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Frederick E. Grine *Editor*

Hofmeyr

A Late Pleistocene Human Skull from South Africa

Springer

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Cover image: Photo of the Karoo landscape of the region near Hofmeyr taken from the lower slopes of the Bamboesberg Mountains. The conical hill, known as Spitskop, is located directly east of the Hofmeyr locality. The Burgersdorp Formation is exposed on the proximate range of hills. Photo by F.E. Grine. Inset photo of the Hofmeyr cranium by F.E. Grine. Cover design by F.E. Grine and K. Thompson.

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Foreword

Over the past decade and a half, the Hofmeyr skull has ignited much curiosity and interest from members of the public, both international and local, who visit the East London Museum. As a well-travelled specimen resting in its original home after its discovery almost seven decades ago, the skull has rekindled a reminder of the rich fossil heritage of the Eastern Cape Province of South Africa and a deeper connection to the story of the evolution of our species. Today the sleepy Karoo town of Hofmeyr has its name carried far and wide by a chance find of a hominin skull from the eroded banks of the Vlekpoort River in 1954. The town has now been elevated to scientific significance through the dedicated research of the authors of the chapters in this volume and the persistent leadership and guidance of its editor, Frederick Grine. The skull rose to worldwide attention in 2007 with the first seminal paper published by Fred Grine and colleagues in *Science* entitled 'Late Pleistocene human skull from Hofmeyr, South Africa, and modern human origins'. Indeed, the importance of Hofmeyr was recognized by *Time* magazine, which declared this *Science* paper to have conveyed one of the top ten scientific discoveries of 2007.

A number of questions have had their answers revealed in the chapters of this book which serve the growing fascination people have regarding our evolutionary history. The skull remained unattended and 'lost' to science until Alan Morris 're-discovered' it as part of audited research on museum human skeletal remains. This was a first and important step in bringing the Hofmeyr skull back into the scientific domain and more importantly bridging a gap between mere curiosity and its link in the study of palaeoanthropology.

This up-to-date collection of work on the Hofmeyr skull elucidates a detailed multidisciplinary synthesis of research on the specimen ranging from the history of its discovery to all aspects of its morphology, geological setting, the movement and diet of the Hofmeyr individual, an interpretation of the endocast, the bony labyrinth and paranasal sinuses and its dentition. It also provides encouragement to museum curators who have human skeletal material in their care never to underestimate the value of any specimen that has not been rigorously investigated particularly in the light of the rapid advances in dating techniques, 2D and 3D morphometric analysis and collaborative research which made sense of the medley of attributes that a single find revealed.

This volume of work makes a further important contribution to the manner in which museums and heritage authorities value paleoanthropological specimens. For the East London Museum, it has placed the Hofmeyr skull into a wide paleoanthropological research orbit allowing a more comprehensive volume of facts to be synthesized for educational programmes which are integral to the vision and objectives of our South African heritage institutions. In addition, through the efforts of Fred Grine, a cast of the Hofmeyr skull has found a place in one of the most comprehensive human origins displays in any museum in the world—the Koch Hall of Human Origins at the Smithsonian Institution's National Museum of Natural History in Washington, DC. This has brought great credence to the Eastern Cape Province and the curatorial home of the skull. At a local level, a second cast has been used extensively for outreach programmes to promote the study of palaeoanthropology, and this has been a popular point of call for hundreds of learners at the annual Scifest Africa held in Makhanda (previously Grahamstown).

Considering that the Hofmeyr site is only one of two in Africa to reveal a reasonably complete human cranium dating to Marine Isotope Stage 3 (the other being at Nazlet Khater in Egypt) it was vitally important that high-quality research was undertaken on the specimen. The various chapters of this volume carry the themes of its background and history, the morphological and morphometric analyses of the skull as a whole and detailed analyses of selected aspects. A final concluding summary highlights the significance of the specimen in understanding human evolution.

The Eastern Cape Province harbours a rich mosaic of coastal middens, Khoisan rock art and lithic sites and the addition of a Late Pleistocene skull to this palette enriches our understanding of the prehistory of *Homo sapiens* in the region. The body of work to follow will cement this mosaic by revealing the importance of a rare discovery, the first of its kind for the region, and encourage further paleoanthropological research in this unique part of the world.

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Preface

There are some issues in human paleontology that are seemingly timeless. One of these is the emergence and subsequent evolution of our own species. An abundance of genetic and paleontological evidence implicates Africa not only as the geographic source of *Homo sapiens* during Marine Isotope Stage (MIS) 7 but also as the home to subsequent morphological and behavioral development until the first successful, lasting emigration into Eurasia and beyond in MIS 3. The African fossil record for our species over this lengthy period is comprised largely of isolated teeth or small cranial and postcranial fragments. Only a dozen or so sites have provided particularly informative crania and/or skeletons, and the majority of these date to MIS 7–5. None are known from MIS 4, and only two that date to MIS 3 at between 37.6 and 36.2 ka—Nazlet Khater and Hofmeyr—have yielded reasonably complete skulls.

MIS 3 is of paleoanthropological significance because of its climatic variability across Africa and especially in southern Africa as the continent experienced a transition from a moderate climatic period in MIS 4 to a severe glacial period, the Last Glacial Maximum in MIS 2. The period between 57 and 20 ka also saw a mosaic of archaeological technologies with the transition from the Middle Stone Age (MSA) to the Later Stone Age (LSA). The lithic record in this span speaks to a geographically adventitious transition to greater bipolar reduction and lithic miniaturization but with persistent regional variability and asynchronous change through time.

In contrast to the detailed coverage that has been afforded the MIS 3 human remains and the site of Nazlet Khater, Hofmeyr has been provided with comparatively little documentation. Hofmeyr is undoubtedly one of the most important Late Pleistocene specimens in Africa. The present volume provides a compendium of research papers by some of the world's leading experts in their respective fields that deal with the background and morphology of this paleoanthropological treasure. These contributions provide an excellent view of what we know about human evolution and adaptation in the Late Pleistocene, and what additional knowledge we seek in the quest to more fully appreciate the Late Pleistocene palaeoanthropology of Africa. I am grateful to all of the colleagues who have devoted their time and expertise to this effort. I hope that they have gained fulfillment from contributing to the documentation, analysis and understanding of Hofmeyr.

I am also grateful to Springer's Vertebrate Paleobiology and Paleoanthropology Series Editor, Eric Delson, for his commitment, unwavering assistance and support throughout all stages of this volume's development. I thank all 29 peer-reviewers for their cogent comments and suggestions on the chapters that comprise this volume. I am grateful to the Production Staff at Springer for their care and devotion to excellence in the production of this book. We didn't always make it easy for them! I thank Dr. Katharine E. T. H. Thompson for her skillful assistance in creating the cover illustration and helping with finalizing many of the figures.

Stony Brook, USA — Frederick E. Grine

The original version of the book was revised: the copyright year in all in-line references of the chapters was incorrect. This has now been corrected. The correction to the book is available at https://doi.org/10.1007/978-3-031-07426-4_14

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Chapter 1
Introduction: The Fossil Record of *Homo sapiens* in Africa – Morphological Variability in the Late Quaternary and the Significance of the Hofmeyr Skull

Frederick E. Grine

Abstract Late Quaternary African fossils from MIS 8 to MIS 2 provide some idea of the considerable morphological diversity that accompanied the emergence and subsequent evolution of *Homo sapiens*. Fossils that are universally accepted as belonging to our species first appear in MIS 7 at about 200 ka. The intervening 190,000 years until just prior to the Holocene finds human fossils from approximately 50 sites across the African continent, but the vast majority are represented by isolated teeth or small fragments of bone. Only a dozen or so particularly informative crania are known from this lengthy span of time. Most of these date to between MIS 7 and MIS 5, none are known from MIS 4, and only two date to MIS 3. The final key phase of human evolutionary development, our worldwide expansion from Africa, occurred in MIS 3 between about 60 and 40 ka. Hofmeyr represents the only example of sub-Saharan cranial morphology that dates to the temporal span of MIS 3. The chapters in this volume document the background to this specimen and provide details of its anatomy in the context of recent African populations and penecontemporaneous Late Pleistocene crania from North Africa and Eurasia.

Keywords Cranial variability • MIS 8 • MIS 7 • MIS 3 • Diversity • Evolution

The Late Quaternary fossil record of Africa provides a tantalizing glimpse into the considerable morphological diversity that accompanied the emergence and subsequent evolution of *Homo sapiens*. Genomic evidence indicates that the lineage that culminates in us may have separated from that leading to Neandertals and Denisovans prior to 430 ka (Meyer et al., 2016). The majority of genetic studies indicate the earliest population divergence within *Homo sapiens* (i.e., between the Khoesan and all other living humans [Veeramah & Hammer, 2014]) occurred sometime between ca. 200–150 ka (Chan et al., 2015; Gronau et al., 2011; Henn et al., 2018; Mallick et al., 2016; Schiffels & Durbin, 2014; Schlebusch et al., 2012; Song et al., 2017; Veeramah et al., 2012), although even earlier divergence dates of 300–250 ka (Scally & Durbin, 2012) or perhaps 350–260 ka (Schlebusch et al., 2017) have been proposed.

With regard to the fossil evidence pertaining to the emergence of our species, it is, of course, possible to attribute any specimen to *H. sapiens* that is seen to exhibit any trait by which it resembles modern humans more than archaic forms such as *H. erectus*. Depending upon one's predilection, a fossil that evinces even a single synapomorphy with us can be viewed as an "early archaic" member of our species. Thus, for example, Bräuer (2001, 2008) referred the Kabwe 1 cranium – the holotype of *Homo rhodesiensis* – along with the Saldanha calotte and the Bodo cranium to "early archaic *Homo sapiens*" that was viewed as being transitional to us from "developed" *Homo erectus*.

However, fossils that arguably display sufficient morphology to qualify as members of populations with obviously close affinities to *H. sapiens* or perhaps even as early members of the species itself appear only in MIS 8 at about 300–260 ka. These include specimens such as the cranium from Florisbad that has been dated to approximately 259 ± 35 ka (e.g., Bräuer, 2008; Bruner et al., 2013; Grün et al., 1996; Lahr & Foley, 1998; Pearson, 2013; Rightmire, 1978, 2009; Stringer, 1996, 2016). Other specimens that are *possibly* somewhat older are known from the Moroccan site of Jebel Irhoud. These fossils were initially dated to 190–90 ka from ESR estimates on associated mammalian teeth (Grün & Stringer, 1991), and this age was supported by a U-series/ESR profile of 160 ± 16 ka for a human tooth

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fragment (Smith et al., 2007). However, subsequent thermoluminescence (TL) dating of burnt flints suggested an age of 315 ± 34 ka and this has been supported by a "recalculated" U-series ESR date of 286 ± 32 ka for hominin tooth enamel (Richter et al., 2017). One is left wondering whether these recalculated dates are perhaps being driven by the similarly ancient molecular divergence estimates (Meyer et al., 2016; Scally & Durbin, 2012; Schlebusch et al., 2017). The Jebel Irhoud specimens possess undivided supraorbital tori, no chin, and an elongate rather than a globular neurocranium. In many respects, they are no more modern than the Florisbad cranium. Although some workers have perceived the Jebel Irhoud assemblage as being attributable to *H. sapiens* (e.g., Hublin, 1992; Hublin et al., 2017; Stringer & Buck, 2014), others have regarded it as representing a late-surviving archaic population (e.g., Bruner & Pearson, 2013). The relationships between MIS 8 populations as represented by specimens like those from Florisbad and Jebel Irhoud and living *Homo sapiens* are far from resolved.

That is not to say that all specimens that derive from this temporal period (MIS 8 at between ca. 300–243 ka) are necessarily attributable to *H. sapiens* or even to a lineage leading to it. Indeed, bones of an undoubtedly distinct species, *Homo naledi*, whose phylogenetic relationships remain unclear, have been recovered from the Rising Star Cave system, South Africa with an estimated age of some 335–236 ka (Berger et al., 2015; Dirks et al., 2017; Hawks et al., 2017).

The oldest fossil over which there is unanimity concerning its undoubted attribution to *H. sapiens* is the Omo I skull and partial skeleton from the upper part of Member 1 of the Kibish Formation, Ethiopia. Omo I is one of three fossils recovered from these deposits in 1967 by a team led by Leakey (1969). Omo II comprises a well-preserved calvarium and Omo III consists of neurocranial and facial fragments. Omo II presents somewhat more archaic morphology than Omo I, which has led to suggestions of a single population that showed considerable individual variation (Day, 1969; Rightmire, 1976; Trinkaus, 2005), the contemporaneous presence of two different populations (Day & Stringer, 1982), or that Omo I is younger and possibly intrusive (e.g., Bräuer, 2001; Bräuer et al., 1997; Chavaillon, 1982). However, subsequent fieldwork led by J. G. Fleagle resulted in the discovery of additional parts of the Omo I skeleton that had weathered out of the level excavated in 1967 by Leakey. Some of these refitted with bones discovered in 1967 (Pearson et al., 2008). This discovery, together with more comprehensive stratigraphic analyses of the site (Brown & Fuller, 2008; McDougall et al., 2005) have provided ample evidence for the contemporaneity of the Member 1 hominin specimens. They were deposited during a period of high-water level in Lake Turkana correlated with Mediterranean sapropel 7 at c. 197 ka (McDougall et al., 2008). Additionally, the Nakaákire Tuff, which outcrops just below the level of the fossils, has been dated to 196 ka (McDougall et al., 2005), and the KHS Tuff at the base of Member 2, which overlies the hominin recovery sites, has been dated by correlation with other tuffs in East Africa to 172 ka (Brown et al., 2012). This served to securely bracket the Omo I and II fossils to between 197 and 172 ka, with their stratigraphic position placing them closer to ca. 195 ka. Aubert et al. (2012) conducted U-series dating on a fragment of the Omo I cranium, which yielded a *minimum* age of some 187–155 ka. However, a more recent study has concluded that the KHS tuff in the overlying Member II of the Kibish Formation has an age of 233 ± 22 ka based on correlations with tuffs elsewhere in Ethiopia (Vidal et al., 2022). As such, the Omo I skeleton would appear to be just over 233 ka old.

Fossils that are universally recognized as being attributable to *Homo sapiens*, as defined by the possession of a *number* of morphological synapomorphies shared with us, appear for the first time in Africa about 200 ka (Weaver, 2012) in the temporal span between MIS 7 and MIS 6. Not only at this time, but subsequently throughout the Pleistocene, the degree of morphological variation among African crania can be rather striking, and its significance continues to be the subject of discussion (e.g., Hammer et al., 2011; Scerri et al., 2018; Stringer, 2007). Unfortunately, the human fossil record in Africa over the next 170,000 years until MIS 2 is decidedly paltry. Indeed, it is only after some 15,000 years ago (e.g., at North African sites such as Afalou-bou-Rhummel, Jebel Sahaba 117 and Grotte des Pigeons) that reasonably large numbers of skeletons are known (Grine, 2016).

African *Homo sapiens* fossils that are constrained between 200 ka (MIS 7) and just prior to the Holocene (in MIS 2) are known from approximately 50 sites. While this number is impressive, evidence from the vast majority of sites consists of isolated teeth or small cranial and postcranial fragments. Only a dozen or so sites have provided particularly informative specimens, and the majority of these (e.g., those from Herto, Singa, Ngaloba, Klasies River, Dar-Es-Soltan, Eyasi and Aduma) date to MIS 7 - MIS 5. None are known from MIS 4, and only two sites that date to MIS 3 have yielded reasonably complete crania (Grine, 2016).

The first of these sites, Nazlet Khater in Egypt (Bouchneb & Crevecoeur, 2009; Crevecoeur, 2008, 2012; Crevecoeur et al., 2009; Vermeersch, 2002), has produced two specimens dated to 37.6 ± 3.5 ka (AMS ^{14}C) and 38 ± 6 ka (ESR on tooth enamel). The cranium, which has been described as "robust," presents an overall modern appearance with a prominent chin, rounded cranial form, modest dental dimensions and no supraorbital torus. At the same time, however, Nazlet Khater evinces several archaic features, including a thick cranial vault, a broad ramus and a robust mandibular corpus. Its inner ear morphology is also unusual among recent humans but occurs with some frequency among both Middle and Upper Paleolithic specimens from Eurasia (Bouchneb & Crevecoeur, 2009; Crevecoeur, 2012).

The second specimen from MIS 3 is the partial skull from Hofmeyr, South Africa (Grine et al., 2007). The skull was discovered in 1954 by a farmer digging for sand in a dry channel bed of the Vlekpoort River. It was found without any associated archaeological or faunal evidence, and its geological context precluded any assessment of its geochronological age. Although the bone lacked sufficient collagen to be amenable to direct AMS ^{14}C dating, extraction of the heavily indurated carbonate sand matrix that largely filled the endocranial cavity enabled assessment using a combination of OSL and uranium-series dating methods. This resulted in an estimate of its burial time at 36.2 ± 3.3 ka (Grine et al., 2007). The cranium is morphologically modern overall, but it possesses a moderately strong supraorbital torus and projecting glabella as well as marked alveolar prognathism (Grine et al., 2007). Preliminary morphometric assessment indicated that while the cranium could be accommodated within the 95% confidence ellipse of some sub-Saharan African samples, it was rather distinct from Khoesan crania and shared distinct affinities with penecontemporaneous Upper Palaeolithic specimens from Eurasia (Grine et al., 2007). Subsequent comparisons between Hofmeyr and remains such as Nazlet Khater point to a greater range of variation among these Late Pleistocene human crania than is evident today (Crevecoeur et al., 2009).

The Hofmeyr skull relates to what Bergström et al. (2021) have identified as the final of three key phases related to modern human evolution, namely our worldwide expansion between about 60 and 40 ka. Bergström et al. (2021) have also emphasized the high degree of morphological variability that is evident in this and the earlier fossil records of *Homo sapiens* in Africa. Indeed, this morphological variability seems to be mirrored by recent analyses that have highlighted genomic variation across Africa and its potential to speak to past migration and selection events (Choudhury et al., 2020a, 2020b; Hollfelder et al., 2021; Ko et al., 2013; Schlebusch et al., 2020; Sirugo et al., 2019; Tishkoff et al., 2009; Vincente & Schlebusch, 2020; Williams et al., 2021).

Whereas the Nazlet Khater specimens have received considerable attention and analysis, there has been comparatively little work done on the Hofmeyr skull beyond its initial description (Grine et al., 2007), comparison with Nazlet Khater (Crevecoeur et al., 2009), and its partial reconstruction (Grine et al., 2010).

The present volume documents the background of this unique specimen and details its morphology in the context of recent African populations and penecontemporaneous Late Pleistocene samples from North Africa and Eurasia. The contributions in Part 1 present information that enables appreciation of the contextual significance of the skull. Although it has not been possible to extract endogenous aDNA from Hofmeyr, a knowledge of the Later Stone Age genetic landscape permits the specimen to be placed in context. Hofmeyr is unique among South African human fossils in deriving from the Karoo of the Eastern Cape Province, and appreciation of its geological setting is essential to interpret the data relating to its biogeochemical assessment. Part 1 also includes a discussion of the history of the discovery and subsequent mishandling of the skull. The three chapters in Part 2 deal with the morphological and morphometric comparisons of the skull as a whole. The first of these provides a detailed morphological description of the specimen, and the other two entail 2D and 3D geometric morphometric studies that place the cranium in the milieu of recent African as well as penecontemporaneous Eurasian population samples. The contributions in Part 3 provide detailed analyses of the endocranium, the bony labyrinth, the frontal and maxillary sinuses, and the dentition. A final chapter provides a summary and synthesis of the contributions to this volume.

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Part I

Background and History

Chapter 2
Lost and Found: The Discovery and Rediscovery of the Hofmeyr Skull

Alan G. Morris

Abstract The discovery of the Hofmeyr Skull reminds us that chance is the biggest factor in the uncovering of the fossil evidence for human evolution. Critical also is the presence of a network of interested amateurs who are, in turn, connected to local institutions where discoveries can be evaluated. The Hofmeyr skull was presented to the East London Museum in January 1956 where it triggered a series of investigations undertaken in the 1960s and 1970s. Unfortunately, without a date, these early studies did not lead to published results. During this time the skull suffered significant damage on three different occasions and was ultimately transferred from the East London Museum to the Port Elizabeth Museum, at which point it was miscataloged and effectively lost. The skull was rediscovered in the Port Elizabeth Museum in the 1980s and reunited with it original accession data. New methods of analysis have not only shown that the specimen is an important human fossil but have finally allowed the specimen to be successfully dated. The discovery and 'rediscovery' of the Hofmeyr skull shows how important careful museum curation is in the field of palaeoanthropology, and this is of special importance in the event that new analytical technologies can be applied in the future.

Keywords Eastern Cape Province • East London Museum • Marjorie Courtney-Latimer • Raymond A Dart • Boskop skull • Optically-stimulated Luminescence

Introduction

Serendipity is perhaps the most powerful tool in the discovery of the fossil remains of human fossils. We tend to forget in these days of expeditions run by well-funded research institutions, that initial discoveries often relied on the chance finding of fossils by interested amateurs. Such was very much the case when a mineralised skull encased in red Karoo soil was brought to Marjorie Courtenay-Latimer at the East London Museum in January 1956. For generations, the stock farmers of the Karoo drylands of the Eastern Cape in South Africa had divided the land so that each of their sons could inherit a farm on his own. By the 1940s the land was stretched beyond its carrying capacity and the grazing animals had stripped the veld of its vegetation. The soil began to erode and soon the beds of the rivers became deep erosion channels as they funnelled the valuable topsoil south toward the Indian Ocean. The government of the day had to take drastic measures, and after expropriating all of the farms on the higher ground, it began a programme of construction of anti-erosion weirs in the riverbeds. It was in one of these deep erosion gullies that Chris Hattingh noticed the fossilised skull now known as the Hofmeyr cranium.

The Discovery

Sometime in 1954, Mr. Hattingh was building an anti-erosion dam on the Vlekpoort River on his farm Klipdrift about 15 kms east of the village of Hofmeyr. He noticed the fossil skull lying near the riverbed at the bottom of an erosion channel at least six metres deep. Hattingh was not sure what to do with his discovery, but eventually he brought it to the attention of a friend, Mr. S. L. Moorcroft. It was Moorcroft who suggested the donation to Marjorie Courtney-Latimer of the East London Museum on the 6th of

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January 1956. There is some debate around the exact year of the discovery, as Hattingh stated in his letter to Courtenay-Latimer in early 1956 that he had found the skull about 18 months before,[1] but in an oral statement to the archaeologist H. J. Deacon when Deacon visited the site in 1964, Hattingh indicated that the discovery was much earlier, circa 1952, and that the skull had spent some years in his garage because his wife would not allow him to bring it into the house (Kaye, 1965). The 1954/55 date perhaps seems more likely as it would have been fresher in his memory in 1956. Hattingh found no other bones or artefacts, but because the river was flowing strongly at the time, he knew that the skull had not travelled far from its original location.[1] The skull was filled with sandy red alluvium. The left side of the braincase and some of the base of the skull had been broken away and lost, but the back part of the mandible and the first two cervical vertebrae were still attached in the position they would have been when the individual died and were now held in position by the hardened red soil.

In the 1950s, the East London Museum and its Director, Courtenay-Latimer, had already gained a reputation for scientific discovery and it is no surprise that Moorcroft brought the skull there. The East London Museum was launched in 1931 with the young Courtenay-Latimer as its sole curatorial employee, a situation that would continue for 15 years (Bruton, 2019; Jewett, 2004). For the first few years the only collections were of some birds' eggs, a few archaeological flints and some Xhosa cultural items originally collected by Courtenay-Latimer's mother. This soon changed as Marjorie Courtenay-Latimer began to collect her own material. This included a range of specimens from a three-month sojourn on Bird Island off the coast of Port Elizabeth and a nearly complete skeleton of the mammal-like reptile *Kannemeyeria* excavated with the help of two friends at Tarkastad in the Karoo in 1933 (Bursey, 2004). But the event which was to bring both the East London Museum and Marjorie Courtenay-Latimer to world fame was the discovery of *Latimeria chalumnae* in December 1938. The story of the identification of the first living coelacanth by Courtenay-Latimer is well known (Bruton, 2017, 2019; Smith, 1956; Thomson, 1991), but the key is the fact that Courtenay-Latimer was able to recognise the critical anatomical features of a living fish that linked it to a form previously seen only in fossil specimens. This was the same ability that she now used to recognise the antiquity and probable scientific importance of the human cranium from Hofmeyr.

Courtenay-Latimer knew that if the skull was old, it would be important. She also recognised that its value would be limited unless there was more knowledge about the context of its discovery. To accomplish this, she travelled to Hofmeyr in August 1956 to see if she could find any more of the specimen. She was shown the donga where the skull had been found, but other than confirming the depth of erosion; she could find no other evidence.[2] Despite her disappointment in failing to locate any more of the fossil, she decided that the specimen needed to be seen by a palaeontologist. While she was visiting Johannesburg for a museum conference, she brought the discovery of the skull to the attention of Professor Raymond Dart. Dart was keen to examine the skull, but he was unable to travel to East London and requested that the specimen be sent to him in Johannesburg. Courtenay-Latimer was very concerned about the possibility of the skull being damaged in transit and Dart had to reassure her that it was common practice to transfer specimens between museums.[3]

It was at this point that the skull suffered the first of several damaging events. During her absence from East London, the ornithologist at the museum "took it upon himself to chip away a lot of the matric [sic] and out into one of the frontal bones".[4] This resulted in significant damage to the lateral edges of the supraorbital margins on both sides of the frontal bone, but especially on the right side (Fig. 2.1). Courtenay-Latimer was furious and "dispensed with his services on account of this sort of thing and lack of co-operation."[4] Despite this setback, Dart encouraged her to send the specimen to him even though she continued to fear more damage to the specimen during transit. Dart emphasised that "if your specimen should turn out to be a near relative [of the newly discovered fossils from Makapansgat] it would be most exciting."[5] In the same letter he encouraged her to revisit the site to confirm the locality and provide pictures or diagrams of the site for a future publication. When the opportunity arose Courtenay-Latimer again travelled to the farm where the fossil had been recovered, but the success of the anti-erosion programme which had begun in the 1950s had buried the actual site of the discovery under meters of new sediment by then.[6] The specimen was finally hand-delivered to Dart by M. D. W. Jeffreys in July 1961, and although Dart was willing to continue with the analysis, he was obviously disappointed that it was not an australopithecine. "It seems to belong to *Homo sapiens*, so do not expect anything extraordinary from its development which will be undertaken as soon as possible."[7]

The First Analyses

The skull's arrival in Johannesburg coincided with a series of important discoveries at Makapansgat in the then northern Transvaal (Dart, 1962) and at Olduvai Gorge in Tanzania

[1]The Archival Sources are located at the end of the text.

Fig. 2.1 Detail of right supraorbital margin showing the damage caused during a presumed attempt to remove matrix from the orbit (Photo credit, F. E. Grine)

(Tobias, 1965), all dating from what was at the time considered the earliest era of human evolution at least two million years before present. Dart and his successor, Phillip Tobias, were focused on the study of these very early fossils and both thought the Hofmeyr specimen was too recent to be of exceptional importance. Despite this, Dart took the time to make some extensive notes on the skull including a set of measurements.[8] His notes are undated, but it seems likely that they were made shortly after the skull arrived in Johannesburg, as a further letter he wrote to Courtenay-Latimer in August 1961 reflects similar conclusions to what he recorded in his notes.[9]

Dart's informal notes focussed on the relationship of Hofmeyr to specimens that had been accepted by Dart as "Boskopoid." The concept of a large-headed extinct race was based on the cranium recovered from the site of Boskop in 1913 (Dart, 1923). While this concept was being seriously questioned by the early 1960s (Singer, 1958), Dart continued to focus on it as a reference point in his analysis of the Hofmeyr skull. The gist of his notes was a comparison of the Hofmeyr cranium to each of the possible ancient Boskop specimens, especially Tuinplaas (Springbok Flats), Border Cave and the original Boskop skull itself. He also compared the skull to Kabwe ("Rhodesian Man") and Florisbad, both from contexts that were pre-Holocene and possibly very ancient. None of these specimens had been dated at the time but all were accepted as "pre-Negro" or "pre-Bushman", terms accepted by most authors at the time. The accepted model that Dart subscribed to in his writings assumed that the ancestors of both groups in South Africa had been robust and archaic in form and had undergone a progressive reduction in size and, in the case of the Khoesan, the acquisition of pedomorphic characters (Brothwell, 1963; Tobias, 1978). The Boskop type was viewed by him as being intermediate between the robust archaics and the modern Khoesan. Dart found that Hofmeyr did not fit very well with the Boskop specimens on his list, but he was determined to find some kind of anatomical association with earlier fossil specimens. In Dart's opinion, the well-developed supra-orbital region and large mastoid were similar to Kabwe and Florisbad, but the skull did not seem to be as "primitive" (robust) as these latter specimens. Dart concluded his notes with the sentence: "There is no doubt from the dimensions of the cranium that we are dealing here with a large, massively built sapient human type of South African skull. The principal points at issue therefore are its racial relationships and its possible antiquity".[8]

Although he shared his assessment with Courtenay-Latimer, Dart did not publish his analysis. Instead, the specimen was given to Mr. Keith Kaye for his B. Sc. (Med) Honours project under the supervision of Phillip Tobias, who was Dart's replacement as Head of the

Department at the University of the Witwatersrand. Kaye's project (Kaye, 1965) differed in approach from Dart's analysis by not focussing on Boskop, and instead on looking at the blending types which were thought at the time to make up living South African aboriginal populations. This approach was very much influenced by Tobias' thinking, especially in relation to the morphological origins of the Khoekhoe, or "Hottentots" as they were referred to at the time. In Tobias' view, the physical composition of the living "Hottentots" was a mixture of four ancestral strains: the Boskop type, the Bush type, the Gerontomorphic (sometimes called Australoid) type and the Kakamas (East African Hamitic) type (Tobias, 1955). This perspective was echoed by Kaye in his project. Kaye looked at a wide range of crania from living and archaeological populations, including many of the same specimens referred to by Dart, but he also included specimens from North and East Africa. His analysis, consistent with the methods of the time, examined specific physical features as markers of hybridising types, and not surprisingly his study found signs of each of the four elements which comprised the "Hottentot" physical type. His conclusion was "that in spite of the fact that the skull does not belong to any population group living today, it appears to be of a Hottentot stock, belonging most likely to the Gonaqua who became extinct in the early Nineteenth century" (Kaye, 1965: 37).

Dart had been pressing to have a professional archaeologist visit the site ever since his initial correspondence with Courtenay-Latimer. He asked Revil Mason, his colleague at Wits, to find someone who could visit the site.[10] Dart's efforts, through Mason, were finally successful and in September 1964, Hilary Deacon of the Albany Museum in Grahamstown, visited the site and provided Kaye with a thorough report on what he found. Sadly, what he found was relatively little. The location of the discovery was silted up and was "just mud and reeds now" (Kaye, 1965: 3). Deacon did find an eland horn core of similar mineralisation about a hundred metres upstream of the discovery site and at the depth of "4 or 5 feet". He donated this to the Department of Anatomy for possible future dating attempts.

The academic plan was for Kaye to continue this project at the Masters level, but he decided to return to his medical studies in 1966 and did no further work on the topic. Dart still felt that there was more to learn from a detailed study of the Hofmeyr specimen and early in 1966 he approached Hertha de Villiers, a lecturer in the Department of Anatomy, to continue the work. de Villiers wrote to Courtenay-Latimer asking permission to continue the study and also to request consent to remove a sample of bone for dating.[11] With Courtenay-Latimer's agreement, she sent the eland horn core and a human cervical vertebra to Oakley at the British Museum of Natural History for ^{14}C analysis.[12] She had carefully removed a vertebral fragment from the adhering matrix for analysis but did not sample the skull itself.

de Villiers waited three years for the laboratory in London to analyse the samples, but on discovering in early 1970 that the samples had not yet been processed, she requested their return from London. She then submitted them instead to the CSIR radiocarbon laboratory in Pretoria.[13] While she waited for the results from Pretoria, de Villiers felt that it would be best if the skull was sent back to its repository in East London as she had completed her measurements and observations. She acted on this on the 2nd of June 1970. Courtenay-Latimer responded two days later telling de Villiers that the skull had been damaged in transit and that "only half" was left and "the maxilla bones were broken up completely".[14] A flurry of correspondence between them confirmed that the packing in Johannesburg had been inadequate, but that whoever unpacked the specimen in East London did not attempt to save any fragments for reconstruction. The damage not only included the anterior of the maxilla with all of its teeth mesial to the first molars, but also the squamous occipital, the tip of the mastoid and the gonial angle of attached right half of the mandibular ramus.

At the same time as the heated correspondence was occurring between de Villiers and Courtenay-Latimer, Hilary Deacon wrote to confirm that he was unable to provide any further information about the site. He wrote that he understood "the circumstances of the find and its value, [but] I don't think there is any particular associated problem that would be answered by radiometric dating.[15] The results from Pretoria on the dating of the eland horn core came back later in the year giving a date of 3,020 ± 90 (Pta 261) years before present (Vogel & Marais, 1971). The vertebral fragment did not produce a date. At best, if the association between the horn core and skull could be accepted, the skull was indeed relatively recent, but if the association was not accepted, then the skull itself remained undated. Deacon did agree that the skull had a study value and that his division at the Albany Museum would be prepared to store the specimen for the long term if this was a problem for the East London Museum.

With no date and no archaeological association, the now damaged specimen was no longer of interest to South African scientists. Courtenay-Latimer retired from the museum in 1973 and in February 1975, the collection of human archaeological skeletons at the East London Museum was exchanged for ornithological material from the collection of the Port Elizabeth Museum. The East London Museum had no one on staff with archaeological experience but did have a strength in ornithology, while the reverse was true in Port Elizabeth. In the process the Hofmeyr skull was miscataloged (R. M. Tietz, pers. comm. to A. G. Morris, 2 July 1990). The records at Port Elizabeth incorrectly labelled the skull as a coastal find from the Qulu River Mouth, about 20 kms west of East London.

The Rediscovery

The Hofmeyr skull, now mislabelled as *Qulu*, was seen by the German paleoanthropologist Günter Bräuer in 1980. Bräuer was intrigued by the "very robust and heavily mineralized skull" but could find no further information about the site. He arranged for a section of the parietal bone to be forwarded to Reiner Protsch in Frankfurt in order to assess whether there was sufficient nitrogen content for radiocarbon dating. The bone fragment was sent to Frankfurt in September 1980, but Protsch did not follow up with a date and Bräuer assumed that the sample possessed too little collagen for analysis (G. Bräuer, pers. comm to A. G. Morris, 9 March 1999). This was now the third sequence of damage to the cranium adding the loss of a significant piece of the left parietal to the previous damage to the frontal processes, the maxillary tooth row, and the cranial base (Fig. 2.2).

Courtenay-Latimer, who was now retired and living in Port Elizabeth, visited the museum in July 1987 and complained to Nancy Tietz, her replacement as director of the East London Museum, that the Hofmeyr skull was now incorrectly labelled. Tietz mentioned this to the Director of the Port Elizabeth Museum who asked the anthropologist Francis Thackeray to have a look at the specimen. Although Thackeray could not confirm its identity, he noted that it had similarities to the ancient Florisbad specimen on which he had worked previously (J. F. Thackeray, pers. comm. to A. G. Morris, 27 January 1989). In his correspondence, Thackeray provided a brief report on the skull in which he noted that "the matrix has been analysed at the Geology Department of the University of Port Elizabeth, at the request of Dr. Graham Ross … of the Port Elizabeth Museum …. The matrix has been described as a riverine sand." Thackeray then notified the current author of the location of the specimen and its questionable provenance. The skull's identity as Hofmeyr rather than Qulu was later recognized from photographs by Morris, and this was confirmed from the original transfer records at the East London Museum by Tietz (R. M. Tietz, pers. comm. to A. G. Morris, 2 July 1990).

The rediscovery of the Hofmeyr skull did not immediately solve any of the issues raised by Dart and Kaye in their analyses. Ultimately the problem was that the specimen remained undated. Morris recognised both the robust morphology and the impression of antiquity from the state of mineralisation (as Bräuer and Thackeray had done independently) and asked Tietz if it would be possible to revisit

Fig. 2.2 Condition of the Hofmeyr skull in 1968 before it was sent back to East London from Johannesburg compared to its condition in 1993 (Reproduced from Grine et al., 2007: Fig. 1)

the original excavation site. Tietz brought the request to the attention of Courtney-Latimer who immediately volunteered to join any expedition to locate the original site (Tietz, 2004).

The original Hofmeyr location on the farm Klipdrift was visited by Morris, his student Jonathan Kovacs, Carl Vernon (the East London Museum ornithologist), Nancy Tietz (the East London Museum director) and Marjorie Courtenay-Latimer, from the 26th to the 29th of October 1992. The team was hosted by the new owner of Klipdrift, Mr. J. Moolman, and housed in the farm homestead. Activities over the three days concentrated on examining the riverbanks to identify any archaeological exposures, but especially to identify the possible discovery location. Five exposures were identified (Fig. 2.3), ranging from Later Stone Age rock art to Middle Stone Age flakes, but none could be associated with the original discovery. The construction of the anti-erosion weir in 1954 had completely silted up the river by 1962 and the site had become overgrown with dense reed-beds by 1992 (Fig. 2.4), a situation unchanged as seen in more recent visits to the site. A series of deep erosion gullies was still visible downstream of the discovery site and these gave an impression of the appearance of the site at the time of the skull's discovery (Fig. 2.5). Some 100 m downstream of the discovery site was an extensive deflation along the edge of the riverbank (Site 4 on Fig. 3). A heavily mineralised metapodial of a kudu-sized bovid projected from the eroding surface, and a single MSA core and LSA bored stone were seen lying on the erosion surface (Fig. 2.6). There was no association between core, stone or bone. As such, other than confirming the discovery site location, the 1992 field visit did not add any further information about the skull's context.

The Hofmeyr skull was transferred to the Department of Human Biology at the University of Cape Town on the return from the site visit. Morris began a new analysis that compared the cranium to a range of modern populations (rather than single individuals) and it was confirmed that the skull fell within the range of modern populations, but on the edge of their variation. Fred Grine of Stony Brook University was invited to help work on the specimen at this stage and the collaboration resulted in the first publication of the specimen (Morris & Grine, 1999). With the addition of Grine to the team, the techniques of analysis were expanded not only in terms of comparative samples (now including Upper Palaeolithic Europeans), but also in methodology (Grine et al., 2007). Multivariate analysis of linear cranial measurements was explored by Isabelle Ribot and this was followed by 3-D geometric morphometric analysis led by Katarina Harvati.

A small fragment of bone detached from the broken left parietal was sent by Grine to the Oxford Radiocarbon Accelerator Unit for possible accelerator mass spectrometry (AMS) dating, but the lab result identified that too little collagen was preserved for this method to succeed (Grine et al., 2007). Grine therefore proposed that the matrix infill of the cranial vault be used as a dating resource as opposed to using methods that would continue to damage the bone itself. In 2003, he carefully cleared out the vault infill under ultraviolet light in the photographic dark room in the Department of Vertebrate Palaeontology at the Iziko Museum in Cape Town. The samples obtained under these conditions were submitted to the Research Laboratory for Archaeology and the History of Art Luminescence Dating

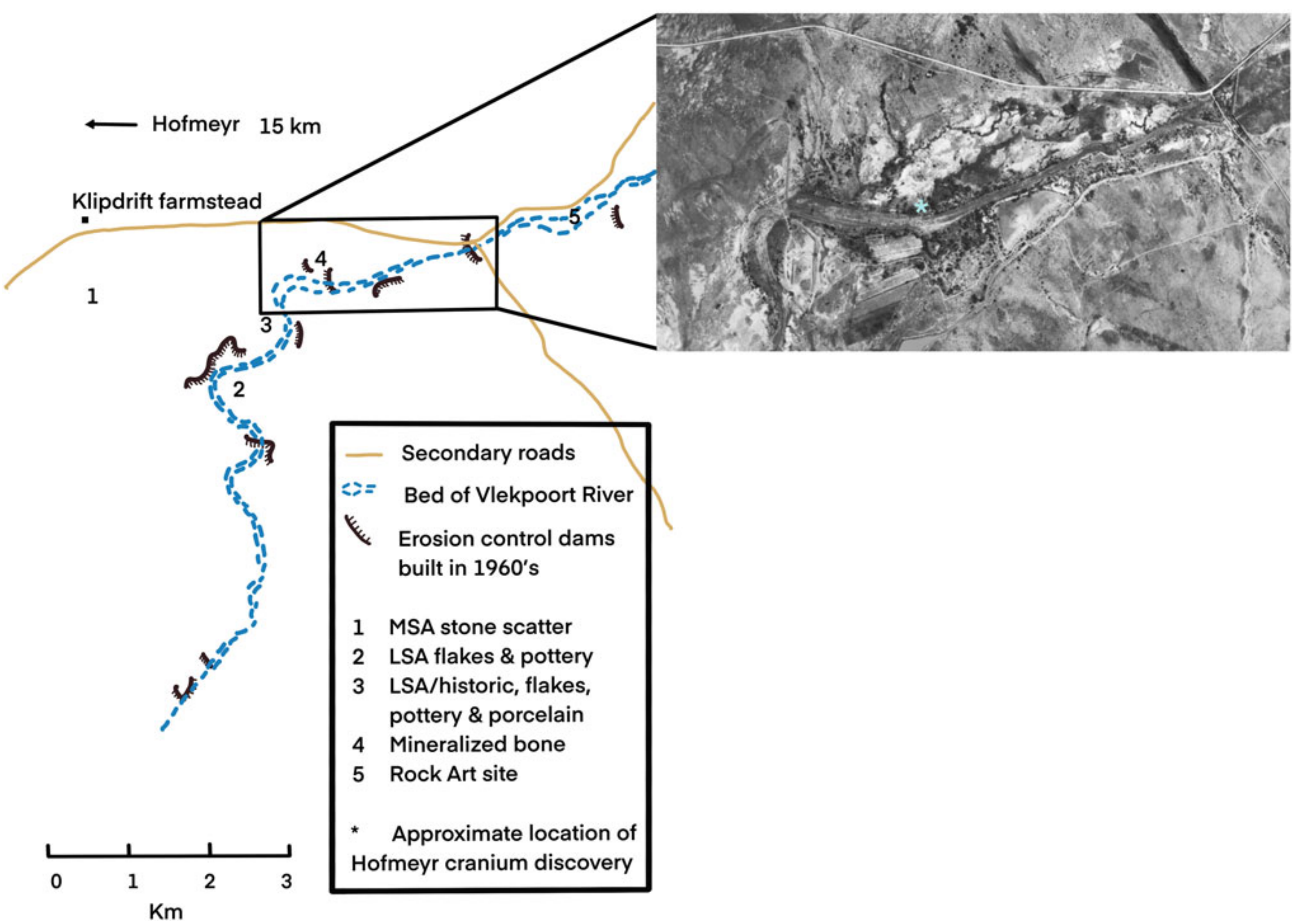

Fig. 2.3 Map of locations visited during the October 1992 field trip to the Hofmeyr area

Fig. 2.4 The anti-erosion weir at the Hofmeyr discovery site in January, 2005 (Photo credit, A. G. Morris)

Laboratory at the University of Oxford in the hope of obtaining an Optically Stimulated Luminescence (OSL) date. This method effectively dates the length of time the infill sediment has been resident in the skull. The method provided the breakthrough which finally provided an estimated date of just over 36,000 years and has allowed for more meaningful interpretations of its morphology (Grine et al., 2007).

Hofmeyr and Changing Methods in the Study of Human Origins

Dart's analysis in the 1960s was strongly coloured by the 19th and early twentieth century concept of racial typology (Morris, 2012). His first description of the skull was consequently couched in terms of racial types and ancestral strains in which statistical data and ranges of variation were missing. Kaye's approach (under the influence of Tobias) was only marginally better because a wider range of specimens was compared to the single skull from Hofmeyr, but his study was also hobbled by the need to base the analysis on imaginary types rather than on analyses of statistical data. The advent of multivariate statistics has allowed individual specimens to be compared in terms of morphological distance. The technique relates the appearance of the Hofmeyr skull to the wide range of variation seen in comparable Upper Palaeolithic specimens and has enabled a more holistic analysis of shape (Grine et al., 2007). The most recent analyses have used a morphometric approach that employs three-dimensional locations of standardised biometric points which produce a more nuanced interpretation of morphological differences.

There has also been an expansion of new dating techniques in parallel to changes to the techniques of morphological analysis. Hofmeyr was discovered just when the first radiocarbon analyses were starting to produce reliable results, but the lack of preservation of collagen in the Hofmeyr bone prevented a successful application of this