford, Martin, and Brigitte Senut, "'Millennium Ancestor,' a 6-million-year-old Bipedal Hominid from Kenya." *South African Journal of Science* 97, no. 1 (2001): 22; Brunet et al., "A New Hominid from the Upper Miocene of Chad, Central Africa," *Nature* 418, no. 6894 (2002): 145-51.

391 Keith, "Pithecanthropus," 353.

Neanderthal story, nor from a distant position of potential ancestry as with Taungs, but instead from a side branch that disrupted a set of assumptions about evolutionary patterns and human uniqueness.

CHAPTER 6

FANTASTIC SPECIMEN: *HOMO FLORESIENSIS*

It was late in the afternoon on a Tuesday when, while digging through the soil of a cave floor, Benyamin Tarus' spade struck bone. Buried within the damp clay of an archaeological excavation pit, six meters below ground, Benyamin had uncovered a small, delicate skull.[392] The skull and corresponding partial skeleton unearthed along with it in September 2003, revealed an entirely unexpected, small, ancient creature that looked partially human but with a hint of enigmatic difference. Despite the location of the discovery—a relatively remote cave on an island in the Indian Ocean—news of Benyamin's swipe of a spade would soon travel around the globe and permeate controversial topics in the science of human evolution regarding humans' past and place in nature.[393]

The following year, the research team declared that this specimen, catalogued as LB1, represented a new species of extinct hominin. They named it *Homo floresiensis* after its discovery island of Flores, Indonesia, and asserted that its anatomy uniquely combined primitive hominin features, including tiny brain size and a large brow ridge, with more derived, human-like features including a small face.[394] LB1 exhibited a number of unexpected features, both in its anatomy and its context. First, it stood much

---

392 Benyamin Tarus (excavator), interview by the author, Liang Bua, April 2018; Thomas Sutikna (archeologist), interview by the author, Liang Bua, April 2018; Wahyu Saptomo (archaeologist), interview by the author, Jakarta, April 2017.

393. In an effort to reflect name-use in Indonesia, I am using first names for some Indonesian actors. Commonly, there is no family name; thus, for the sake of consistency and a more accurate reflection of how they call themselves, I tried to largely use first names, although I recognize this is inconsistent with how I use the names of actors from other countries.

394 Brown et al., "New Small-Bodied Hominin," 1055–61.

shorter in stature than modern humans, only just over a meter tall (earning it the nickname "the Hobbit" by the international team of archaeologists who made the find). Moreover, despite its tiny brain, it was found alongside stone tools and appeared to have lived very recently in the past—perhaps even surviving alongside modern humans in the region until about 12,000 years ago.[395]

To discover a small-brained, tool-wielding hominin with a unique set of primitive features that existed at a time when modern humans were thought to be alone on the planet was shocking and perplexing; the find potentially challenged many ideas at the core of the human evolutionary story. These declarations from the discovery team, then, were widely questioned and disputed by critics who argued that the find was something much less dramatic—perhaps the specimen was simply a diseased modern human, a small-brained "village idiot."[396] The Hobbit was thus fantastic—though in different senses of the word depending on the interpreter. For some scientists it was wonderful, the "most significant discovery concerning our own genus" in a lifetime; for others it was entirely fanciful, evidence that the science of human origins had "lost its way."[397] Depending on the interpretation, the specimen had the capacity to either challenge all the textbooks and rewrite part of the human evolution story or be entirely discarded. How could such divergent opinions exist?

---

395 This date was later revised (Sutikna et al. 2016). Moreover, the large feet later added to Hobbit narrative, see William Jungers et al., "The Foot of *Homo floresiensis*," *Nature* 459, no. 7243 (2009): 81-84; Michael Morwood et al., "Archaeology and Age of a New Hominin from Flores in Eastern Indonesia," *Nature* 431, no. 7012 (2004): 1087–91.

396 John Vidal, "Bones of Contention," *The Guardian*, January 12, 2005.

397 "Ancient Hobbit-Sized Human Species Discovered," *NBC News*, October 27, 2004; Vidal, "Bones."

As discussions about LB1 circulated through the pages of newspapers and scientific journals, the intellectual trials that international scientists faced in negotiating the bones within the hominin story were magnified by the practical challenges of studying the bones on the ground. The fragile physical specimen had to be transported, cleaned, preserved, and studied in a context of complex cross-cultural interactions. While the bones—and reproductions of them—circulated, the conflicts and debates in the local and global spheres were intertwined. The tension between the spheres grew as the bones' scientific status and significance became increasingly contentious and as the interactions between globalized science and society that created numerous misunderstandings and debates played out in the pages of scientific journals, meetings, laboratories, documentaries, and newspaper articles.

This chapter examines the controversy surrounding LB1 and asks: how did the bones inform two such drastically different interpretations? Addressing this question requires following the specimen as it emerged from the ground and moved into the heart of global debates about human evolution, with attention to both the local character of knowledge production and global paleoanthropological discussions.[398] This approach responds to calls for histories of science to connect the local and global networks to reveal the ways in which science links vastly distant parts of the world as well as calls for historians to engage complex negotiations and exchanges across cultures. By situating the scientific endeavor on the ground, while recognizing the multidimensional social and

[398] Secord, "Knowledge," 654–72; Fan, "Circulating," 209–36.

political contexts in which it is located, a clearer picture emerges regarding the role of day to day translations and transactions in knowledge production.[399]

Much of the existing scholarship on LB1 has been written by western scientists who were directly involved in the conflict and limited to English-language sources.[400] This chapter, in contrast, attempts to utilize primary sources recorded in the Indonesian language (Bahasa Indonesia), including unpublished field notes translated by the author and oral history interviews obtained directly at the field site. By incorporating a broader range of materials, this chapter begins to shed light on previously overlooked facets of Indonesian science and provides a new lens through which to view the debates, generating a more complex picture of knowledge production in a cross-cultural setting. By beginning to broaden the range of voices contributing to the story, this perspective seeks to reconfigure the historical narratives of science largely dominated by European actors and institutions.[401]

This perspective reveals the particular ways in which the debates were shaped by local factors that influenced how the debates became embedded within ongoing, larger controversies in the science of human origins. I argue that the controversy raised by the

---

399 Fan, "Science in Cultural Borderlands," 213–31; Lissa Roberts, "Situating Science in Global History: Local Exchanges and Networks of Circulation," *Itinerario* 33, no. 1 (2009): 9–30.

400. See, for example, scientists' coverage: Michael Morwood and Penny Van Oosterzee, *A New Human: The Startling Discovery and Strange Story of the Hobbits of Flores, Indonesia* (London: Routledge, 2009); Dean Falk, *The Fossil Chronicles: How Two Controversial Discoveries Changed Our View of Human Evolution* (Berkeley: University of California Press, 2011); Henry Gee, *The Accidental Species: Misunderstandings of Human Evolution* (Chicago: University of Chicago Press, 2013); Maciej Henneberg, Robert B. Eckhardt, and John Schofield, *The Hobbit Trap: Money, Fame, Science and the Discovery of a New Species* (Kent Town: Wakefield Press, 2008); and historical works including Lydia Pyne, *Seven Skeletons: The Evolution of the World's Most Famous Human Fossils* (NY, NY: Viking, 2016).

401 This work is still in progress and will be developed further. This reconfiguration has been determined as necessary by numerous scholars in recent years; see Sebestian Kroupa, Stephanie J. Mawson, and Dorit Brixius, "Science and Islands in Indo-Pacific Worlds," *The British Journal for the History of Science* 51, no. 4 (2018): 541–58.

bones was fueled by a unique mixture of intercultural exchange and long-standing questions of human uniqueness—both of which made the controversy raised by the bones particularly explosive.[402]

Beginning with the historical context of the place of discovery, I show how particular actors and ideas arrived at the archaeological site to make this discovery in 2003. I then trace the initial analyses of the specimen and its publication in 2004, before turning to the critical response that arose from that publication and the alternative explanations that began to form. Finally, I show how further analysis of the specimen gave way to a new theory just as the controversy reached a boiling point in 2007, after which a consensus began to form. The specimen, I show, rattled long-standing, scientific disputes concerning questions of human origins—and the debates around it became so heated in part because the answers lay at the heart of what it means to be human.

Part I: Background and Discovery

The site where Benyamin's spade struck bone was long known locally for its historical significance. A large limestone cave situated among the hills of western Flores, the site was frequently visited by Benyamin's community, the local people of this region of Flores, the Manggarai, who designated it Liang Bua, or "cool cave" in their language (Bahasa Manggarai). In 1950, the locals noticed archaeological objects near the surface and alerted a Dutch archaeologist of the site's potential.[403] Over the next four decades,

402 Matt Cartmill, "Human Uniqueness and Theoretical Content in Paleoanthropology," *International Journal of Primatology* 11, no. 3 (1990): 173–92.

403 Theodor Verhoeven, "Preliminary Overview of the Prehistoric Research of the Cave Liang Bua Near Téras, North-West of Ruteng, West-Flores, Nusa Tenggara Timur, Flores, Indonesia," Unpublished Report, 1972, Indonesian National Archaeological Research Center (hereafter ARKENAS); Rokus Due

excavations expanded in fits and starts from small test pits dug by the Dutch archeologist and priest Father Theodor Verhoeven to large-scale, organized excavations coordinated by the Indonesian National Archaeological Research Center (Pusat Penelitian Arkeologi Nasional).[404]

Awe, "Laporan Singkat Ekskavasi Liang Bua 1978," Unpublished Report, ARKENAS. This raises interesting questions about "bioprospecting;" see: Schiebinger, *Plants and Empire*; Vanessa Heggie, "Why isn't Exploration a Science?" *Isis* 105, no. 2 (2014): 318–34.

[404] Reports and summaries of these excavations include, but are not limited to, Due Awe, "Laporan Singkat 1978," 1–41; Tim Penelitian, "Laporan 1978 dan 1980," 1–46; Tim Penelitian Liang Bua, "Laporan Penelitian di Liang Bua Tahun 1981," Unpublished Report, ARKENAS, 1–19; Tim Penelitian Liang Bua, "Laporan Penelitian Arkeologi di Liang Bua, Tahun 1982," Unpublished Report, ARKENAS, 1–27; Tim Penelitian Liang Bua, "Laporan Peninjauan Situs Liang Bua Tahun 1983," Unpublished Report, ARKENAS, 1–10; Tim Penelitian Liang Bua, "Laporan Penelitian Arkeologi di Liang Bua Tahun 1985," Unpublished Report, ARKENAS, 1–30; Tim Penelitian Liang Bua, "Laporan Peninjauan Situasi Situs Liang Bua Kabupaten Manggarai, Nusa Tenggara Timur, Tahun 1986," Unpublished Report, ARKENAS, 1–18; Jatmiko, "Laporan Penelitian Arkeologi di Liang Bua Tahun 1989," Unpublished Report, ARKENAS, 1–34.

Figure 20 Manggarai men aiding with survey 1976, courtesy of the Liang Bua Team

The cave floor quickly revealed an abundance of artifacts, from pottery to animal bones and human burials. In the 1970s, a team of Indonesian archaeologists searched in one meter by one meter "sectors," extending the digs deep into the soft clay floor. The team, led by Professor Raden Pandji Soejono, director of the National Archaeological Research Center, and coordinated by Flores local Rokus Due Awe, continued digging

down in the deposits into the late 1980s, eventually reaching depths of multiple meters and necessitating the building of wooden shoring to keep the sector walls from collapsing.[405] They searched for an endpoint for the digging, whether that was bedrock at the bottom of the cave or an end of the archeological deposits—a "sterile" layer (lapisan steril) that would predate human arrival in the cave.[406] In 1989, however, without having discovered a bottom throughout the cave, the team moved on, allocating resources to the many other archaeological sites in the Indonesian archipelago. The decades of digging had revealed an unprecedented record of the human story, one that was more continuous and extensive than anywhere else in Indonesia.[407]

Figure 21 Liang Bua excavations 1986, courtesy of the Liang Bua Team

405 Tim Liang Bua, "Laporan Peninjauan 1986," 1–18.
406 See Tim Liang Bua, "Laporan Peninjauan 1986," 1–18; Jatmiko, "Laporan Penelitian," 1–34.
407 Jatmiko, "Laporan Penelitian," 1–34.

During this time, archaeological excavations elsewhere on Flores were raising big questions about the island's prehistory. At a site 50 km away, in the Soa Basin of central Flores, Father Verhoeven had uncovered stone tools alongside a species of the extinct elephant genus *Stegodon*. Based on the association with this extinct species, Verhoeven claimed that the tools were most likely 750,000 years old. He thus hypothesized that an earlier species of human ancestors or relatives had lived on Flores before modern humans arrived about 40,000 years ago.[408] Perhaps, Verhoeven reasoned, that species was *Homo erectus*, a more primitive ancestor known from the nearby island of Java. The idea that *H. erectus* could have crossed over from Java to Flores, which was largely dismissed at the time, was important because this scenario required *H. erectus* to cross a difficult water crossing. Crossing from Java to Flores involves navigating the Wallace Line, a deep water trench that separates the continental shelf from the oceanic islands of Wallacea—a formidable ecological boundary that many species, from birds to most primates, are unable to traverse.[409] Was it possible that species more primitive than modern humans could have navigated such an endeavor?

Shortly after excavations closed at Liang Bua in 1989, new research projects at Soa reignited interest in Flores' potential deep history. Researchers once again raised questions about the ancient stone tools as evidence of a *H. erectus* occupation of this remote island, particularly when an Australian archaeologist, Michael Morwood, used a

---

408 Johannes Maringer and Theodor Verhoeven, "Die Steinartefakte aus der Stegodon-Fossilschicht von Menge Ruda auf Flores, Indonesien," *Anthropos* 65 (1970): 530–46.

409 Jane R. Camerini, "Evolution, Biogeography, and Maps: An Early History of Wallace's Line," *Isis* 84, no. 4 (1993): 700–27.

new dating method to confirm dates of over 800,000 years for the stone tools.[410] These dates, Morwood claimed, validated Verhoeven's claims from decades prior. Although the bones of the tool makers had yet to be found, the team claimed that the tools meant *H. erectus* had "acquired the capacity to make water crossings," which suggested that "the cognitive capabilities of this species may be due for reappraisal."[411] These findings led Morwood to become increasingly interested in Flores. When he learned from his Soa colleague, archaeologist Jatmiko, that the digs at Liang Bua had not yet reached bedrock, he reached out to Soejono at the National Archaeological Research Center to instigate a new project at the site.

With the new chapter of Liang Bua research, Morwood and the team sought to dig the earlier pits deeper than Professor Soejono had—beyond any "sterile layer"—until they could be sure they hit bedrock.[412] To undertake the project, Morwood partnered with Soejono, who hired researchers with experience at the site, including Jatmiko as well as Rokus Due Awe, a Flores local who had helped with the direct digs there since the 1965 dig with Father Verhoeven. There was also continuity with the Manggarai excavators brought on to help uncover the thousands of pieces of pottery, dozens of stone tools, and multiple human burials that came out of the ground. Ande Mali, who had worked in the cave since the 1970s, was joined by his son, Benyamin Tarus, who transitioned from a child who had visited the cave in the 1980s to an excavator alongside his father.[413]

---

410 Michael Morwood et al., "Fission-Track Ages of Stone Tools and Fossils on the East Indonesian Island of Flores," *Nature* 392, no. 6672 (1998): 173–76.

411 Morwood, "Fission-Track," 176.

412 Tim Penelition, "Laporan 1978 dan 1980," 13.

413 Tarus, interview; Ande Mali (excavator), interview by the author, Teras, July 2019.

The expertise that Jatmiko, Soejono, and Soejono's previous assistant, archaeologist Thomas Sutikna, brought to the team aided not only in the cross-cultural translations that were now required between the increasingly international team but also in scientific practice. Field sciences comprise remarkably unique and individual sites and circumstances, and experience at Liang Bua was critical to success, as Morwood would quickly find.[414] Bringing his experience from rocky, open-air archaeological sites across Australia and central Flores, Morwood arrived at Liang Bua, with its very different, soft, damp cave deposits, in 2001 carrying entirely the wrong tools for the job. He brought with him a giant pickaxe, for example, which was far too destructive in the fine soil of the site, where much smaller tools were needed. This caused uproarious laughter among his Indonesian colleagues, who informed him about the site's context and stratigraphy before setting the pickaxe aside.[415]

As the team began taking Soejono's sectors to new depths, reaching 11 m below the surface, they revealed a whole new set of prehistoric discoveries. Far from hitting a sterile layer, they continued to find stone tools, but now the tools were associated with extinct animal bones such as that of *Stegodon*. Then, a small primate arm bone (radius) was unearthed in 2001 in one of the deepest sedimentary layers excavated thus far. Although the bone was unusual in its curvature and small size, the bone specialist, Rokus, hypothesized that it was hominin. Over the next year, Morwood and Sutikna toted it around Java in a plastic Tupperware container in Sutikna's knapsack, seeking opinions on

414 Robert E. Kohler and Jeremy Vetter, "The Field," in *A Companion to the History of Science* (Chichester, MA: Wiley Blackwell, 2016): 282–95.

415 Indeed, Sutikna still has the pickaxe for safekeeping and as a reminder of the comical affair; Sutikna, interview, April 2018.

this strange primate bone. Some researchers initially thought the radius might belong to an orangutan; others even speculated that it was that of a chimpanzee—a notion that was very strange, given that chimpanzees have only ever been found in Africa.[416]

The radius remained a mystery until that Tuesday in September 2003 when Benyamin uncovered a skull in a different section of the cave, a pit located against the east wall in sector VII. Digging at a depth of 5.9 m, the swipe that revealed the skull also took the fragile brow ridge clean off. After alerting Wahyu Saptomo, the archaeologist in charge of sector VII, and recruiting the help of Jatmiko, Benyamin switched to a small bamboo pick to carefully begin exposing the skull.[417] As the skull slowly came into view, so too did the fact that it was not an isolated find; the skull was surrounded by the bones of its skeleton.[418]

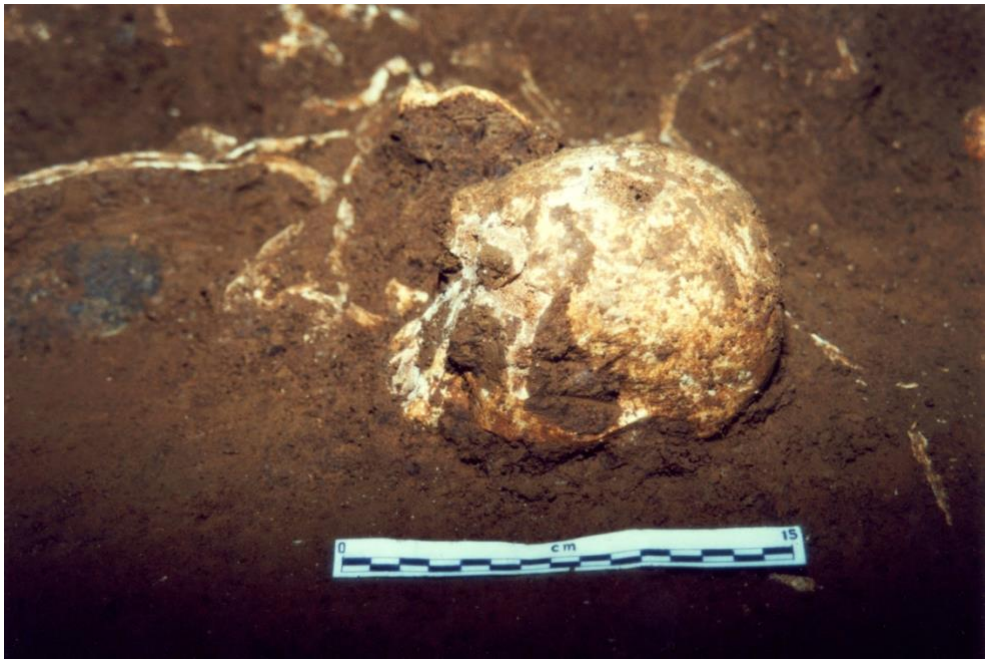


Figure 22: LB1 in situ, courtesy of the Liang Bua Team

416 Sutikna, interview, April 2018.
417 Tarus, interview.
418 Saptomo, interview.

At first glance it appeared to be relatively human, although a very small one—perhaps a child. However, after a few days of cleaning, careful preservation methods applied to the bone, and finally extraction from the ground, Soejono's previous assistant and lead archaeologist, Thomas Sutikna, noticed the distinctly non-human features such as the brow ridge. Once the team carefully removed LB1 from the ground and brought it to the hotel room that had been converted into a temporary laboratory, Rokus noticed that the wisdom teeth were erupted and worn. This could not be the skull of a young child. The team leaders, Sutikna, Jatmiko, and Saptomo, then carried the mysterious find first by boat to Bali and then by bus to Jakarta.[419]

Part II: Initial Analysis, September 2003–October 2004

As the specimen made its way to Jakarta, questions about its significance churned in the minds of the researchers in charge of the project. Sutikna had faxed a sketch of the discovery to Morwood and Soejono, who both wondered if it could be *H. erectus*, as Morwood had predicted elsewhere on Flores.[420] However, if so, why was the specimen so small? These questions of significance were complemented by a practical problem: who would decide? Until this point, Liang Bua had been an archaeological site that produced simply pottery, stone tools, animal bones, and modern human bones. The new specimen raised a problem: no one on the team was truly qualified to analyze this type of object. If the creature was truly a non-human relative like *H. erectus*, then a paleoanthropologist

419 Jatmiko (archaeologist), interview by the author, Liang Bua, April 2017.
420 Thomas Sutikna (archaeologist), interview by the author, Liang Bua, July 2019.

with expertise in fossil hominins was needed to properly compare the new specimen with other fossils.

Deciding who would be brought in to study the specimen was not a simple issue; instead, it was rooted in a deeply culturally and politically charged history in the archipelago. Indonesia had been ruled by the Dutch for more than three centuries before declaring independence in 1945; in the decades since, Indonesians had worked to craft an independent, self-sufficient nation.[421] Throughout the second half of the twentieth century, the drive for political independence was mirrored in the science as well, which had a strong nationalist tone and sought to promote and support local experts to overcome a history of foreign researchers holding the vast majority of scientific authority and ownership.[422] Soejono wanted to give LB1 to his long-time collaborator, paleoanthropologist Teuku Jacob, who had not only fought in the revolution with Soejono but also worked with him to build a postcolonial science of prehistory in Indonesia. In so doing, the two scientists had constructed a practice of sharing specimens between their two laboratories across Java that stretched back to the 1960s and was even in place during earlier Liang Bua excavations.[423]

---

421 Merle Calvin Ricklefs, *A History of Modern Indonesia since c. 1200* (Stanford: Stanford University Press, 2008); Adrian Vickers, *A History of Modern Indonesia* (Cambridge: Cambridge University Press, 2005).

422 Warwick Anderson and Hans Pols, "Scientific Patriotism: Medical Science and National Self-Fashioning in Southeast Asia," *Comparative Studies in Society and History* 54, no. 1 (2012): 93–113.

423 As early as 1964, Jacob and Soejono's papers are sprinkled with acknowledgments that detail the exchange, with Soejono "entrusting" specimens to Jacob for study; see Teuku Jacob, "A Human Mandible from Anjar urn field, Indonesia," *Journal of the National Medical Association* 56, no. 5 (1964): 436; D. J. Mulvaney and R. P. Soejono, "The Australian-Indonesian Archaeological Expedition to Sulawesi," *Asian Perspectives* 13 (1970): 163–77; Indriati, *Recent Advances*. Jatmiko even brought a skeleton from Liang Bua to Jacob's laboratory in Yogyakarta in 1989; Jatmiko, interview.

In contrast, Morwood wanted to invite a colleague from his own university, University of New England, Armidale, Australia. Citing a contract that he and Soejono previously signed called the "Agreement for Cooperation," Morwood reminded Soejono that the contract stated that any findings were not to be analyzed by anyone outside the two institutions (The University of New England and the Indonesian National Archaeological Center). In one of the nuanced challenges that can occur when collaborating across cultures, however, this agreement had very different implications for each of the two parties. Indonesia had developed a very different way of handling disciplines, separating archaeological centers from paleoanthropological laboratories into distinct institutions, unlike Australian universities that house them in the same institution (generally a university). Therefore, the agreement privileged Morwood in important ways. The agreement meant (whether deliberately or not) that no one from Indonesia could be brought in to study the bones, as the paleoanthropologists were housed at a different institution. Morwood thus won the argument and invited Peter Brown to Jakarta to analyze the specimen.

Figure 23 Research team: Jatmiko (standing, left), Wahyu Saptomo (standing, right), seated left to right Thomas Sutikna, Raden Pandji Soejono, Michael Morwood

Less than one month after Benyamin's discovery, Brown arrived in Jakarta to conduct the analysis. He was quickly surprised by what he saw, particularly the shape of the jaw. Then, later when he attempted to shove mustard seeds into the small braincase, he found that only a fraction of the amount of seeds he had snuck on the plane from Australia fit.[424] The skeleton was full of anomalies and contradictions, Brown soon realized; after 10 days of examining the skull, he turned to the outside world for assistance. He emailed a colleague from graduate school, Christopher Stringer of the Natural History Museum in London, asking him for help regarding some difficult issues

[424] Ewen Callaway, "The Discovery of *Homo floresiensis*: Tales of the Hobbit," *Nature* 514, (October 23, 2014), 422–26.

that the specimen raised. An accomplished paleoanthropologist, Stringer was also a potential contributor to the idea developing in Brown's mind. A leading proponent of the Out of Africa hypothesis, Stringer had long argued that modern humans evolved in Africa before migrating out and replacing relatives in other locations (rather than populations evolving regionally from earlier resident populations).[425] An idea that accepts species diversity and emphasizes replacement, this theory potentially fit a primitive hominin discovery on Flores rather well.

After prepping Stringer for the magnitude of this surprising specimen, Brown introduced the fossil as a small-brained (one-third the size of the average modern human) biped that stood only 1.3 m tall, found in an unexpected place. It was something that will rewrite a few textbooks Brown claimed.[426] In discussions that followed, Brown detailed the features that appeared to him to be similar to the genus *Australopithecus*—a group of small-brained bipedal species in Africa, living 4.0–1.5 million years ago. He contrasted these with characteristics that seemed more like those commonly recognized as *Homo*, such as face shape. After finding out that there were also associated stone tools that Brown would not have predicted such a small-brained creature could have been smart enough to make, Stringer commented, "wow- this is a fantastic specimen and I am still taking it in."[427]

One of the main problems Brown was struggling with at the time was the name: particularly the genus.[428] How to label a species that had some human-like features, but

425 Stringer and Andrews, "Genetic and Fossil Evidence," 1263–68.
426 Peter Brown (paleoanthropologist) interview, NOVA Documentary.
427 Chris Stringer, email to Peter Brown, October 15, 2003.
428 See Gee, *Accidental Species*.

those features were combined with a tiny brain and other primitive characteristics? Where to place it in humans' family tree? Questions of how to define *Homo* were not a new problem; just a few years earlier, a leading paleoanthropologist had declared it "remarkable that the taxonomy and phylogenetic relationships of the earliest known representatives of our own genus, *Homo*, remain obscure."[429] The genus had been long marked largely by brain size and associated tool use; no remains with a cranial capacity measuring under 600 (cc) had ever been included. At 380 cc, LB1 was nowhere near the generally accepted measurements, and Brown did not want to rewrite the genus.[430] In addition, overshadowing all of these strange features Brown explained, the remains were not very geologically old, to which Stringer excitedly replied, "weirder and weirder."[431]

A manuscript draft that fell on the desk of *Nature*'s paleontology editor, Henry Gee, in early 2005, introduced a strange creature with an even stranger name: *Sundanthropus florianus*.[432] Reviewers of the paper disagreed with Brown's proposed genus, arguing that the skull looked too much like *Homo* to be placed in a separate genus, regardless of brain size. The reviewers were also interested in the geographical proximity to *H. erectus* in Java. Whereas Brown maintained that there were significant differences between LB1 and *H. erectus*, the reviewers introduced an explanation for a close relationship but potential differences: dwarfism, particularly island dwarfism. Citing a previous hypothesis of an "island rule" for mammals on small islands, where specific ecological conditions such as "resource availability, reduced levels of interspecific

429 Bernard Wood, "Origin and Evolution of the Genus *Homo*," *Nature* 355, no. 6363 (1992): 783.
430 Gee, *Accidental Species*, 6.
431 Chris Stringer, email to Peter Brown, October 7, 2003.
432 Gee, *Accidental Species*, 6.

competition…, and absence of predators" sometimes lead to insular dwarfing for creatures to be more energy efficient, these scholars wondered if LB1 could have been a descendant of *H. erectus* that arrived on Flores, became isolated, and shrank in size.

Figure 24 LB1 skull, courtesy of the Liang Bua Team

By the end of the review process, Brown and the Jakarta research team had shifted the name to *H. floresiensis* (the species name altered after the realization that it translated to "flowery anus") and chosen the most likely explanation for its existence on Flores as "long-term isolation, with subsequent endemic dwarfing, of an ancestral *H. erectus* population."[433] Alongside the description of LB1, the team had crafted a second paper, on which Morwood was the lead author, describing the associated stone tools' and

433 Brown et al., "New Small-Bodied," 1055.

the specimen's estimated age range (38,000 years ago to 18,000 years ago), which overlapped "significantly in time" with *Homo sapiens* in the region.[434]

When the news of the island Hobbit broke, just 13 months after its discovery, the international excitement was palpable. A press conference held in London on October 27, 2004, revealed the fantastic discovery for the first time, with Stringer and Gee detailing the specimen's remarkable features.[435] The announcement then appeared in *Nature* and full media frenzy ensued. Brown spoke to hundreds of journalists, phones were continuously ringing, and plans for a documentary began unfolding to cover the strange human relative from Flores.[436] International debates also began to arise over *H. floresiensis* as researchers from all over the world started to weigh in.

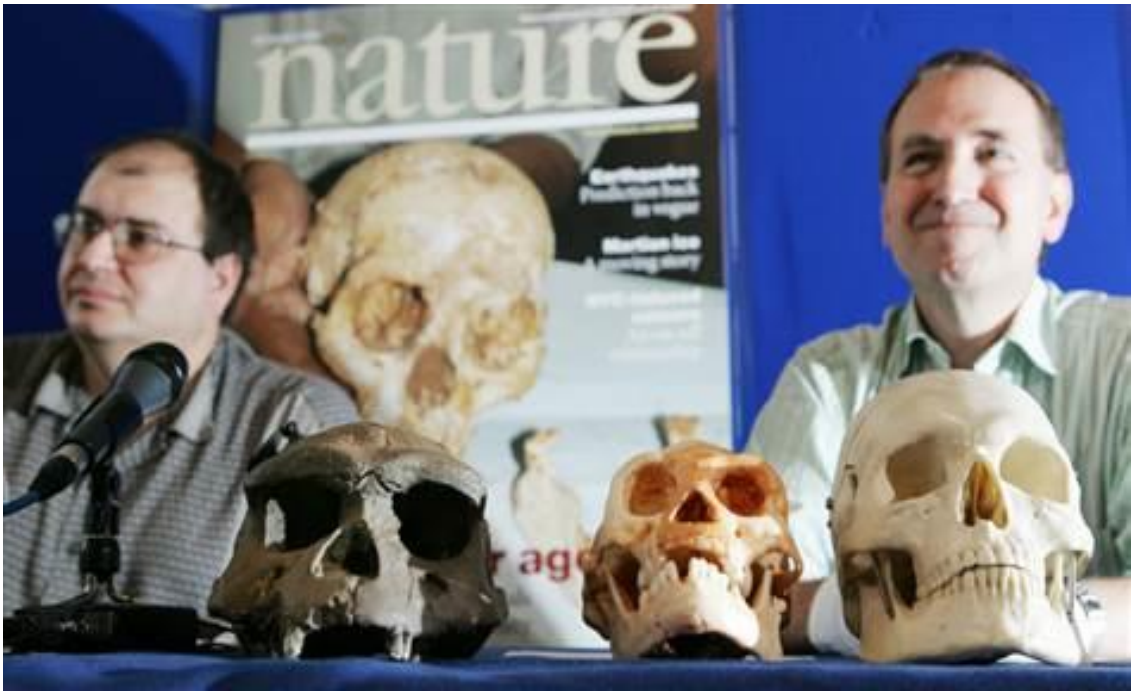


Figure 25 Press conference in London, Henry Gee left and Chris Stringer right

434 Morwood et al., "Archaeology and Age," 1087.
435 "Ancient Hobbit-Sized Human Species Discovered," *NBC News*, October 27, 2004.
436 Morwood and Van Oosterzee, *A New Human*; Falk, *Fossil Chronicles*, 60.

Some paleoanthropologists, such as Stringer, celebrated the find as a catalyst for rewriting the contemporary understandings of human evolution. "The implications of *Homo floresiensis* for understanding the scale of our ignorance are immense" and reveal "how much we still have to learn," the senior paleontology editor for *Nature*, Henry Gee, claimed.[437] For researchers such as Stringer and Morwood, the specimen represented a fantastic, excellent piece of evidence for a complex human past. As geologist and team member from the University of Wollongong, Australia, Richard Roberts, explained, there had previously been a "nice simple story" of recent hominin survival, in which Neanderthals went extinct and modern humans spread throughout the world: "It made nice sense. Everyone was happy with that. And then suddenly the Hobbit pops its head up."[438]

The Hobbit's interference to the "nice simply story" involved challenging multiple assumptions at the heart of questions about human origins. To accept that a small-brained hominin had reached an oceanic island, made tools, and survived into the recent past—while retaining multiple primitive features (e.g., *Australopithecus*-size brain, large brow ridges, and absence of chin)—was to rethink the role of cognition in tool use, exploration, and recent hominin evolution. In addition, accepting *H. floresiensis* as a new species of *Homo* meant accepting a rewrite of the human genus, and for some researchers, as will be seen below, it meant entirely rethinking the origin of our own species. Theoretical ideas were at stake, and cultural interactions around scientific

437 Gee, *Accidental Species*, 77.
438 Callaway, "The Discovery," 426.

practices were a growing concern on the ground. Soejono had been overruled and a foreign scholar had come into the country to study the specimen.

Constructing Alternatives, November–December 2004

A number of researchers were unconvinced that the discipline of paleoanthropology could find itself in such a state of ignorance, as Gee claimed, about the overall pattern and diversity of recent hominin evolution. When *H. floresiensis* was announced, alternative explanations suggesting that the specimen had been misinterpreted quickly began to arise. If, as researchers claimed, the decision came down to either discarding the skull or discarding "all previous theories of human evolution," a group of people found it more reasonable to discard the skull.[439] These researchers asked, "was the Flores find really a lasting and important scientific discovery, or just an accidental misinterpretation of no very great significance?"[440] For these researchers, the specimen's original interpretation was fantastic in that it was based entirely on a fantasy. Speaking to the press about alternative explanations for a small-brained, stone-tool–wielding creature on Flores, some wondered if this was simply a misinterpreted modern human, and two leading explanations for this human's odd features emerged.

As the news broke to excited reactions in London and Australia, the tone on the ground in Indonesia in late October was decidedly different. Plans for a press conference in the specimens' home country to occur simultaneously with the London event had failed to materialize, and much of the international interest revolved around the English-

439 Henneberg et al., *Hobbit Trap*, 53.
440 Henneberg et al., *Hobbit Trap*, 52.

speaking team members. Indonesia was a nation that had been ruled by the Dutch for over three centuries, and many Indonesian scientists felt the legacy of their colonial past reemerging.[441] Praise for the specimen that had been dug from Indonesian soil—discovered and extracted without the physical presence of a single foreign researcher—was centered on foreign scientists located in Australia and England. Contributing to the tone was the fact that Indonesia's leading paleoanthropologist, Professor Teuku Jacob, had not been involved.

Jacob quickly reacted, visiting the archaeological center just days after the announcement, packing up the skull, and taking it back across Java to his own laboratory for further analysis. International headlines swirling around the discovery quickly turned to Jacob's actions and declared a "tug of war" over the specimen.[442] Scientists outside Indonesia were shocked; Jacob's behavior was not "normal protocol," many argued.[443] The issue of "normal" protocol, however, looked different from different perspectives. Indeed, Jacob's actions were entirely normal from his own perspective. He had worked alongside Soejono for decades, the two of them in their complementary specialties, exchanging objects as needed. News reports consistently emphasized that he was not part of the discovery team—although again, neither had Brown been initially. The only thing distinguishing them was the agreement Morwood had drafted.[444]

Less than two weeks after the announcement appeared in *Nature*, Jacob held a press conference detailing his own interpretation of LB1. Seated behind the skull, he

---

441 Ricklefs, *A History*; Vickers, *A History*.
442 Anna Salleh, "Hobbit Skull in Tug of War," *ABC News*, November 25, 2004.
443 Salleh, "Hobbit Skull;" "Skulduggery: The Lady Vanishes," *The Economist*, December 9, 2004.
444 See footnote 423.

declared that the Jakarta research team had been wrong. "It is not a new species," he declared in no uncertain terms, "it was simply a small modern human, a pygmy."[445] During Verhoeven's early excavations in Flores, skeletons and skulls had long been turning up that appeared unusually small, Jacob pointed out: for example, at nearby sites Liang Toge and Liang Momer. Beginning in the 1950s and 1960s, Jacob and Verhoeven had recognized these small specimens as "pygmies" or "proto-negritos."[446] Small humans in Flores' prehistory were to be expected; in fact, in his dissertation research surveying Indonesian paleoanthropology 40 years earlier, Jacob had wondered, "are all the Mesolithic remains from Flores pygmies?"[447] Displeased that this previous research had been ignored, Jacob asked why LB1 had been compared with species such as *H. erectus* and *H. habilis* in Africa, "so far separated from it in time and space," instead of other findings on Flores.[448] "I presume," Jacob declared "the Liang Bua fossils are related to the Liang Toge skull, which was considered a proto-Negrito by Verhoeven."[449] Jacob's dismissal of the Jakarta research team's analysis—and indeed their dismissal of his earlier analyses from Flores—only increased the tensions between the researchers.

While Jacob argued his hypothesis of modern human pygmies at Liang Bua, another hypothesis was emerging that also sought to explain LB1 as a modern human. In

---

445 Vidal, "Bones."

446 Theodor Verhoeven, "Proto-Negrito in den Grotten auf flores," *Anthropos 1*, no. 2 (1958): 229–32; Teuku Jacob, "Some Problems Pertaining to the Racial History of the Indonesian Region," (PhD diss., University of Utrecht, 1967), 2. For more information on the discussion of race and pygmies in this region, see Chris Ballard, "Strange Alliance: Pygmies in the Colonial Imaginary," *World Archaeology* 38, no. 1 (2006): 133–51; Fenneke Sysling, "Geographies of Difference: Dutch Physical Anthropology in the Colonies and the Netherlands, Ca. 1900-1940," *BMGN - Low Countries Historical Review* 128, no. 1 (2013): 105–25; Fenneke Sysling, *Racial Science and Human Diversity in Colonial Indonesia* (Singapore: NUS Press, 2016); Jacob, "Some Problems."

447 Jacob, "Some Problems," 17.

448 Teuku Jacob, "Conflict from Flores: Storm in a Teacup," *Kompas*, December 15, 2004.

449 Jacob, "Conflict from Flores.".

the two weeks since the specimen had been announced, a number of researchers had spoken to the press, postulating possible pathologies; perhaps LB1 was simply a human that suffered from some sort of disease. The same day that Jacob held the press conference, two professors of anthropology and comparative anatomy in Australia, Maciej Henneberg and Alan Thorne, submitted a paper to *Nature* arguing that LB1 was a microcephalic modern human.[450] Microcephaly, which means "small-headedness" encompasses a group of diseases that causes stunted brain growth in humans, often associated with sub-normal body size. Microcephaly was a more "logical" and simple way to explain the creature's features, they claimed, in comparison with an "elaborate explanation of a new species."[451] This pathology could account for LB1's "inconsistencies," such as the brain size being "equal to the smallest of any human ancestor found anywhere in the world," and teeth being "of the same size and characteristics as modern humans."[452] The paper was rejected hours later.

Henneberg and Thorne held a very different view of human evolution from that of Brown, one that had different implications for both the pattern of evolution and the definition of modern humans. Thorne, alongside anthropologist Milford Wolpoff, was the architect of the Multiregional hypothesis.[453] This idea suggests that, instead of modern humans migrating out of Africa to replace resident species across the Old World, the human species arose around two million years ago and has since been interbreeding within a single, globally distributed, temporally continuous human species. For the

450 Henneberg et al., *Hobbit Trap*, 36.
451 Henneberg et al., *Hobbit Trap*, 36.
452 Henneberg et al., *Hobbit Trap*, 29.
453 Wolpoff et al., "Modern *Homo sapiens*," 411–83.

reasons Stringer was predisposed to accepting an extinct hominin species on Flores, multiregional researchers such as Thorne were predisposed to reject it. LB1 had to be pathological to maintain this theoretical view of modern human origins.

Although, at first glance, the Multiregional and Out of Africa hypotheses set out to explain how, when, and where modern humans originated, they differed in how they defined and understood the concept of "modern humans." Rather than viewing modern humans as the descendants of a distinct group that arose in the last 200,000 years in Africa and then migrated across the globe, multiregionalists conceptualize modern humans as a single, geographically variable species characterized by continuous genetic exchange.[454] Brown's interpretation of LB1 challenged this view by attempting to accommodate the small-brained hominin within the modern human species.

Following the rejection of their manuscript by *Nature*, Henneberg and Thorne turned to an obscure journal titled *Before Farming,* where the first pathological explanation paper appeared in December 2004, titled "Flores Human May be Pathological *Homo sapiens*." The paper claimed that Brown's claims effectively debased the "palaeonuerological picture drawn from the last 50 years of research with human fossil remains."[455] Therefore, the more parsimonious explanation of LB1's existence on Flores alongside stone tools was that it was a microcephalic modern human. Responding to the *Before Farming* paper, Brown told the press that Henneberg and Thorne's

454 Wolpoff et al., 411–83.

455 Maciej Henneberg and Alan Thorne, "Flores Human may be Pathological *Homo sapiens*," *Before Farming* 4 (2004): 3.

unsubstantiated claims amounted to nothing more than mere "scratchings on a toilet wall."[456]

Jacob, Henneberg, and Thorne were not the only researchers to raise objections. Other researchers sought to rethink the specimen's validity as well, including Robert Martin, a paleoanthropologist at the Field Museum, Chicago, who began wondering about the effects of dwarfing on the primate brain—ultimately landing on the hypothesis of microcephaly. Others raised smaller but still serious questions about the designation of LB1 within the genus *Homo* and the geological age, and many researchers agreed that more specimens were needed before definitive explanations could be proposed.[457]

Alliances Form, 2005

In early 2005, Thorne, Henneberg, and American paleoanthropologist Robert Eckhardt began to align themselves with Jacob. Despite their different explanations of LB1 as either a pygmy or a diseased modern human, these researchers did agree that LB1 was not a new, nonhuman species. In February, while Jacob delayed his promised return date of LB1 to Jakarta (therefore escalating the tensions between himself and the Jakarta research team), Thorne, Eckhardt, and Henneberg visited Jacob's laboratory in central Java to examine LB1. They took measurements and conducted analyses to use in a paper.[458]

---

456 Henneberg et al., *Hobbit Trap*, 51.

457 See Leslie Aiello, "Five Years of *Homo floresiensis*," *American Journal of Physical Anthropology* 142, no. 2 (2010): 167–79.

458 Henneberg et al., *Hobbit Trap*, 45.

Meanwhile, the Jakarta research team moved forward with their analyses as they anxiously awaited the return of the specimens that they considered stolen by Jacob. Jacob had a reputation for "hoarding" hominin fossils, and the Jakarta team was worried the bones would never be examined by other researchers again—a big concern both for confirming their findings and because they had not finished analyzing all the specimens now in Jacob's possession.[459] As is often the case in paleoanthropology, new evidence could potentially eliminate at least one side of a debate about a new species. If additional individuals having the same unusual characteristics as LB1 were discovered, the explanation of pathology would become increasingly implausible. The team had found such evidence in the form of a new jaw while excavating during the year Brown was finalizing the paper. Although this new specimen, catalogued as LB6, could potentially bolster the team's initial claims, it had not yet been studied and it was one of the specimens now with Jacob.

Regardless, the team moved ahead with the analyses of other fragments discovered in that 2004 field season, along with the scans of the braincase that had been collected from LB1 before Jacob took possession of it. Morwood invited paleoanthropologist Dean Falk to use these scans to conduct an analysis of the brain endocast, created from the impression left on the inside of the skull. Falk published her research on LB1's brain in *Science* in March 2005, claiming that the endocast constructed from the braincase did not resemble modern humans or microcephalics but instead

459 Jeffrey D. Mervis, "Keeper of the Keys to Fossil Kingdom," *Science* 279, no. 5356 (1998): 1477.

appeared like that of *H. erectus*.[460] The following day, news broke that the specimens had been returned to Jakarta broken.[461]

LB1's pelvis had been shattered into "100 crumbs," as Brown put it, and the new, unpublished jaw (LB6) had been broken clean in half and then glued back together at an anatomically incorrect angle.[462] Whereas Jacob publicly insisted that the bones had been in good condition when they left his lab and therefore must have been damaged in transit, this claim quickly appeared to be at odds with the objects themselves. The presence of glue and molding clay on the bones' surfaces provided evidence of attempts to fix some of the breakage of the delicate bones.[463]

The damage to the bones shocked the international scientific community, and researchers continued debating the significance of LB1 both in the media and in scientific journals. The damage to a type of specimen such as this, an American scientist claimed, is the equivalent of "slashing the Mona Lisa and then trying to fix it with chewing gum."[464] "It's an outrage," added Peter Brown. The event escalated the already tense relations between the Jakarta research team and Jacob, and the controversy on the ground in Indonesia reached a boiling point. Security around the bones tightened, and the excavations were called off for the immediate future in an effort to allow for a cooling off period for the conflict to diffuse.[465]

---

460 Dean Falk et al., "The Brain of LB1, *Homo floresiensis*," *Science* 308, no. 5719 (2005): 242–5.

461 Dan Vergano, "Fresh Scandal Over Old Bones," *USA Today*, March 21, 2005.

462 Rex Dalton, "More Evidence for Hobbit Unearthed as Diggers are Refused Access to Cave," *Nature* 437 (October 13, 2005), 934–5.

463 Lorraine Cornish (curator), interview by the author, Natural History Museum London, July 2018.

464 Vergano, "Fresh Scandal."

465 Indonesian (specifically Javanese) culture generally tends to avoid direct conflict and controversy, so pausing the research appeared to be a good strategy to wait for tensions between the Jakarta team and Jacob (which were playing out in the press) to simmer, but this is not how it was interpreted; see Dalton, "More Evidence," 934.

Analyses continued, nonetheless. Henneberg and Thorne's team submitted manuscripts to *Nature* and, later, *Science*, which were both rejected owing to the lack of sufficient evidence, while Jacob set off for Flores to conduct a study of living populations there.[466] In April of 2005, Jacob and a team of Indonesian researchers visited the Manggarai villages located near Liang Bua. Their goal was to study the people of the Rampasasa village and measure features such as height and cranial shape to see how much they differed from LB1 and other specimens such as that of Liang Toge. As his team prepared a paper on their findings, Jacob publicly announced that "the pygmy people of Flores are not a prehistoric race. Our team has successfully found a community of pygmies living in the modern world."[467] For Jacob, this discovery of a "community" of living pygmies justified what he had claimed all along, that pygmies had long existed on Flores and therefore LB1 was nothing new. In a similar manner, this helped Thorne, Henneberg, and Eckhardt place LB1 closer to the known range of variation for modern humans.

A Major Transformation, 2005–2006

Meanwhile, research continued in both Flores and Jakarta. In 2005, Brown utilized photographs and (computed tomography) CT scans of the unpublished jaw (LB6) that Sutikna had taken before the specimen was broken to begin a salvaged examination of it.[468] Beyond the craniodental remains, the team began to turn toward other pieces of LB1, which had not yet been fully analyzed. In addition, in October of that year, the team

466 Henneberg et al., *Hobbit Trap*, 88.
467 Teuku Jacob (paleoanthropologist), "Alien from Earth," interview by NOVA.
468 Sutikna, interview, July 2019.

announced further discoveries of *H. floresiensis* individuals, hoping to establish that LB1 was not a singular, aberrant individual.[469]

Debates continued to churn internationally, with archaeologist Robin Dennell suggesting, "we may be on the threshold of a major transformation in our understanding of human evolution that will have profound and far-reaching implications," and others continuing to dismiss the fossils.[470] On the ground, Morwood began reaching out for additional assistance both to further understand the specimens and to help fix the damage to the specimens. Morwood turned to anatomist Susan Larson from Stony Brook University, who specialized in the anatomy of the arm and shoulder. Larson then invited her colleague Bill Jungers, an expert of the lower limbs and hominin bipedal locomotion, and together they set off to Jakarta to analyze the specimen in early 2006.

Jungers brought with him a cast of the specimen known as Lucy (*Australopithecus afarensis*), for comparison with LB1.[471] When he began making comparisons, he was struck by a number of similarities. For example, when he compared the pelvises of both creatures, the reconstructed sacrum (the bone at the base of the spine) of Lucy fit almost perfectly with the ilium (hip bone) of LB1. This formed the basis of a new hypothesis to explain the evolutionary history of *H. floresiensis*: perhaps it was more likely that the creature's ancestry stretched much deeper in time than *H. erectus*, a hypothesis that had been considered by Brown but was only just beginning to be explored. However, first, the broken pieces of the bones needed to be put back together in

469 Michael Morwood et al., "Further Evidence for Small-Bodied Hominins from the Late Pleistocene of Flores, Indonesia," *Nature* 437, no. 7061 (2005): 1012.
470 Dennell and Roebroeks, "An Asian Perspective," 1099–104.
471 Johanson et al., "A New Species," 1–14.

the right way—and the bones needed to be strengthened to be further studied and handled.

Lorraine Cornish was tasked with refitting the "100 crumbs" of the pelvis and repairing the other broken elements. Invited by Jungers, Cornish traveled to Jakarta in the summer of 2006 to help conserve the specimen. As the head of conservation at the Natural History Museum in London, Cornish had extensive experience with fossils, and she thus embarked on a whirlwind five-day trip to the research center in Jakarta to help fix what had been broken.[472]

Figure 26 Lorainne Cornish in Jakarta with LB1, courtesy of Lorraine Cornish

472 Cornish, interview.

That same summer, Jacob, Eckhardt, Thorne, Henneberg, and their team published the first major, peer-reviewed paper arguing that the Hobbit was a modern human, not a new species.[473] The work was a blend of Jacob's stance on Flores pygmies on one hand and Henneberg and Thorne's theories of pathology on the other. Using data from the study of living Manggarai people at Rampasasa, the paper first argued that the features of LB1 are not strange enough to warrant the identification of LB1 as representing a new species but that it fit within the range of variations in modern humans, even "encountered routinely among Australomelanesians" in the area.[474] The paper argued that *H. floresiensis* was not unique. Rather than exhibiting "a mosaic of primitive, unique and derived features not recorded for any other hominin," as Brown and the team had claimed, LB1 "exhibits a combination of characters that are not primitive but instead regional, not unique but found in other modern human populations, particularly some still living on Flores, and not derived but strikingly disordered developmentally."[475]

Debates Continue

The analyses continued as researchers began to circulate information and evidence. For example, Cornish traveled to the United States in 2006 to give a talk at the Smithsonian National Museum of Natural History, bringing with her casts of the only bones that were sufficiently small to conveniently carry from Jakarta by air: the wrist bones. In the audience was Smithsonian research fellow and Arizona State University

473 Teuku Jacob et al., "Pygmoid Australomelanesian Homo sapiens skeletal remains from Liang Bua, Flores: population affinities and pathological abnormalities," *Proceedings of the National Academy of Sciences* 103, no. 36 (2006): 13421–6.
474 Jacob et al., "Pygmoid," 13421.
475 Jacob et al., "Pygmoid," 13421.

PhD student Matthew Tocheri, an emerging expert on the evolution of the wrist in primates. Seeing the casts, Tocheri immediately recognized bones retaining "wrist morphology that is primitive for the African ape-human clade" and clearly unlike more derived modern human wrist bones.[476] Tocheri then teamed up with Jungers and began a formal analysis of the wrist bones.

Jungers was simultaneously continuing to amass evidence for a potentially close relationship between LB1 and ancestors more distant and primitive than Asian *H. erectus*. Pointing to different aspects of the skeleton, from the shoulder to the legs and the feet, Jungers and his colleagues began to reveal resemblances to earlier African species that lived millions of years ago, including *Australopithecus* and the earliest species of our own genus, *Homo habilis*. Although the "habaline" connection had been mentioned by Brown in 2004 and was increasingly favored by the team in 2005, shifting it to the primary hypothesis for the ancestry of *H. floresiensis* required a major shift in the paleoanthropological perspective. It suggested that hominins had left Africa far earlier—or in a far more primitive form, at least—than scientists had expected and that a population of an African lineage with an *Australopithecus*-size brain could have traveled across the globe without having left a trace in the fossil record. Whereas this idea raised new questions, it also potentially solved old ones. If this was the case, then the Hobbit's size was not much of an issue; its ancestors were already small in body and brain. Maybe the Hobbit had never shrunk to a small size on Flores after all.

476 Matthew Tocheri, "The Primitive Wrist of *Homo floresiensis* and its Implications for Hominin Evolution," *Science* 317, no. 5845 (2007): 1743–5.

Around this time, detailed analyses of the theory of island dwarfing were also emerging. Robert Martin, who had been skeptical of Brown's claims about the new species early on, had begun to study scaling data on the bodies—and particularly the brains—of mammals that had undergone dwarfing on islands. Martin published a paper in 2006 arguing that even if a *H. erectus* ancestral population had become scaled down in size, its expected brain size would still be significantly larger than that of LB1.[477] Although Martin chose to temporarily back the hypothesis of microcephaly, he told a reporter, "I'm not saying I'm 100% certain it's microcephaly, I'm saying that the brain size is simply too small."[478] The island-dwarfing hypothesis was beginning to be called into question.[479]

A series of new analyses of LB1 was presented by Jungers, Tocheri, Falk, Eckhardt, and others at a joint meeting of the Paleoanthropology Society and American Association of Physical Anthropologists in Philadelphia in March 2007. The talks quickly illustrated that opinions had increasingly diverged and researchers on either side were unable to agree. Arguments ensued multiple times during the conference, so much so that at one point, expressing frustration with the scientists pushing for a pathological explanation, Jungers asked, "What color is the sky in your universe?"[480] The conference

---

477 Robert Martin et al., "Flores Hominid: New Species or Microcephalic Dwarf?," *The Anatomical Record Part A: Discoveries in Molecular, Cellular, and Evolutionary Biology: An Official Publication of the American Association of Anatomists* 288, no. 11 (2006): 1123–45.

478 Elizabeth Culotta, "But is it Pathological," *Science* 312: 5776 (May 19, 2006): 983.

479 The debate over brain shrinkage through island dwarfing has continued; see Eleanor Weston and Adrian M. Lister, "Insular Dwarfism in Hippos and a Model for Brain Size Reduction in *Homo floresiensis*," *Nature* 459, no. 7243 (2009): 85–8.

480 Matthew Tocheri (paleoanthropologist), interview by the author, September 3, 2020.

proceedings were later summarized in the semi-popular journal *Evolutionary Anthropology* under the title "Blue Skies Prevail in Stormy Philadelphia."[481]

These postcranial analyses of LB1 ultimately appeared in a special issue of the *Journal of Human Evolution*, with 13 articles detailing the different aspects of the anatomy. In the conclusion to the issue, Morwood and Jungers wrote that although "the initial description of *Homo floresiensis*…assumed that this endemic hominin species was the result of insular dwarfing of an ancestral *H. erectus* population," the team now favored an "alternative hypothesis" based on the more detailed analyses of the skeletal remains.[482] Whereas they emphasized that LB1 was not an *Australopithecus*, they proposed that "the individuals recovered from Liang Bua retain a wide-ranging suite of primitive morphological traits indicating that they may be descendants of a pre-*erectus* hominin species in Asia."[483] Thus, Morwood and Jungers now "preferred" the interpretation of *H. floresiensis* as "a basal member of the genus *Homo*."[484]

Although the evolutionary history of *H. floresiensis* continued to be murky—some studies found resemblances to *Australopithecus* whereas others pointed to a similarity to *H. erectus*—the new analyses had the effect of shifting the overall public opinion about LB1's validity. By identifying characteristics throughout the skeleton that were known features of earlier hominins, including basal *Homo* species, Jungers and the Jakarta team had made it increasingly difficult to imagine that pathology could explain

---

481 Mark Coleman et al., "From Hobbits to Giants: Blue Skies Prevail in Stormy Philadelphia," *Evolutionary Anthropology: Issues, News, and Reviews* 16, no. 4 (2007): 123–5.

482 Michael Morwood and William Jungers, "Conclusions: Implications of the Liang Bua Excavations for Hominin Evolution and Biogeography," *Journal of Human Evolution* 57, no. 5 (2009): 640.

483 Morwood and Jungers, "Conclusions," 640.

484 Morwood and Jungers, 640.

the unusual features of LB1. As Morwood and Jungers argued, "we are unaware of any systemic pathology that converts modern humans into phenotypes of their ancestors."[485]

In 2010, Leslie C. Aiello, paleoanthropologist and president of the Wenner-Gren Foundation, published a perspective titled "Five Years of *Homo floresiensis*."[486] In her paper, Aiello asked the now six-year-old question of "did the new material represent a paradigm-changing chapter in human evolution or was it just a diseased modern human?"[487] Aiello admitted that there is "no doubt that a pathological explanation for *H. floresiensis* is, at face value, a simpler and more comfortable solution to the many questions raised by the discoveries at Liang Bua."[488] She reminded readers that such an argument "has been used many times in the past to account for unexpected fossil discoveries that do not fit with preconceived notions for human evolution."[489] (For example, see my discussion on the Feldhofer Neanderthal, Chapter 2.) However, she cautioned that because the pathological explanations were failing to hold up to scrutiny, it might be "time to examine the preconceived notions that we hold."[490]

Discussion

Discovered in a somewhat unexpected place and in an unexpected archaeological context, LB1 took the paleoanthropological community by surprise. The hypotheses that emerged to explain the bones were situated in, and shaped by, a range of local scientific

485 Morwood and Jungers, 643.
486 Aiello, "Five Years," 167–79.
487 Aiello, 167.
488 Aiello, 176.
489 Aiello, 176.
490 Aiello, 176.

contexts, including the early history of research at Liang Bua, Morwood's work in Soa, and the cultural and political expectations of ownership and authority of scientific objects. Local histories shaped the particular set of actors, ideas, and scientific practices that both produced the surprising skeleton and contributed to the controversies that surrounded it. By retaining a local perspective of the story—asking who gathered around the fossil and what ideas they brought to its study—we can acknowledge the wide range of people who were involved. Historians of science have begun to call for more nuanced portrayals of knowledge production in this manner, incorporating actors like Benyamin Tarus who do not end up in scientific publications but nonetheless play a role in the bones' story.

By coupling this local analysis with a global perspective, we see the theoretical commitments and professional networks that contributed to the debates. The discovery produced by those local contexts was ultimately interpreted in larger, global debates about modern human origins as well as human uniqueness. By existing on a remote island in the recent human past, with a small brain, and found alongside stone tools, LB1 posed significant challenges to the multiregional theory of human evolution and other assumptions about recent human evolution and diversity. For multiple researchers across the globe, LB1 had massive implications for their entire body of work. The interaction and tension between these two realms made LB1 so controversial. As Stringer commented, "in this situation, one group of people are going to be 100% wrong."[491] Although it was often not explicitly discussed, Stringer's, Thorne's, and Brown's reactions to the same set of bones, for example, were very much a reflection of their

[491] Chris Stringer (paleoanthropologist), "Alien from Earth," interview by NOVA.

theoretical views on human evolution that had roots extending far into the discipline's history and across a range of issues about human nature and origins. The intersection of science and society at both the local and international levels shaped the debates around the Hobbit.

Conclusion

At first glance, the discovery of a small hominin on an oceanic island located thousands of miles away from the presumed origin point of humans and their ancestors might not look like a strong candidate to challenge long-held ideas at the center of the human story. Nevertheless, the Hobbit's apparent recent existence, its evidence of modern behaviors, and its mosaic of primitive and derived features was the perfect storm to challenge notions of what it means to be human.

The bones were not analyzed and interpreted in vacuum; their stories were shaped by the particular time and place in which they were uncovered. The discovery location of Flores determined, in part, which actors would gather around the bones, which material collections they would be compared to, and with which theories those actors would approach the analyses of the bones. The divergent opinions that arose around the specimen—the claims it was either fantastically wonderful or fantastically fanciful—can only be understood by combining an analysis of the science on the ground with the disembodied discussions that occurred around the globe.

CHAPTER 7

CONCLUSION

In the one hundred and fifty years that elapsed between the shoveling of fossils out of a cave mouth in the Neander Valley and the swipe of a spade 12,000 kilometers to the Southeast, the science of paleoanthropology transitioned from a haphazard effort to understand the human past by anatomists and geologists, to a complex, global scientific endeavor. As we have seen, throughout that history fossil discoveries have persistently emerged that prompted widely divergent opinions about the meaning and significance of fossil bones. What are we to make of this reoccurring feature of the science, as gleaned through the eyes of these three discoveries? And how can we apply this understanding of paleoanthropology in the past to the science in the present and future? Answering these questions requires acknowledging the main findings of this research, which can be considered in four main points.

The primary finding from these examinations of the Neanderthal, the Taungs Baby, and the Hobbit is that the fossils themselves do play a role in knowledge production—in very particular ways that are determined by their locations. Understandings and judgements of the material objects, constructed by the actors who gather around them, the tools at those actors' disposal, and the scientific, cultural, and political assumptions that those actors bring to their investigations are all shaped by the local context of their discoveries. How, then do can we think about the question I posed in the introduction of this work: what role do fossils play in knowledge production—is paleoanthropology a theory-heavy enterprise within which fossil human ancestors were interpreted, or is it a series of hominin fossil discoveries that led to the construction of

theories? The stories of these three fossils reveal that indeed, each specimen's discovery locale and its unique combination of features does determine the types of assumptions it uncovers, ideas it disrupts, and hypotheses it generates.

Recognizing that the locale-specific context in which fossils are discovered and interpreted plays a role in knowledge production challenges claims that fossils "[have] meaning only to the extent that they could be fitted into theories of how human evolution occurred," or that "a comprehensive history "must focus on the theories, not on the fossils."[492] While I asked in the beginning of this work if paleoanthropology is primarily theory driven or fossil driven, the chapters have revealed that such a binary distinction flattens our understanding of the science. Instead, as this work has shown, it is through examining the interplay of the theoretical commitments of how human evolution occurred, combined with the specific context of the fossils' discovery, that results in a more complete picture of how the specimens give rise to different interpretations and fierce debates.

While it may appear self evident that the fossils play a role in knowledge construction, the explicit recognition here of the objects' importance in the story has consequences for the ways we approach and understanding the science. By moving our analyses away from solely theories of human evolution, we shift the scope and focus of our analyses, changing the types of questions we ask about who counts in the histories, where the science occurs, and more. By allowing scientific practices and the local character of the science to be a part of the picture, we gain a more detailed view of the

[492] Bowler, *Theories*, 5-6.

scientific process, and the ways that process leads to new hypotheses, debates, and ultimately knowledge.

The second major finding of this work is that the scientific practices involved in studying fossils have shaped both the interpretations of those fossils and also the larger judgements about what it means to be human. We have seen that questions about how to understand a specimen and decide where to place it on the human family tree (if at all) have often boiled down to questions of comparison and measurement. Building on the point that the fossils were not simply fit into preexisting theories about human evolution, but instead played a role in knowledge production, it follows that it is critical to pay attention to the ways in which scientists sought to generate knowledge from the objects. These practices, which range from measuring brain size and shape to circulating specimens and making anatomical comparisons, determined scientists' perceptions of the fossils and helped determine how they thought about human nature and origins. Arthur Keith's cerebral Rubicon, for example quantified human nature, tying morality to cranial capacity, a feature William King identified by the shape of the forehead.

This perspective diverges from historical works that caricature paleoanthropological controversies as scuffles about ego and emotion. Instead, this view recognizes that a major factor in the debates was a result of a fossil record comprising sparse, fragile material objects spread over vast distances. The challenges of conducting research under these circumstances cannot be ignored.

Third, this research has shown that the scientific practices surrounding hominin fossil analyses—and the interpretations that follow from those practices—are shaped by local features and culture. Factors ranging from access to resources to availability of

transportation shaped every aspect of the fossils' interpretations, to the specimens it could be compared to, the actors involved with its analyses, and more. Additionally, we have seen how local, cultural ideologies increasingly shaped the science across the twentieth century. As once-colonized countries gained a sense of self-determination and autonomy, researchers frequently reflected that ethos in the science of human origins, shaping where the fossils were located and whether or not they traveled. Indeed, future work that explores the development of paleoanthropology detailed in these pages, from a European centered discipline to a globalized endeavor—and the tensions involved with that transition, not yet directly dealt with here—would be a fruitful endeavor.

The fourth, interrelated, key conclusion from this work is that, as paleoanthropology continues to develop and establish global perspectives on the topic human origins, the phenomenon of divergent interpretations occurring around the discovery of new fossil discoveries will continue to persist. The tenacity of arguments for a pathological or microcephalic explanation of a newly discovered fossil, for example, reflects not only the uncertainty inherent in the task of looking millions of years in the past, but also the reality that science is a "human act." While paleoanthropologists are discovering new facets of the human story, filling in the picture with more detail than ever before at an exponentially increasing rate—these researchers are still embedded in their time and culture. The objects, bits and pieces of fossilized bones that hung on to their material form for millions of years, are being examined by a collection of different

people who are making measurements from a "specific point of view in time and space, from one particular viewpoint of a possible observer."[493]

Definitive conclusions about the human story, then, should not necessarily be expected in the science of paleoanthropology. Instead, the process of analysis, comparison, and even debate, leads to a series of working hypotheses about our origins that can be tested, continuously evaluated, and adjusted as new pieces of evidence come to light. Therefore**,** this view of paleoanthropology from the perspective of a historian gives us a new understanding of the interplay between science and society, while raising new questions and research directions. How, for example, can recognizing that surprising fossil discoveries expose hidden assumptions about the process of human evolution help us think about the science in the present and future? Looking forward, the outlook gleaned from this analysis encourages researchers to obtain a broader perspective on what it is they are doing when they examine the fossils of human ancestors. It reminds them to consider where the fossils are located in space, time, and culture, how the fossils travel, who surrounds them and shapes their stories, and what factors make the objects so surprising and controversial.

Considering the underlying assumptions about humans, our past, and our place in nature in the science of paleoanthropology is important because the interpretations derived from these fossils are of significant interest to the broader community. The paleoanthropologist who conducts research, down to the most basic, fundamental aspects of analysis—such as measurement—is examining an object that is "drawn from one's

493 Frayn, *Copenhagen*, 71.

own ancestry" and making claims about the "very personal" problem of what it means to be human.[494]

[494] Clark, "Bones," 132.

REFERENCES

Aiello, Leslie C. “Five Years of *Homo Floresiensis*.” *American Journal of Physical Anthropology* 142, no. 2 (2010): 167–79. https://doi.org/10.1002/ajpa.21255.

Alberti, Samuel J. “Objects and the Museum.” *Isis* 96, no. 4 (2005): 559–71. https://doi.org/10.1086/498593.

Anderson, Warwick and Hans Pols. “Scientific Patriotism: Medical Science and National Self-Fashioning in Southeast Asia.” *Comparative Studies in Society and History* 54, no. 1 (2012): 93–113.

Ballard, Chris. “Strange Alliance: Pygmies in the Colonial Imaginary.” *World Archaeology* 38, no. 1 (2006): 133–51. https://doi.org/10.1080/00438240500510155.

Barthes, Roland. *Camera Lucida: Reflections on Photography*. London: Vintage, 1981.

Black, Davidson. “Asia and the Dispersal of Primates.” *Bulletin of the Geological Society of China* 4, no. 2 (1925): 133–83.

Blake, Charles Carter. “On the Occurrence of Human Remains Contemporaneous with Those of Extinct Animals.” *The Geologist* 4 (1861): 395–99.

Blake, Charles Carter. “On the Crania of the Most Ancient Races of Men.” *The Geologist* 5 (1862): 205–33.

Blake, Charles Carter. “On the Alleged Peculiar Characters, and Assumed Antiquity of the Human Cranium from the Neanderthal.” *Journal of the Anthropological Society of London* 2 (1864): cxxxix–clvii.

Bowler, Peter J. *Theories of Human Evolution: A Century of Debate, 1844–1944*. Baltimore: Johns Hopkins University Press, 1989.

Bowler, Peter J. *Evolution: The History of an Idea*. Berkeley, CA: University of California Press, 2003.

Boule, Marcellin. *Fossil Men Elements of Human Palaeontology.* Jessie Elliot Ritchie and James Ritchie (trans). Edinburgh: Oliver and Boyd, 1923.

Brace, Charles Loring. “Refocusing on the Neanderthal Problem.” *American Anthropologist* 64, no. 4 (1962): 729–41. https://doi.org/10.1525/aa.1962.64.4.02a00030.

Brunet, Michel, Franck Guy, David Pilbeam, Hassane Taisso Mackaye, Andossa Likius, Djimdoumalbaye Ahounta, Alain Beauvilain et al. “A New Hominid from the Upper Miocene of Chad, Central Africa.” *Nature* 418, no. 6894 (2002): 145–51.

Brown, Peter, Thomas Sutikna, Michael J. Morwood, Raden P. Soejono, Jatmiko, E. Wahyu Saptomo, and Rokus Awe Due. “A New Small-Bodied Hominin from the Late Pleistocene of Flores, Indonesia.” *Nature* 431, no. 7012 (2004): 1055–61. https://doi.org/10.1038/nature02999.

Broom, Robert. “The Evidence Afforded by the Boskop Skull of a New Species of Primitive Man (*Homo capensis*).” *Anthropological Papers of the AMNH* 23, no 2 (1918): 63–79.

Broom, Robert. “What the World Owes to South Africa.” *Scientific American* 141, no. 2 (1929): 119–21. https://doi.org/10.1038/scientificamerican0829-119.

Broom, Robert. “Note on the Milk Dentition of Australopithecus.” *Journal of Mammalogy* 99, no. 1 (1930): 85–88.

Broom, Robert. “New Fossil Anthropoid Skull from South Africa.” *Nature* 138, no. 3490 (1936): 486–88. https://doi.org/10.1038/138486a0.

Broom, Robert, and G. W. H. Schepers. *The South African Fossil Ape-Men: the Australopithecinae*. Pretoria: Transvaal Museum, 1946.

Broom, Robert. *Finding the Missing Link*. London: Watts, 1950.

Busk, George. “Observations on a Systematic Mode of Craniometry.” *Transactions of the Ethnological Society of London* (1861): 341–48.

Busk, George. “Pithecoid Priscan Man from Gibraltar.” *The Reader* 4 (1864): 109–10.

Bynum, William F. “Charles Lyell's Antiquity of Man and Its Critics.” *Journal of the History of Biology* 17, no. 2 (1984): 153–87. https://doi.org/10.1007/bf00143731.

Camerini, Jane R. “Evolution, Biogeography, and Maps: An Early History of Wallace's Line.” *Isis* 84, no. 4 (1993): 700–27. https://doi.org/10.1086/356637.

Callaway, Ewen. “The Discovery of *Homo floresiensis*: Tales of the Hobbit.” *Nature* 514, October 23, 2014: 422–26. doi:10.1038/514422a.

Cartmill, Matt. “Human Uniqueness and Theoretical Content in Paleoanthropology.” *International Journal of Primatology* 11, no. 3 (1990): 173–92. https://doi.org/10.1007/bf02192868.

Caspari, Rachel, and Milford Wolpoff. “The Dubois Syndrome.” *History and Philosophy of the Life Sciences* 34, no. 1 (2012): 33–42.

Clark, Wilfrid Le Gros. “Bones of Contention.” *The Journal of the Royal Anthropological Institute of Great Britain and Ireland* 88, no. 2 (1958): 131–45. https://doi.org/10.2307/2844248.

Coleman, Mark N., Andrea L. Baden, Rachel Jacobs, and Biren A. Patel. “From Hobbits to Giants: Blue Skies Prevail in Stormy Philadelphia.” *Evolutionary Anthropology: Issues, News, and Reviews* 16, no. 4 (2007): 123–25.

Corbey, Raymond. *The Metaphysics of Apes: Negotiating the Animal-Human Boundary*. New York: Cambridge University Press, 2005.

Cook, Gordon C. “George Busk FRS (1807–1886), Nineteenth-Century Polymath: Surgeon, Parasitologist, Zoologist and Palaeontologist.” *Journal of Medical Biography* 5, no. 2 (1997): 88–101. https://doi.org/10.1177/096777209700500207.

Cosans, Christopher Ernest. *Owen's Ape & Darwin's Bulldog: beyond Darwinism and Creationism*. Bloomington: Indiana University Press, 2009.

Dalton, Rex. “More Evidence for Hobbit Unearthed as Diggers are Refused Access to Cave.” *Nature* 437, October 13, 2005: 934–35.

Culotta, Elizabeth. “But is it Pathological?” *Science* 312, no. 5776, May 19, 2006: 983.

Daston, Lorraine and Peter Galison. “The Image of Objectivity.” *Representations* (1992): 81–128.

Daston, Lorraine. *Biographies of Scientific Objects*. Chicago: University of Chicago Press, 2000.

Daston, Lorraine. *Things That Talk: Object Lessons from Art and Science*. New York: Zone Books, 2004.

Dart, Raymond A. “Boskop Remains from the South-East African Coast.” *Nature* 112, no. 2817 (1923): 623–25. https://doi.org/10.1038/112623a0.

Dart, Raymond. “*Australopithecus africanus* the Man-Ape of South Africa.” *Nature* 115, no. 2884 (1925): 195–99. https://doi.org/10.1038/115195a0.

Dart, Raymond A. “The Dentition of *Australopithecus africanus*.” *Folia Anatomica Japonica* 12, no. 4 (1934): 207–21. https://doi.org/10.2535/ofaj1922.12.4_207.

Dart, Raymond A., and Dennis R. Craig. *Adventures with the Missing Link*. London: H. Hamilton, 1959.

Darwin, Charles. *The Descent of Man*. London: Murray, 1871.

Dawson, Charles, and Arthur Smith Woodward. "On the Discovery of a Palaeolithic Human Skull and Mandible in a Flint-bearing Gravel Overlying the Wealden (Hastings Beds) at Piltdown, Fletching (Sussex)." *Quarterly Journal of the Geological Society* 69, no. 1 (1913): 117–23.

Delisle, Richard. "Human Palaeontology and the Evolutionary Synthesis During the Decade 1950–1960." In *Ape, Man, Apeman: Changing Views since 1600: Evaluative Proceedings of the Symposium ... Leiden, the Netherlands, 28 June-1 July 1993*, 217–28. Leiden: Dept. of Prehistory, Leiden University, 1995.

Delisle, Richard. *Debating Humankind's Place in Nature, 1860–2000: The Nature of Paleoanthropology*. Upper Saddle River, NJ: Pearson Prentice Hall, 2007.

Dennell, Robin, and Wil Roebroeks. "An Asian Perspective on Early Human Dispersal from Africa." *Nature* 438, no. 7071 (2005): 1099–04. https://doi.org/10.1038/nature04259.

Delson, Eric, Niles Eldredge, and Ian Tattersall. "Reconstruction of Hominid Phylogeny: A Testable Framework Based on Cladistic Analysis." *Journal of Human Evolution* 6, no. 3 (1977): 263–78.

Desmond, Adrian J. *Huxley: from Devil's Disciple to Evolution's High Priest*. Reading, Mass: Addison-Wesley, 1997.

Dobzhansky, Theodosius. "On Species and Races of Living and Fossil Man." *American Journal of Physical Anthropology* 2, no. 3 (1944): 251–65. https://doi.org/10.1002/ajpa.1330020303.

Drell, Julia R. "Neanderthals: A History of Interpretation." *Oxford Journal of Archaeology* 19, no. 1 (2000): 1–24. https://doi.org/10.1111/1468-0092.00096.

Dubois, Eugene. *Pithecanthropus erectus: Eine Menschenaehnliche Uebergangsform*. Batavia: Landesdruckerei, 1894.

Dubois, Eugene. "On Pithecanthropus Erectus: A Transitional Form Between Man and the Ape." *The Journal of the Anthropological Institute of Great Britain and Ireland* 25 (1896): 240–55.

Dubow, Saul. "Human Origins, Race Typology and the Other Raymond Dart." *African Studies* 55, no. 1 (1996): 1–30. https://doi.org/10.1080/00020189608707838.

Dubow, Saul. *A Commonwealth of Knowledge: Science, Sensibility, and White South Africa, 1820–2000*. New York: Oxford Univ. Press, 2010.

Duckworth, Wynfrid L.H. "The Fossil Anthropoid Ape from Taungs." *Nature*, 115 (1925): 236.

Elliot Smith, Grafton. "Men of the Old Stone Age." *The American Museum Journal* XV (1915): 319–25.

Elliot Smith, Grafton. *The Evolution of Man: Essays*. London: Oxford University Press, 1924.

Elliot Smith, Grafton. "The Fossil Anthropoid Ape from Taungs." *Nature* 115 (1925): 235.

Elliot Smith, Grafton. "Taungs Fossil Skull: More Manlike than any Known Ape." *The Times*. In Grafton Elliot Smith Papers, University College London Archives.

Endersby, Jim. *Imperial Nature: Joseph Hooker and the Practices of Victorian Science*. Chicago: University of Chicago Press, 2010.

Fabian, Ann. *The Skull Collectors Race, Science, and America's Unburied Dead*. Chicago: University of Chicago Press, 2010.

Falk, Dean. *The Fossil Chronicles How Two Controversial Discoveries Changed Our View of Human Evolution*. Berkeley: University of California Press, 2011.

Falk, Dean, Charles Hildebolt, Kirk Smith, Mike J. Morwood, Thomas Sutikna, Peter Brown, E. Wahyu Saptomo, Barry Brunsden, and Fred Prior. "The Brain of LB1, *Homo floresiensis*." *Science* 308, no. 5719 (2005): 242–45.

Fan, Fa-Ti. "Science in Cultural Borderlands: Methodological Reflections on the Study of Science, European Imperialism, and Cultural Encounter." *East Asian Science, Technology and Society* 1, no. 2 (2007): 213–31. https://doi.org/10.1215/s12280-007-9022-5.

Fan, Fa-Ti. "Circulating Material Objects: The International Controversy Over Antiquities and Fossils in Twentieth-Century China." *The Circulation of Knowledge Between Britain, India and China* (2013): 209–36. https://doi.org/10.1163/9789004251410_010.

Frayn, Michael. *Copenhagen*. New York: Anchor Books, 1998.

Gee, Henry. *The Accidental Species Misunderstandings of Human Evolution*. Chicago: University of Chicago Press, 2013.

Goodrum, Matthew. "Dart, Raymond Arthur." In *Complete Dictionary of Scientific Biography*, 237–42.

Goodrum, Matthew R. "Prolegomenon to a History of Paleoanthropology: The Study of Human Origins as a Scientific Enterprise. Part 2. Eighteenth to the Twentieth Century." *Evolutionary Anthropology: Issues, News, and Reviews* 13, no. 6 (2004): 224–33. https://doi.org/10.1002/evan.20030.

Goodrum, Matthew R. "The Beginnings of Human Palaeontology: Prehistory, Craniometry and the 'Fossil Human Races.'" *The British Journal for the History of Science* 49, no. 3 (2016): 387–409. https://doi.org/10.1017/s0007087416000674.

Goodrum, Matthew R. "The History of Human Origins Research and its Place in the History of Science: Research Problems and Historiography." *History of Science* 47, no. 3 (2009): 337–57. https://doi.org/10.1177/007327530904700305.

Goodrum, Matthew. "Hermann Schaaffhausen (1816–1893)." In *Online Biographical Dictionary of the History of Palaeoanthropology*, 2013.

Goodrum, Matthew R. "The Idea of Human Prehistory: The Natural Sciences, the Human Sciences, and the Problem of Human Origins in Victorian Britain." *History and Philosophy of the Life Sciences* 34 (2012) 117–45.

Grayson, Donald K. *The Establishment of Human Antiquity*. New York: Academic Press, 1983.

Gregory, William K. "*Hesperopithecus* Apparently not an Ape nor a Man." *Science* 66, no. 1720 (1927): 579–81. https://doi.org/10.1126/science.66.1720.579.

Gregory, William K., and Milo Hellman. "Evidence of the Australopithecine Man-apes on the Origin of Man." *Science* 88, no. 2296 (1938): 615–16.

Gundling, Tom. *First in Line: Tracing Our Ape Ancestry*. New Haven: Yale University Press, 2005.

Hackett, Abigail and Robin Dennell. "Neanderthals as Fiction in Archaeological Narrative." *Antiquity* 77, no. 298 (2003): 816–27. https://doi.org/10.1017/s0003598x00061755.

Haeckel, Ernst. *The History of Creation.* London: Kegan Paul, Trench & Co, 1876.

Hamilton, Carolyn, Bernard Mbenga, and Robert Ross. *The Cambridge History of South Africa*. Cambridge: Cambridge University Press, 2010.

Hammond, Michael. "Anthropology as a Weapon of Social Combat in Late-Nineteenth-Century France." *Journal of the History of the Behavioral Sciences* 16, no. 2 (1980): 118–32. https://doi.org/10.1002/1520-6696(198004)16:23.0.co;2-r.

Hammond, Michael. "The Expulsion of the Neanderthals from Human Ancestry: Marcellin Boule and the Social Context of Scientific Research." *Social Studies of Science* 12, no. 1 (1982): 1–36. https://doi.org/10.1177/030631282012001002.

Heggie, Vanessa. "Why isn't Exploration a Science?" *Isis* 105, no. 2 (2014): 318–34.

Henneberg, Maciej, and Alan Thorne. "Flores Human may be Pathological *Homo sapiens*." *Before Farming* 4 (2004): 2–4.

Henneberg, Maciej, Robert Edckhart and John Schofield. *The Hobbit Trap: Money, Fame, Science and the Discovery of a 'New Species.'* Walnut Creek, CA: Left Coast Press, 2010.

Hockney, David. *Secret Knowledge: Rediscovering the Lost Techniques of the Old Masters*. London: Thames & Hudson, 2001.

Howell, F. Clark. "The Place of Neanderthal Man in Human Evolution." *American Journal of Physical Anthropology* 9, no. 4 (1951): 379–416. https://doi.org/10.1002/ajpa.1330090402.

Hrdlička, Aleš. "Variation in the Dimensions of Lower Molars in Man and Anthropoid Apes." *American Journal of Physical Anthropology* 6, no. 4 (1923): 423–38. https://doi.org/10.1002/ajpa.1330060408.

Hrdlička Aleš. *The Skeletal Remains of Early Man*. City of Washington: The Smithsonian Institution, 1930.

Hrdlička, Aleš. "The Taungs Ape." *American Journal of Physical Anthropology* 8, no. 4 (1925): 379–92. https://doi.org/10.1002/ajpa.1330080402.

Humphry, George. "The Microcephalic or Idiot Skull, and the Macrocephalic or Hydrocephalic Skull." *Journal of Anatomy and Physiology* 29, no. 2 (1895): 304.

Huxley, Thomas Henry. *Evidence as to Man's Place in Nature*. London, 1863.

Huxley, Thomas Henry. "Further Remarks upon the Human Remains from the Neanderthal." *Natural History Review* (1864): 429–46.

Johanson, Don, Tim White, and Yves Coppens. “A New Species of the Genus *Australopithecus* (Primates: Hominidae) from the Pliocene of East Africa.” *Kirtlandia* 28 (1978): 1–14.

Jolly, Clifford J. “The Seed-Eaters: A New Model of Hominid Differentiation Based on a Baboon Analogy.” *Man* 5, no. 1 (1970): 5–26. https://doi.org/10.2307/2798801.

Jacob, Teuku. “A Human Mandible from Anjar Urn Field, Indonesia.” *Journal of the National Medical Association* 56, no. 5 (1964): 421–6.

Jacob, Teuku. “Some Problems Pertaining to the Racial History of the Indonesian Region.” PhD diss, University of Utrecht, 1967.

Jacob, Teuku. “Conflict from Flores: Storm in a Teacup.” *Kompas*, December 15, 2004.

Jacob, Teuku, Etty Indriati, Radien P. Soejono, K. Hsü, David W. Frayer, Robert B. Eckhardt, Adam J. Kuperavage, Alan Thorne, and Maciej Henneberg. “Pygmoid Australomelanesian *Homo sapiens* Skeletal Remains from Liang Bua, Flores: Population Affinities and Pathological Abnormalities.” *Proceedings of the National Academy of Sciences* 103, no. 36 (2006): 13421–26.

Jungers, William L., William EH Harcourt-Smith, R. E. Wunderlich, Matthew W. Tocheri, Susan G. Larson, T. Sutikna, Rhokus Awe Due, and Michael J. Morwood. “The Foot of *Homo floresiensis*.” *Nature* 459, no. 7243 (2009): 81–84.

Kimbel, William H., and Lucas K. Delezene. “’Lucy’ Redux: A Review of Research on *Australopithecus afarensis*.” *American Journal of Physical Anthropology* 140, no. 49 (2009): 2–48.

Keith, Arthur. “*Pithecanthropus erectus*—A Brief Overview of Human Fossil Remains.” *Science Progress (1894–1898)* 3, no. 17 (1895): 348–69.

Keith, Arthur. *The Antiquity of Man*. London: Williams and Norgate, 1915.

Keith, Arthur. “Discovery of Neanderthal Man in Malta.” *Nature* 101, no. 2543 (1918): 404–05.

Keith, Arthur. “The Fossil Anthropoid Ape from Taungs.” *Nature* 115, no. 2885 (1925): 234–36. https://doi.org/10.1038/115234a0.

Keith, Arthur. “The Taungs Skull.” *Nature*, 116 (July 1925): 11.

Keith, Arthur. “The Taungs Skull.” *Nature*, 116 (September 1925), 462–63.

Keith, Arthur. *Concerning Man's Origin: Being the Presidential Address given at the Meeting of the British Association Held in Leeds on August 31, 1927, and Recent Essays on Darwinian Subjects*. London: Watts, 1928.

Keith, Arthur. "Australopithecinæ or Dartians." *Nature* 159, no. 4037 (1947): 377. https://doi.org/10.1038/159377a0.

Keith, Arthur. *A New Theory of Human Evolution*. London: Watts, 1948.

Kendall, Martha B. "Fuhlrott, Johann Karl." Essay. In *Complete Dictionary of Scientific Biography*. Detroit: Charles Scribner's Sons, 2008.

Kern, Emily. "Archaeology Enters the 'Atomic Age': A Short History of Radiocarbon, 1946–1960." *The British Journal for the History of Science* (2020): 1–21.

King, William. "The Reputed Fossil Man of the Neanderthal." *Quarterly Journal of Science* 1 (1864): 88–97.

King William. "The Neanderthal Skull." *Anthropological Rev*iew (1863): 393–94.

King, William. "On the Neanderthal Skull, or Reasons for Believing it to Belong to the Clydian Period and to a Species Different from that Represented by Man," *British Association for the Advancement of Science, Notices and Abstracts for 1863* (1864): 81–83.

Kjærgaard, Peter C. "'Hurrah for the Missing Link!': A History of Apes, Ancestors and a Crucial Piece of Evidence." *Notes and Records of the Royal Society* 65, no. 1 (2011): 83–98. https://doi.org/10.1098/rsnr.2010.0101.

Kjærgaard, Peter C. "The Fossil Trade: Paying a Price for Human Origins." *Isis* 103, no. 2 (2012): 340–55. https://doi.org/10.1086/666365.

Knight, Donald R., and Alan D. Sabey. *The Lion Roars at Wembley: British Empire Exhibition 60th Anniversary 1924–1925*. London: Barnard & Westwood, 1984.

Kohler, Robert E., and Jeremy Vetter. "The Field." *A Companion to the History of Science* (2016): 282–95.

Kuljian, Christa. *Darwin's Hunch: Science, Race and the Search for Human Origins*. Auckland Park, South Africa: Jacana, 2016.

Kroupa, Sebestian, Stephanie J. Mawson, and Dorit Brixius. "Science and Islands in Indo-Pacific Worlds." *The British Journal for the History of Science* 51, no. 4 (2018): 541–58.

Landau, Misia. *Narratives of Human Evolution*. New Haven: Yale University Press, 1993.

Latour, Bruno. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge: Harvard University Press, 1987.

Leakey, Louis, Jack Evernden, and Garniss Curtis. "Age of Bed I, Olduvai Gorge, Tanganyika." *Nature* 191, no. 4787 (1961): 478–79. https://doi.org/10.1038/191478a0.

Leakey, Louis S. B., Phillip V. Tobias, and John R. Napier. "A New Species of the Genus *Homo* from Olduvai Gorge." *Nature* 202, no. 4927 (1964): 7–9. https://doi.org/10.1038/202007a0.

Leakey, Mary D., and Richard L. Hay. "Pliocene Footprints in the Laetolil Beds at Laetoli, Northern Tanzania." *Nature* 278, no. 5702 (1979): 317–23.

Lewin, Roger. *Bones of Contention: Controversies in the Search for Human Origins*. Chicago, Ill: University of Chicago Press, 1997.

Lightman, Bernard V., Gordon McOuat, and Larry Stewart. *The Circulation of Knowledge between Britain, India and China: The Early-Modern World to the Twentieth Century*. Leiden: Brill, 2013.

Lyell, Charles. *Principles of Geology, Being an Attempt to Explain the Former Changes of the Earth's Surface, by Reference to Causes Now in Operation*. London: John Murray, 1832.

Lyell, Charles. *The Geological Evidences of the Antiquity of Man*. London: John Murray, 1863.

Madison, Paige. "The Most Brutal of Human Skulls: Measuring and Knowing the First Neanderthal." *The British Journal for the History of Science* 49, no. 3 (2016): 411–32. https://doi.org/10.1017/s0007087416000650.

Madison, Paige. "The Forgotten Fossil: The Wild *Homo calpicus* of Gibraltar." *Endeavour* 40, no. 4 (2016): 268–70. https://doi.org/10.1016/j.endeavour.2016.09.005.

Madison, Paige. "Characterized by Darkness: Reconsidering the Origins of the Brutish Neanderthal." *Journal of the History of Biology* (2020). https://doi-org/10.1007/s10739-020-09623-4.

Manias, Chris. “Sinanthropus in Britain: Human Origins and International Science, 1920–1939.” *The British Journal for the History of Science* 48, no. 2 (2014): 289–319. https://doi.org/10.1017/s0007087414000909.

Manias, Chris. “Building Baluchitherium and Indricotherium: Imperial and International Networks in Early-twentieth Century Paleontology.” *Journal of the History of Biology* 48, no. 2 (2014): 237–78. https://doi.org/10.1007/s10739-014-9395-y.

Manias, Chris. “Robert Broom’s Prehistoric Sketches: Conveying Objects through Illustration in the Early-twentieth Century.” *Museum History Journal* 10, no. 2 (2017): 162–82. https://doi.org/10.1080/19369816.2017.1328858.

Manias, Chris. “Jesuit Scientists and Mongolian Fossils: The French Paleontological Missions in China, 1923–1928.” *Isis* 108, no. 2 (2017): 307–32. https://doi.org/10.1086/692677.

Manias, Chris. “Reconstructing an Incomparable Organism: The Chalicothere in Nineteenth and Early- twentieth Century Palaeontology.” *History and Philosophy of the Life Sciences, 40* no. 1 (2018): 1–21.

Martin, Robert D., Ann M. MacLarnon, James L. Phillips, and William B. Dobyns. “Flores Hominid: New Species or Microcephalic Dwarf?” *The Anatomical Record Part A: Discoveries in Molecular, Cellular, and Evolutionary Biology* 288, no. 11 (2006): 1123–45.

Mayer, Fredrich. “Über die Fossilen Überreste eines Menschlichen Schädels und Skeletes in einer Felsenhohle des Düssel-oder Neanderthales.” *Mullers Archiv* (1864): 26.

Maringer, Johannes and Theodor Verhoeven. “Die Steinartefakte aus der Stegodon-Fossilschicht von Menge Ruda auf Flores, Indonesien.” *Anthropos* 65 (1970): 530–46.

Mayr, Ernst. “Taxonomic Categories in Fossil Hominids.” *Cold Spring Harbor Symposia on Quantitative Biology* 15 (1950): 109–18. https://doi.org/10.1101/sqb.1950.015.01.013.

Mayr, Ernst. *Animal Species and Evolution*. Cambridge: Harvard University Press, 1963.

McFarlane, Donald A. and Joyce Lundberg, “The 19th Century Excavation of Kent's Cavern, England,” *Journal of Cave and Karst Studies* 67 (2005): 39–47

Menez, Alex. “The Gibraltar Skull: Early History, 1848–1868.” *Archives of Natural History* 45, no. 1 (2018): 92–110. https://doi.org/10.3366/anh.2018.0485.

Mervis, Jeffrey D. “Keeper of the Keys to Fossil Kingdom.” *Science* 279, no. 5356 (1998): 1477.

Milam, Erika Lorraine. *Creatures of Cain: The Hunt for Human Nature in Cold War America*. Princeton: Princeton University Press, 2019.

Morell, Virginia. *Ancestral Passions: The Leakey Family and the Quest for Humankind's Beginnings*. New York: Simon & Schuster, 1996.

Morwood, Michael J., P. B. O'Sullivan, F. Aziz, and A. Raza. “Fission-Track Ages of Stone Tools and Fossils on the East Indonesian Island of Flores.” *Nature* 392, no. 6672 (1998): 173–76. https://doi.org/10.1038/32401.

Morwood, Michael J., Raden P. Soejono, Richard G. Roberts, Thomas Sutikna, C. S. M. Turney, K. E. Westaway, W. J. Rink, et al. “Archaeology and Age of a New Hominin from Flores in Eastern Indonesia.” *Nature* 431, no. 7012 (2004): 1087–91. https://doi.org/10.1038/nature02956.

Morwood, Michael J., and William Jungers. “Conclusions: Implications of the Liang Bua Excavations for Hominin Evolution and Biogeography.” *Journal of Human Evolution* 57, no. 5 (2009): 640–48. https://doi.org/10.1016/j.jhevol.2009.08.003.

Morwood, Michael J. and Penny Van Oosterzee. *A New Human: The Startling Discovery and Strange Story of the Hobbits of Flores, Indonesia*. London: Routledge, 2009.

Morton, Samuel George. *Crania Americana; Or, a Comparative View of the Skulls of Various Aboriginal Nations of North and South America.* Philadelphia: J. Dobson Press, 1839.

Mulvaney, D. J., and R. P. Soejono. “The Australian-Indonesian Archaeological Expedition to Sulawesi.” *Asian Perspectives* 13 (1970): 1630–77. In Etty Indriati (ed) *Recent Advances on Southeast Asian Paleoanthropology and Archaeology.* Yogyakarta: Gadjah Mada Press, 2007.

Murray, John, Heinz Peter Nasheuer, Cathal Seoighe, Grace P. Mccormack, D. Michael Williams, and David A. Harper. “The Contribution of William King to the Early Development of Palaeoanthropology.” *Irish Journal of Earth Sciences* 33 (2015): 1–16. https://doi.org/10.3318/ijes.2015.33.1.

Nair, Savithri Preetha. “‘Eyes and No Eyes’: Siwalik Fossil Collecting and the Crafting of Indian Palaeontology (1830–1847).” *Science in Context* 18, no. 3 (2005): 359–92. https://doi.org/10.1017/s026988970500058x.

Oakley, Kenneth and Joseph Sidney Weiner. “Piltdown Man.” *American Scientist* 43, no. 4 (1955): 573–83.

Osborn, Henry Fairfield. "*Hesperopithecus*, the Anthropoid Primate of Western Nebraska." *Nature* 110, no. 2756 (1922): 281–83. https://doi.org/10.1038/110281a0.

Owen, Richard. "Osteological Contributions to the Natural History of the Chimpanzees (Troglodytes, Geoffroy) Including the Description of the Skull of a Large Species (*Troglodytes gorilla*, Savage) Discovered by Thomas S. Savage, MD in the Gabon Country, West Africa," *Transactions of the Zoological Society of London* 3 (1848): 416.

Pickford, Martin, and Brigitte Senut. "'Millennium Ancestor,' a 6-million-year-old Bipedal Hominid from Kenya." *South African Journal of Science* 97, no. 1 (2001): 22.

Pietsch, Tamson. *Empire of Scholars: Universities, Networks and the British Academic World, 1850–1939*. Manchester: Manchester University Press, 2015.

Podgorny, Irina. "Fossil Dealers, the Practices of Comparative Anatomy and British Diplomacy in Latin America, 1820–1840." *The British Journal for the History of Science* 46, no. 4 (2012): 647–74. https://doi.org/10.1017/s0007087412000702.

Pyne, Lydia V. *Seven Skeletons: The Evolution of the World's Most Famous Human Fossils*. New York: Viking, 2016.

Raj, Kapil. *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe: 1650–1900*. New York: Palgrave Macmillan, 2010.

Raj, Kapil. "Go-betweens, Travelers, and Cultural Translators." *A Companion to the History of Science* (2016): 39–57.

Ramaswamy, Sumathi. *The Lost Land of Lemuria: Fabulous Geographies, Catastrophic Histories*. Berkeley: University of California Press, 2004.

Reader, John. *Missing Links: The Hunt for Earliest Man*. Harmondsworth, England: Penguin Books, 1990.

Rees, Amanda. "Stories of Stones and Bones: Disciplinarity, Narrative and Practice in British Popular Prehistory, 1911–1935." *The British Journal for the History of Science* 49, no. 3 (2016): 433–51. https://doi.org/10.1017/s0007087416000649.

Ricklefs, Merle Calvin. *A History of Modern Indonesia Since c. 1200.* Stanford: Stanford University Press, 2008.

Richmond, Jesse. “Design and Dissent: Religion, Authority, and the Scientific Spirit of Robert Broom.” *Isis* 100, no. 3 (2009): 485–504. https://doi.org/10.1086/644626.

Richmond, Jesse. “Experts and Australopithecines: Credibility and Controversy in the Science of Human Evolution, 1924–1959.” PhD diss., University of California San Diego, 2009.

Richmond, Jesse. “Discipline and Credibility in the Post-war Australopithecine Controversy: Le Gros Clark versus Zuckerman.” *History and Philosophy of the Life Sciences* (2012): 43–78.

Rieppel, Lukas. “Plaster Cast Publishing in Nineteenth-century Paleontology.” *History of Science* 53, no. 4 (2015): 456–91. https://doi.org/10.1177/0073275315580954.

Roberts, Lissa. “Situating Science in Global History: Local Exchanges and Networks of Circulation.” *Itinerario* 33, no. 1 (2009): 9–30. https://doi.org/10.1017/s0165115300002680.

Rudwick, Martin. “Georges Cuvier's Paper Museum of Fossil Bones.” *Archives of Natural History* 27, no. 1 (2000): 51–68. https://doi.org/10.3366/anh.2000.27.1.51.

Rudwick, Martin. *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution*. Chicago: University of Chicago Press, 2005.

Rudwick, Martin. *Worlds Before Adam: The Reconstruction of Geohistory in the Age of Reform*. Chicago: University of Chicago Press, 2010.

Schaaffhausen, Hermann in George Busk. “Translation with Comments of ‘On the Crania of the Most Ancient Races of Man by D. Schaaffhausen.” *Natural History Review* (1861): 155–76.

Schaaffhausen, Hermann. “Ueber Beständigkeit und Umwandlung der Arten.” *Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westphalens* 10 (1853): 420–51.

Schaaffhausen, Hermann. “Zur Kenntnis der ältesten Rasseschädel.” *Archiv für Anatomie, Physiologie und wissenschaftliche Medicine* (1858): 453–78.

Salleh, Anna. “Hobbit Skull in Tug of War,” *ABC News*, November 25, 2004

Sigrid Schmalzer. *The People’s Peking Man: Popular Science and Human Identity in Twentieth-Century China.* Chicago: The University of Chicago Press, 2008.

Schiebinger, Londa. “Forum Introduction: The European Colonial Science Complex.” *Isis* 96, no. 1 (2005): 52–55. https://doi.org/10.1086/430677.

Schiebinger, Londa L. *Plants and empire*. Harvard University Press, 2009.

Schmitz, R. W., D. Serre, G. Bonani, S. Feine, F. Hillgruber, H. Krainitzki, S. Paabo, and F. H. Smith. "The Neandertal Type Site Revisited: Interdisciplinary Investigations of Skeletal Remains from the Neander Valley, Germany." *Proceedings of the National Academy of Sciences* 99, no. 20 (2002): 13342–47. https://doi.org/10.1073/pnas.192464099.

Schmitz, Ralf W., and Thissen Jürgen. *Neandertal Die Geschichte Geht Weiter*. Heidelberg: Spektrum, Akad. Verl., 2000.

Schoetensack, Otto. "Der Unterkiefer des Homo Heidelbergensis aus den Sanden von Mauer bei Heidelberg: Ein Beitrag zur Palaeontologie des Menschen." *Zeitschrift für induktive Abstammungs- und Vererbungslehre* 1 (1908): 408–10.

Schwartz, Jeffrey H. "Race and the Odd History of Human Paleontology." *The Anatomical Record Part B: The New Anatomist* 289B, no. 6 (2006): 225–40. https://doi.org/10.1002/ar.b.20119.

Schwartz, Jeffrey H. *What the Bones Tell Us*. Tucson: University of Arizona Press, 1998.

Secord, James A. "Introduction: The Big Picture." *The British Journal for the History of Science* 26, no. 4 (1993): 387–89.

Secord, James A. "Knowledge in Transit." *Isis* 95, no. 4 (2004): 654–72. https://doi.org/10.1086/430657.

Shapin, Steven. "Placing the View from Nowhere: Historical and Sociological Problems in the Location of Science." *Transactions of the Institute of British Geographers* 23, no. 1 (1998): 5–12. https://doi.org/10.1111/j.0020-2754.1998.00005.x.

Shapin, Steven, and Simon Schaffer. *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*. Princeton: Princeton University Press, 2018.

Shapin, Steven, 1982. "The History of Science and its Sociological Reconstruction," *History of Science*, 20: 157–211.

Shreeve, James. *The Neanderthal Enigma: Solving the Mystery of Modern Human Origins*. London: Penguin, 1996.

Shipman, Pat. *The Man who Found the Missing Link: Eugène Dubois and His Lifelong Quest to Prove Darwin Right*. Cambridge, Mass: Harvard University Press, 2002.

Shipman, Pat, and Paul Storm. “Missing Links: Eugène Dubois and the Origins of Paleoanthropology.” *Evolutionary Anthropology: Issues, News, and Reviews* 11, no. 3 (2002): 108–16. https://doi.org/10.1002/evan.10021.

Sommer, Marianne. “‘An Amusing Account of a Cave in Wales’: William Buckland (1784–1856) and the Red Lady of Paviland.” *The British Journal for the History of Science* 37, no. 1 (2004): 53–74. https://doi.org/10.1017/s0007087403005326.

Sommer, Marianne. “Mirror, Mirror on the Wall.” *Social Studies of Science* 36, no. 2 (2006): 207–40. https://doi.org/10.1177/0306312706054527.

Sommer, Marianne. *Bones and Ochre: The Curious Afterlife of the Red Lady of Paviland*. Cambridge, Mass: Harvard University Press, 2008.

Sollas, William J. “The Taungs Skull.” *Nature* 115, no. 2902 (1925): 908–09.

Spencer, Frank. “The Neanderthals and Their Evolutionary Significance: A Brief Historical Survey.” Essay. In *Origins of Modern Humans: A World Survey of the Fossil Evidence.*, 1–49. New York: Alan Liss, 1984.

Spencer, Frank. *Piltdown: A Scientific Forgery*. New York: Oxford University Press, 1990.

Spencer, Frank. “The Neandertals and Their Evolutionary Significance, a Brief Historical Survey.” in Fred H. Smith and Frank Spencer (eds), *The Origins of Modern Humans: A World Survey of the Fossil Evidence* (New York: A.R. Liss, 1984): 1–49.

Star, Susan Leigh, and James R. Griesemer. “Institutional Ecology, Translations and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39.” *Social Studies of Science* 19, no. 3 (1989): 387–420.

Stocking, George W. *Victorian Anthropology*. London: Collier Macmillan, 1987.

Stoczkowski, Wiktor. *Explaining Human Origins: Myth, Imagination and Conjecture*. Cambridge: Cambridge University Press, 2002.

Stringer, Chris, Peter Andrews. “Genetic and Fossil Evidence for the Origin of Modern Humans.” *Science*. 239 (1988): 1263–68.

Stringer, Chris. “Replacement, Continuity and the Origin of *Homo sapiens*” in: *Continuity or Replacement? Controversies in Homo sapiens Evolution*. Fred Smith (ed). Rotterdam: Balkema, 1992: 9–24.

Štrkalj, G., and Phillip Tobias. “Raymond Dart as a Pioneering Primatologist.” *Homo* 59, no. 4 (2008): 271–86. https://doi.org/10.1016/j.jchb.2008.06.002.

Sutikna, Thomas, Matthew W. Tocheri, Michael J. Morwood, E. Wahyu Saptomo, Rokus Due Awe, Sri Wasisto, Kira E. Westaway et al. “Revised Stratigraphy and Chronology for *Homo floresiensis* at Liang Bua in Indonesia.” *Nature* 532, no. 7599 (2016): 366–69.

Sysling, Fenneke. “Geographies of Difference: Dutch Physical Anthropology in the Colonies and the Netherlands, ca. 1900–1940.” *BMGN - Low Countries Historical Review* 128, 1 (2013): 105–25. https://doi.org/10.18352/bmgn-lchr.8357.

Sysling, Fenneke. *Racial Science and Human Diversity in Colonial Indonesia*. Singapore: NUS Press, 2016.

Tattersall, Ian. “Paleoanthropology: The Last Half-century.” *Evolutionary Anthropology: Issues, News, and Reviews* 9, no. 1 (2000): 2–16. https://doi.org/10.1002/(sici)1520-6505(2000)9:1.

Tattersall, Ian. *The Fossil Trail: How We Know What We Think We Know about Human Evolution*. Oxford: Oxford University Press, 2009.

Tattersall, Ian “Most Momentous Year in the History of Paleoanthropology,” *Scientific American* June 12, 2015.

Theunissen, Bert. *Eugène Dubois and the Ape-Man from Java: The History of the First 'Missing Link' and its Discoverer*. Dordrecht: Kluwer, 1988.

Tobias, Phillip V. “The Discovery of the Taung Skull of Australopithecus Africanus Dart and the Neglected Role of Professor R.B. Young.” *Transactions of the Royal Society of South Africa* 61, no. 2 (2006): 131–38. https://doi.org/10.1080/00359190609519963.

Tobias, Phillip V. *The Brain in Hominid Evolution*. New York: Columbia University Press, 1971.

Tobias, Phillip V. *Into the Past: A Memoir*. Johannesburg : Picador Africa and Wits University Press, 2005.

Tocheri, Matthew W., Caley M. Orr, Susan G. Larson, Thomas Sutikna, E. Wahyu Saptomo, Rokus Awe Due, Tony Djubiantono, Michael J. Morwood, and William L. Jungers. “The Primitive Wrist of *Homo floresiensis* and its Implications for Hominin Evolution.” *Science* 317, no. 5845 (2007): 1743–45.

Trinkaus, Erik and Pat Shipman. *Neandertals: Changing the Image of Mankind*. New York: American Council of Learned Societies, 2008.

Trinkaus, Erik. "Cladistics and the Hominid Fossil Record." *American Journal of Physical Anthropology,* 83 (1990): 1–11.

van Keuren, David. "Theories of Human Evolution: A Century of Debate, 1844–1944," *Isis* 78, no. 3 (1987): 293.

van Riper, A. Bowdoin. *Men Among the Mammoths: Victorian Science and the Discovery of Human Prehistory*. Chicago: University of Chicago Press, 1993.

van Reybrouck, David. "Boule's Error: On the Social Context of Scientific Knowledge." *Antiquity* 76, no. 291 (2002): 158–64. https://doi.org/10.1017/s0003598x00089936.

Verhoeven, Theodor. "Proto-Negrito in den Grotten auf Flores," *Anthropos* 1/2 (1958): 229–32.

Vergano, Dan. "Fresh Scandal Over Old Bones." *USA Today* March 21, 2005.

Vetter, Jeremy "Cowboys, Scientists, and Fossils." *Isis* 99, no. 2 (2008): 273–303. https://doi.org/10.1086/588688.

Vetter, Jeremy. *Field Life: Science in the American West during the Railroad Era*. Pittsburgh: University of Pittsburgh Press, 2016.

Vickers, Adrian. *A History of Modern Indonesia* (Cambridge: Cambridge University Press, 2005).

Vidal, John. "Bones of Contention." *The Guardian*, January 12, 2005. https://www.theguardian.com/science/2005/jan/13/research.science

Henke, Winfried. "Historical Overview of Paleoanthropological Research." *Handbook of Paleoanthropology. Heidelberg: Springer-Verlag* (2007).

Weidenreich, Franz. "The 'Neanderthal Man' and the Ancestors of '*Homo Sapiens*.'" *American Anthropologist* 45, no. 1 (1943): 39–48. https://doi.org/10.1525/aa.1943.45.1.02a00040.

Weiner, Joseph Sidney, Kenneth Page Oakley, and Wilfred E. Le Gros Clark. "The Solution of the Piltdown Problem." In *Bulletin of the British Museum (Natural History), Geology* 2, no. 3 (1953): 139–46.

Weston, Eleanor M., and Adrian M. Lister. "Insular Dwarfism in Hippos and a Model for Brain Size Reduction in *Homo floresiensis*." *Nature* 459, no. 7243 (2009): 85–88.

White, Tim D., Gen Suwa, and Berhane Asfaw. "*Australopithecus ramidus*, a New Species of Early Hominid from Aramis, Ethiopia." *Nature* 371, no. 6495 (1994): 306–12. https://doi.org/10.1038/371306a0.

Wolpoff, Milford H. "Competitive Exclusion Among Lower Pleistocene Hominids: The Single Species Hypothesis." *Man* 6, no. 4 (1971): 601. https://doi.org/10.2307/2799185.

Wolpoff, Milford, Wu Xinzhi, and Alan Thorne. "Modern Homo Sapiens Origins: A General Theory of Hominid Evolution Involving the Fossil Evidence from East Asia." In *The Origins of Modern Humans*. Fred Smith ed. Liss, New York 1984, 411–83.

Wolpoff, Milford et al., "Modern Human Origins" *Science*. 241 no. 4867 (1988): 772–74.

Wood, Bernard. "The 'Neanderthals' of the College of Surgeons." *Annals of the Royal College of Surgeons of England* 61, no. 5 (1979): 385.

Wood, Bernard. "Origin and Evolution of the Genus *Homo*." *Nature* 355, no. 6363 (1992): 783–90.

Wood, Bernard, and Mark Collard. "The Changing Face of Genus *Homo*." *Evolutionary Anthropology: Issues, News, and Reviews* 8, no. 6 (1999): 195–207. https://doi.org/10.1002/(sici)1520-6505(1999)8:6<195::aid-evan1>3.0.co;2-2.

Woodward, Arthur Smith. "A New Cave Man from Rhodesia, South Africa." *Nature* (1921): 371.

Woodward, Arthur Smith. "The Fossil Anthropoid Ape from Taungs." *Nature*, 115 (1925): 235.

Young, Robert B. "The Calcareous Tufa Deposits of the Campbell Rand, from Boetsap to Taungs Native Reserve." *South African Journal of Geology*, 28 (1925) 55–67.

Zuckerman, Solly. "Age-changes in the Chimpanzee, with Special Reference to Growth of Brain, Eruption of Teeth, and Estimation of Age; with a Note on the Taungs Ape. *Journal of Zoology*, 98 no 1. (1928), 1–42.