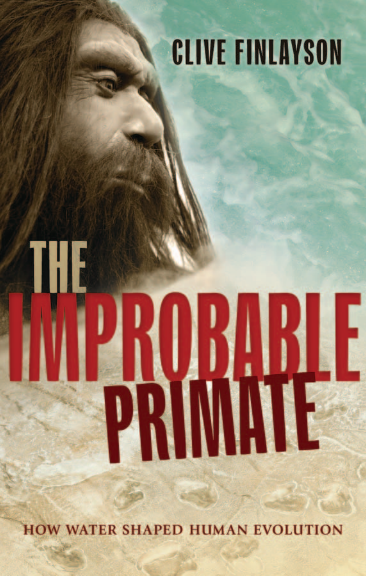

CLIVE FINLAYSON

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PREFACE

NEVER MORE THAN ONE SPECIES OF MAN . . .

In 1950, Ernst Mayr wrote about our species and our evolution in a Cold Spring Harbor symposium which was dedicated to the origin and evolution of man.[1] The symposia held at the Cold Spring Harbor Laboratory in New York since 1933 have debated major discoveries in biology and are highly regarded as landmark meetings. Mayr was one of the century's leading and highly respected evolutionary biologists and a key contributor to the modern evolutionary synthesis. In 1942 he had published a seminal book *Systematics and the Origin of Species from the Viewpoint of a Zoologist*. In it he featured his biological species concept, defining species as groups of organisms capable of freely interbreeding with each other and producing viable offspring in the wild. Mayr's paper at the Cold Spring Harbor symposium was therefore a must for contemporary students of human evolution. He made several very pointed remarks that are worth recalling over 60 years later. Mayr recognized that without fully appreciating the correct categorization of humans, we would be unable to understand our evolution: 'The whole problem of the origin of man depends, to a considerable extent, on the proper definition and evaluation of taxonomic categories.' He recognized that the arrival of the fully upright human marked a significant and unprecedented departure from anything that had come before and surmised that this arrival in what he called a different adaptive zone exposed humans to new selection pressures. This departure from all primate models that had preceded it, was so marked that it deserved a higher taxonomic category than that of species. With *Homo* came a new genus and, I would argue, a highly improbable primate. Mayr then went on to make a remark for which he has been criticized by palaeoanthropologists ever since. Mayr clearly stated that 'Indeed, all the now available evidence can be interpreted as indicating that, in spite of much geographical variation, never more than one species of man existed on the earth at any one time'. Mayr, I will argue, was right even though today many scholars of our evolution would disagree, still preferring to award species status to fossils of *Homo* based on morphological criteria.

The possible exception to Mayr's statement could be the Hobbit on Flores. Its small stature may have prevented interbreeding with other humans, purely because of physical limitations, but we cannot be certain of this. The application of the biological species concept to allopatric populations, those separated from each other by geographical or other barriers, has always been problematic because it is impossible to know whether those populations might be capable of interbreeding were these impediments removed. The Hobbit, isolated in a remote world almost taken out of a Jules Verne novel, is an example of an allopatric population whose taxonomic status is difficult to determine. Hobbit aside, what is clear now is that *Homo sapiens* was a polytypic species, that is, highly geographically variable but all individuals capable of reproducing with each other as Mayr recognized, but no different from many other similar examples from the natural world. But there is no evidence to suggest that these populations were ever distinct enough for interbreeding to have been prevented. The bastion of the palaeoanthropologists who supported the many species of Man, the Neanderthals, collapsed with the clear evidence that our own lineage interbred with theirs to a sufficient degree that the signal was retained in our genome. Then came the Denisovans, another ancient lineage now also shown to have exchanged genes with our own. If these populations were able to interbreed, and behave like one and the same species, after hundreds of thousands of years of isolation, then the question is resolved and Mayr shown to have been right.

Not everyone agrees. Some palaeoanthropologists maintain a multi-species view while accepting that there was interbreeding. They argue that hybridization can occur in the wild today between closely related species.[2] Mayr understood well that different species sometimes hybridize but they form stable hybrid zones which are confined geographically.[3] However, this is not what we observe with the Neanderthals, the Denisovans, and our ancestors. If the genetic signal has been retained right down to today, interbreeding would not have been an isolated affair.

Some notable palaeoanthropologists have followed Mayr in declaring *Homo sapiens* to have been a polytypic species throughout its nearly 2-million-year-old history. Emiliano Aguirre, the great scientist who discovered the spectacular site of Atapuerca was one and Milford Wolpoff in Michigan was another.[4] When I first entered this world of the study of our evolution, back in the early 1990s, the case seemed closed. The Neanderthals were considered a different species from us and so were a number of others, like *Homo erectus* and *Homo heidelbergensis*. Linked to these distinctions was the Out-of-Africa model. It explained the global expansion of our species from the African continent in relatively recent times, perhaps no more than 50 thousand years ago; our ancestors replaced all the archaic *Homo* species that they came across during the epic journey. It really was about how superior we were and how we had left no room for anyone else on the planet. We just had to be a different species.

How wrong we were. Time has shown that Mayr, Aguirre, and Wolpoff were probably right. The criticism that will be levelled against this viewpoint is that it is clear that the evolution of *Homo* was not linear and species branched off repeatedly. Lineages certainly branched off repeatedly, many more times than even the most ardent species-splitting palaeoanthropologist might admit; but they were lineages, not species. It may be argued that palaeoanthropologists are using the definition of species in a different way, following concepts of palaeontological species for example.[5] But surely the only species concept that is verifiable is the biological species concept, which requires good species not to interbreed regularly or produce viable offspring in the wild. One-offs or hybrid zones reinforce the message that evolving species may be linked by intermediates but two lineages that produced viable offspring in significant numbers would on this argument be part of the same species. Neanderthals and humans, on this basis, are the same species; and so, I will argue, was *erectus*, *heidelbergensis*, the Denisovans, and any other lineage we might care to compartmentalize. My argument in support of integrating *erectus* and *heidelbergensis* also under *Homo sapiens* follows since these forms were ancestral to the Neanderthals, humans, and the Denisovans; their morphological differences are the product of small samples and the discontinuity of the fossil record and mask continuous evolutionary trajectories over 2 million years. If the end products, after those 2 million years, were still behaving as one and the same species then it is unlikely that earlier forms, which were separated by less time, would have been any different.

In the early days I was taken by the multi-species idea and also by the Out-of-Africa replacement model. It seemed clear-cut and beyond dispute. But as I started to read more papers and books, and to think about all that I had been taught as a zoologist about the biogeography and evolution of species I began to question the widely accepted model. I was then only getting started in the world of human evolutionary studies and the views of a newcomer, and one who was not even a palaeoanthropologist, cut no ice. But the field of human evolution is first and foremost biology; the field of human geographical dispersals and extinctions is biogeography; and the field of the dynamics of human populations is population genetics. So let's use these tried and tested tools to understand ourselves. We might do better than developing hypotheses on the basis of metric measurements of isolated human crania when we cannot get a handle on the natural variation within the populations from which the crania came.

Once we emancipate ourselves from the shackles of rigid multi-species thinking the world opens itself up in front of us. Our evolution, from *erectus* on, concerned anatomical changes: those changes involved the tweaking of the starting body plan but they did not involve new designs. The earliest *erectus* differs from the most recent *sapiens* in degree. The process of evolution depended on each population; those in the arid areas of southern Middle Earth (Fig. 1; see also Chapter 5) kept on going down the lightweight and gracile line; those populations further north reinvested in muscle for power; and we do not know what *erectus* in south-east Asia did. Populations kept mixing and separating, generating the impression of a mosaic evolution of features. We should expect the greatest degree of contact and mixing to be precisely in the core area of Middle Earth, because it was an extended hub with similar climatic and environmental conditions throughout. No population was archaic, no population was modern: some were simply older and others more recent. Each was adapted to its own particular moment.

I will argue in this book that water was a key ingredient in shaping our evolution. The differences that we observe, for example, between the gracile kinds of humans and the more muscular ones, such as the Neanderthals, had a lot to do with water. The need to drink water daily unifies all humans, past and present ones. Yet most emphasis in human evolutionary studies is on food: what was eaten and how it was procured. Rarely does water enter the discussion. I will propose that the patchy distribution of water across the landscape in arid and semi-arid areas was critical to the origin and evolution of humans capable of traversing large tracts of land efficiently and speedily. Lightweight and gracile bodies behaved optimally under such conditions and muscularity was sacrificed in such situations. In addition to this, the problem-solving, information storage and retrieval abilities of good brains were particularly favoured in situations where choices of where and when to go for water determined whether individuals survived or died. Only in those parts of the world where water sources were common, could the investment in bulky, muscular bodies proceed unchecked. In the wet regions of Eurasia, close to the oceanic influence of the Atlantic and where topography accumulated water, the Neanderthals

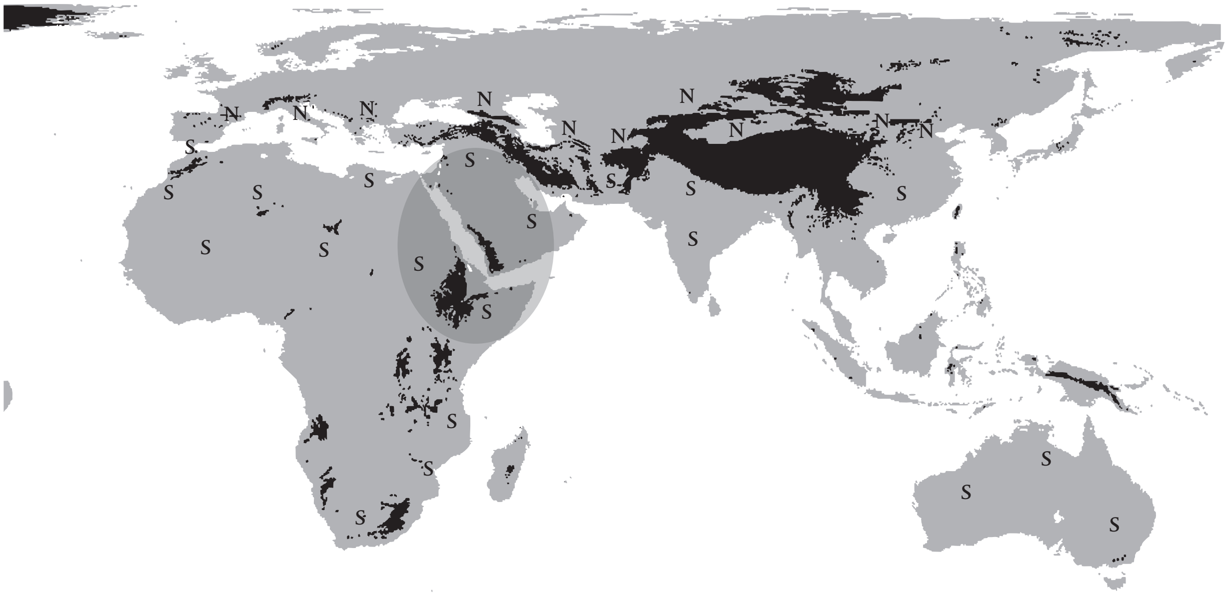

FIGURE 1. Map showing the geographical extent of Middle Earth. N = northern Middle Earth, a region that was colonized by humans from the core or southern Middle Earth; with a cool climate and short winter daylength this part of Middle Earth was always harder for humans to live in than southern Middle Earth. S = southern Middle Earth, a region of relatively continuous human presence, punctuated by periods when deserts or rainforests created barriers. Ellipse marks core Middle Earth which is defined in this book as the cauldron of human evolution.

epitomized this particular strategy. The differences between the extremes of a continuum—our lineage and the Neanderthals—were nevertheless insufficient to have produced two distinct biological species. They were, instead, geographical components of a widespread polytypic species. Seeing our evolution as that of an evolving polytypic species clarifies our behavioural evolution too. The use of different kinds of stone tools, the co-occurrence of distinct ways of making stone tools in the same site, and trends towards an increasingly lightweight and portable kit are best understood in the context of this evolving species, with its geographical variants, and with water as a major driver and marker of differences.

If taxonomic splitting of our species into distinct species has hindered how we see and understand ourselves, the typological classification of stone tools has set the understanding of our behavioural evolution back decades. It is time that we stopped talking of stone ages as if they were defining markers of our behavioural and cognitive evolution. There is too much overlap and variability for such a simple and clear-cut picture of Lower-Middle-Upper Stone Ages or Palaeolithic to make any sense. It follows that if stone ages did not exist, except in the minds of archaeologists, transitions between different stone ages are just as irrelevant. It gets worse. How important were stone tools in the daily lives of people and how defining were they of the people who made them?

The toolkit of the Mardu people of the deserts of Australia consists of multi-purpose appliances and instant tools (see Chapter 10). How much of that kit was stone? Not much. A few flakes and stone pounders and some stones used as anvils when grinding seeds. The rest was made out of wood or vegetal fibre.

The 780-thousand-year-old evidence from Gesher Benot Ya'aqov (GBY; Chapter 6) shows us how important wood and plant matter were to humans that far back. Wood and other plant matter only preserves under very special situations, such as the waterlogged conditions at GBY. Most of the time, such materials rot and disintegrate. So we really have no handle on the tool and weapon kit people had but the little we have hints at the importance of wood: 400-thousand-year-old wooden spears in Schöningen (Germany) or the rich array of wooden implements at the 40-thousand-year-old Neanderthal site of Abric Romani (Spain).[6] It makes sense that wood should have been the main material used by humans throughout our evolutionary history. After all, trees were always available in the habitats that we chose to live in. Just to show how this view impacts on some interpretations of material culture, the use of bone and ivory by the people of the Eurasian Plain after 45 thousand years ago has often been cited as an example of behavioural modernity when all it may show is the flexibility of humans in adapting to circumstances. There were few trees on the open steppe of the Eurasian Plain. Instead there were reindeer, providing antlers, and woolly mammoths, providing ivory and bone. People even made the superstructure of their tents out of mammoth bone.[7] This is not modernity, it is adaptability and improvisation. It had not happened earlier because nobody had entered the open steppe of Eurasia before that.

So what is modernity? I do not know. I would discard the concept altogether. Anatomical modernity is defined with hindsight, a poor way of doing science: we are the latest and so our anatomical features are supposed to be those that characterize being modern when what we really mean is most recent. The same criticism can be levelled on behavioural modernity. The problem once again lies with the application of the term. In the archaeological literature it has become linked to cognitive superiority. Humans became modern because they were cognitively superior to others, who by this definition were archaic. So the most recent (modern to the archaeologists) people on the planet are considered to be cognitively superior to all those who came before. In effect this puts us at the pinnacle of the evolutionary pyramid; all others, even the Neanderthals, must be at least one step below. If modernity, used in this sense, implies cognitive superiority, does this mean that we are cognitively superior to our parents and grandparents and their own parents who may not have had aeroplanes, fridges, or the Internet? Does it mean that 21st-century humans are cognitively superior to the Romans? Clearly they are not. Why then must the humans of 20 thousand years ago be cognitively superior (or modern) to the Neanderthals of 40 thousand years ago? Is it because they had different technology and did things differently?

Archaeologists have defined behavioural modernity ambiguously in relation to types of tools and other material culture. How do we distinguish, for example when we find a flint blade in an archaeological context, between the functional use of the blade and the evolutionary position of its makers? Simply put, was the blade made to fit a particular purpose or was it made because that was what that particular group of people did? It is impossible to distinguish between the two. The people of 45 thousand years ago were no more modern than their predecessors or their 'archaic' neighbours, just as we are no more modern than the people of 45 thousand years ago. We have confused the cumulative effects of culture in a social species with behavioural progression.

The thread of human evolution over 1.8 million years ago has therefore been one of adapting to an increasingly arid world while being tied down to the need to drink water regularly. Biologically, this has been expressed by the enhancement of those existing features that made this possible: bigger brains, lighter bodies, longer hind limbs. Behaviourally, it has been expressed through the development of an increasingly multi-purpose and light-weight kit. That is the thread but there were many variations and reversals along the way. The indigenous people of Australia or the westerners that first met them were no more modern than the first populations of *Homo sapiens*. Each did very well in the context of its time. The western settlers who made contact with the indigenous people of Australia made the basic mistake of confusing them for backward savages. I cannot help feeling that many contemporary archaeologists and palaeoanthropologists have made the same mistake when judging the peoples of the past.

As I was finishing this book, a paper was published[8] that reported an ancient African paternal lineage which had not been previously detected by geneticists. The time of the most recent common ancestor of this African-American Y chromosome lineage is estimated at 338 thousand years ago. The paper reported that the date exceeded the oldest anatomically modern human fossils by well over 100 thousand years ago. In palaeoanthropological language, the new date would put this ancestor within the realm of *Homo heidelbergensis* and not *sapiens*, a real problem of interpretation. I do not have such a difficulty. On the contrary it serves to confirm the unity of *Homo sapiens* and that the classification of Middle Pleistocene humans as a separate species—*Homo heidelbergensis*—was wrong.

As this book was going to print, the sensational fifth skull from Dmanisi, Georgia, was published in the journal *Science*.[9] The 1.8-million-year-old skull, attributed to *Homo erectus*, was significantly different in shape from the other skulls from the same site. Put together, the five skulls were as variable as African fossils that have been traditionally classified as three distinct species: *H. erectus*, *H. habilis*, and *H. rudolfensis*. The authors concluded that 1.8 million years ago there had been, in fact, only a single species of *Homo*, for them *erectus*, on the planet. This conclusion supports the idea put forward in this book that we can regard the observed variability of available specimens as representative of variation within a single biological species. If this was by now clear for the most recent branches of the human tree (*sapiens* and *neanderthalensis*), the latest findings show that it was also applicable to the earliest *Homo*.

The ideas presented in this book are my own but they have benefited from discussion with many colleagues and friends. I am most grateful to all of them. My wife, friend, and colleague, Geraldine, has been my prime assessor; she has always had time to discuss and debate an insight, an idea, or a comment, often at the drop of a hat. This might have been while excavating inside a cave, while driving on a motorway, or simply over dinner. She has kept me on track too, warning me of the pitfalls of some of my arguments. Her unique knowledge of habitat structure has been critical for this book.

My son Stewart is my natural history companion, sharing many hours in remote locations with me. His fresh views on animal behaviour and ecology and his passion for caves have kept my own spirit alive. He understands the importance of a good grounding in natural history before even hoping to try to relate to

those great naturalists who were our ancestors, often commenting with incredulity on unrealistic remarks that he has read in scientific papers.

Darren Fa, my former PhD student, is a friend and colleague who has also been deeply involved in our research programme for a long time and who, with Geraldine, participated in an early presentation of our understanding of human biogeography, back in 2000. As a marine biologist, his knowledge and insights of human activity along the intertidal zone are making an important contribution to this field.

I would like to thank all friends and colleagues who have worked with me in the study of our origins and have in some way contributed to the ideas put forward in this book: Joaquín Rodríguez Vidal, Francisco Giles Pacheco, Larry Sawchuk, José Carrión, Juan José Negro, Richard Jennings, Jordi Rosell, Ruth Blasco, Marcia Ponce de León, Christoph Zollikofer, José María Gutierrez López, Alex Menez, and Antonio Sanchez Marco.

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1

The Inverted Panda

If we were able to go back to the Middle Miocene world of 16 million years ago, when apes were widespread across large areas of the Old World,[1] we would be forgiven for not predicting the future existence of a creature that would one day call itself *Homo sapiens.* We might have predicted something like a gorilla, an orang-utan, or a chimpanzee but not a human. Yet this improbable primate's heritage is in the deep forests of the Miocene apes and it is here where we should start looking for the antecedents to the path that led to humans.

Let us start with the brain. There is, after all, no other organ that defines us better. Katherine Milton at Berkeley gave us a great and convincing insight into the function of the primate brain in a forest context.[2] She highlighted the complexity of the rainforest world that the early insect-eating ancestors of the primates entered at the end of the Cretaceous, some 70 million years ago. This was a world that was coming under the dominance of the flowering plants and some of these early insectivorous mammals were probably drawn up into the trees where insects gathered round flowers. Once up there, flowers and young leaves may have been added to the diet. We can imagine a scene with shrew-like mammals scurrying among the branches of an ancient forest, snapping away at juicy insects clustered around ancient flowers. Occasionally one might take a bite at an insect and accidentally swallow a petal. If it liked the taste, and there was no ill effect, petals might have been added to this individual's diet. Let us imagine that these animals with a wide tolerance in the recognition of insects, which may have allowed for such mistakes, could have gained some advantage from consuming petals. In time the forest might have been swamped with petal-snapping descendants and any genetic novelty improving petal-snapping would have been favoured. I shall say more about how behaviour can predispose animals to particular genetic novelties in Chapter 4. The traits that characterized the primates thus evolved as plants became increasingly important in the diet, the grasping hand being an early innovation that has stayed with us until today.

Once in the difficult, three-dimensional forest canopy any improvements to the visual apparatus would have been favoured. This is because visual discrimination—colour vision, sharpened acuity, and depth perception—would have helped to detect ripe fruits and tiny, young, and succulent leaves from among the vast expanses of green. The green world of the forest canopy may seem luxuriant to us viewing it from the outside but this is a false impression. It is not an easy world at all for a primate. High-quality foods, particularly fruit, are distributed in patches with lots of unsuitable trees in between. These foods are often seasonal so a knowledge of when, as well as where, to locate the good patches is critical to survival. The canopy actually resembles an open ocean or a plains environment in the sense that life is boom