Declaration

I, Aurore Marie Sophie Val, declare that this PhD thesis is my own, unaided work. It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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Signed on the 25th of July 2013, in Johannesburg.

Abstract

The cave deposits at Malapa, on the Malapa Nature Reserve, Cradle of Humankind World Heritage Site, Gauteng Province, South Africa, have yielded the remains of two extremely well-preserved hominins (*Australopithecus sediba*) and associated fauna, dated by U/Pb methods and palaeomagnetism to 1.977-1.8 Ma. The state of preservation of the hominins and some of the non-hominin material, characterised by complete and near complete elements, antimeric sets of bones, specimens in articulation, and well-preserved bone surfaces, is remarkable in the context of Plio-Pleistocene fossil assemblages accumulated in caves, and indicates a unique combination of taphonomic processes, not yet observed in contemporaneous cave deposits in the region. A comprehensive approach, including palaeontological, physical, and spatial analyses of the hominins and associated fauna was undertaken to determine, describe and interpret the taphonomy of the faunal material, with particular reference to the holotype and paratype of *Au. sediba*, Malapa Hominin 1 (MH1) and Malapa Hominin 2 (MH2). An innovative combination of Computed-Tomography (CT), micro-CT scanning and virtual reconstruction techniques was applied to create a 3D model of a selected area of the Malapa cave, with renderings of the two near-complete *Au. sediba* skeletons. The original burial position of the hominins was reconstructed, which necessitated the refitting of *ex situ* fossils into *in situ* deposits. The spatial distribution and orientation of the hominin remains illustrate a very low degree of dispersal of the bones, indicative of very little disruption between death and burial, due to an absence of damage by scavengers and possible natural mummification. The very few carnivore-damaged bones and relative abundance of complete and/or articulated specimens, the presence of antimeric sets of bones in the faunal assemblage, as well as the diversity of the faunal spectrum, and the significant percentage of animals with climbing proclivities (such as carnivores and hominins) indicate that the majority of the faunal material recovered was most likely accumulated via a natural death trap. Their bodies came to rest in a deep area of the cave system with restricted access to

scavengers. Skeletons and bones accumulated in a talus cone below a vertical shaft. There, they decomposed, and became buried without major disruption by biotic or abiotic agents. A new forensic approach, referred to as *palaeoforensic taphonomy*, was followed in each step of the taphonomic analysis of the two hominins in order to reconstruct the processes of decay, disarticulation, burial and preservation. Results show that both individuals did probably not enter the cave system at the same time. They reached skeletonization and were slightly weathered before final burial, indicating several years of exposure before burial. Insects proved to be the primary modifiers of the hominin remains, pre- and post-depositional with hide beetles (*Omorgus squalidus*) providing the closest match for some of the fossil modifications observed. Based on the high number of articulated remains, the absence of preferential orientation for the elongated bones and of significant movement of the hominin remains inside the deposit, the debris flow hypothesis that was previously proposed as the principal agent to explain the burial of the hominins and other well-preserved animals is challenged. Evidence of natural mummification before burial for MH1 and MH2 suggests the possible preservation of soft tissue. The innovative 3D techniques applied in this research to conduct the spatial analysis of the fossils proved useful to address taphonomic questions, and will serve as a guide for future excavations of the Malapa *in situ* deposits, especially for locating the missing skeletal elements of MH1 and MH2.

Acknowledgements

This thesis would not have seen the light of day without the precious aid of numerous people, all of whom – at various levels - have helped to contribute to this work. I thank them all.

Francesco d'Errico, from the University of Bordeaux 1 in France, was the first to suggest a collaborative research project with Lucinda Backwell at the University of the Witwatersrand in Johannesburg, and encouraged the dual registration for the PhD. Francesco and Lucinda have provided me with constant support, advice, guidance and encouragement. I am grateful for the learning experience it was to conduct research under the supervision of two internationally recognized and respected scientists. I wish to thank them for their time and their patience with me. They have constituted constant sources of inspiration for me, on a professional and personal level.

Lee Berger proposed the initial project involving the 3D reconstruction of the Malapa site. I am grateful for having been given the opportunity to become part of an incredible scientific journey, as a member of the team of Malapa researchers. His enthusiasm and passion helped a great deal in bringing this research project to fruition.

I express my gratitude to Bruce Rubidge at the Bernard Price Institute for Palaeontological Research and to Francis Thackeray at the Institute for Human Evolution for welcoming so warmly and being constantly supportive and helpful in all my negotiation of administrative procedures. Special thanks to Francis who enhanced my stay in South Africa by accompanying me during my very first visits of some of the sites from the Cradle of Humankind, namely Kromdraai, Sterkfontein and Swartkrans, and by livening these visits up with an abundance of details, explanations and anecdotes.

I thank Wilma Lawrence for her competent administrative assistance, and Bonita de Klerk for her patience in answering my many questions about the Malapa fossils and providing me with precious information, pictures and data. I am grateful to Wendy King,

Evlyn Ho and Sarah Sejake for making my life so much easier when it came to administration, funding and registration procedures, and to Gerry Germishuizen for facilitating the vehicles and electronic equipment I had to use during my studies. I also thank Michèle Charuel and Brigitte Socolovert in Bordeaux in France, who assisted with the dual registration procedure.

Several people and funding bodies have financially supported this thesis and I wish to acknowledge them, for without funding this research would not have been possible: the National Research Foundation in South Africa (and Waheeda Bala), the Carstens Trust (and Marion Bamford), the Institut Français en Afrique du Sud, and my parents who generously supported most of my living expenses during the past three years.

Job Kibii is thanked for accompanying me to the Malapa site and answering my multiple questions. We had several interesting discussions about early hominins, taphonomy, primates and fauna. Bernard Zipfel granted me access to the comparative bone collection which he curates, and provided constructive advice. Jackie Berger is thanked for allowing me to use the CT scanner of the Charlotte Maxeke Hospital in Johannesburg.

I obtained vital practical help with the 3D reconstruction of the Malapa site. In Italy, Dario Conforti (Optech Company) and Matteo Sgrenzaroli (Gexcel Company) graciously showed me how to use 3D Reconstructor software; in France, Jean Dumoncel assisted with the virtual reconstruction of the Malapa cave using Photoscan software; and in South Africa, Matt Caruana aided me with the manual scanning and virtual rendering of some hominin casts.

No research, study, analysis or publication on the hominin and associated faunal material recovered from the cave deposits of the Cradle of Humankind would be possible without the dedicated work of those who patiently and diligently remove fossils from the calcified sediment in which they are preserved. Special thanks are due Charlton Dube,

Sifelani Jirah, Meshack Kgasi, Roseberry Languza, Gladys Mokoma, Pepsi Mukanela, Thilivhali Nemvhundi, Moses Ngcamphalala, Samuel Tshabalala and Celeste Yates.

Many scientists have freely given of their time to answer queries, send me papers and advise. My gratitude goes to Bruno Maureille, Pascal Murail, Stéphane Rottier, Pat Shipman, Henri Duday, Dominic Stratford and Pierre Belleudy. I had the pleasure to have interesting discussions with Rachelle Keeling about the taphonomy at Malapa.

I have received many constructive and relevant comments and suggestions from three examiners, which have helped greatly to improve the quality of the final version of this PhD thesis.

I wish to express my appreciation to Paul Dirks for numerous advice and critics on my work. We had several very useful email exchanges and discussions concerning my thesis; he provided me with critical information about the geology at Malapa, which was very utile for the understanding of the taphonomy of the site.

I send my gratitude to Cynthia Kemp and to Ian Mckay for their precious help during the editing.

I am very grateful to Kris Carlson: not only did he teach me how to use Avizo software and about 3D, micro CT and CT scanning techniques, but he also provided constructive feedback on some parts of my dissertation. Tea Jashashvili is warmly thanked for her considerable help with virtual reconstruction and for sharing her deep understanding of 3D computer software.

Christine has been a wonderful friend and colleague. I thank her for sharing of knowledge and experience and, as a remarkable female scientist in this very masculine field of research, for inspiring me.

Luis Torres is thanked for his knowledge of engineering, for communicating his points of view on my work on several occasions and for his constant moral support.

I wish to thank Jean-Baptiste Mallye, for his valuable advice and commentary on my thesis. To him I owe my interest in taphonomy, faunal analysis and fossil bone study, which was first sparked by his undergraduate lectures and was later developed during the MSc project we did together. A lot of what I have needed and put to practice during the course of this thesis was taught to me by him.

Finally, I thank my family. My sisters, Perrine and Beatrice, provided constant encouragement. Without the huge support (both in spirit and in kind) of my parents, this thesis would have never happened. Merci Papa et Maman, for having believed in me all these years and always encouraging me.

Mike, merci.

Table of contents

Declaration.....i

Abstract.....ii

Acknowledgements.....iv

Table of contents.....viii

List of Figures.....xviii

List of Tables.....xxiii

Chapter 1. General introduction.....1

1. HOMININ FOSSILS FROM SOUTH AFRICAN CAVE DEPOSITS.....1
2. TAPHONOMIC ISSUES.....3
3. RESEARCH QUESTIONS FOR THE MALAPA ASSEMBLAGE AND OBJECTIVES OF THIS STUDY.....6
4. THESIS OUTLINE.....12

Chapter 2. Early hominin taphonomy from African deposits.....15

1. HOMININ TAPHONOMY IN CAVE DEPOSITS OF SOUTH AFRICA.....16

1.1. Presentation of the region.....16

1.1.1. Fossil bearing sites in the Cradle of Humankind.....16

1.1.2. Hominin discoveries.....17

1.2. Hominin taphonomy.....19

1.2.1. Introduction.....19

1.2.2. Geomorphology and formation of the fossil deposits in dolomitic caves.....20

1.2.3. Primate bones in cave deposits: causes of the accumulation.....21

Abiotic agents: debris flow, rain and gravity.....21

Falling accidents.....21

Biotic agents: mammalian carnivores.....22

Avian biotic agents: birds of prey.....27

Other biotic agents.....28

Occupation of caves by hominin and non-hominin primates.....30

2. HOMININ TAPHONOMY IN PALAEOLAKE AND FLUVIAL CONTEXTS.....32

2.1. Actualistic data on bone transport in water.....32

2.1.1. *Introduction*.....32

2.1.2. The experiments.....32

Factors influencing bone transport potential.....33

Review of transport potential per anatomical element.....35

Transport in water and orientation of the bones.....39

2.2. Hominin taphonomy in lacustrine and fluvial contexts.....40

2.2.1. *Introduction*.....40

2.2.2. *Case studies*.....40

Sahelanthropus tchadensis (Toumaï) and associated fauna.....40
Orrorin tugenensis and associated fauna.....41
Ardipithecus ramidus and associated fauna.....42
Kenyanthropus platyops and associated fauna.....43
Australopithecus afarensis (Lucy).....43
Australopithecus afarensis individuals from the AL-333 locality.....44
Selam (DIK 1-1): a juvenile *A.afarensis* skull and associated skeleton from Dikika, Ethiopia.....44
Other gracile and robust australopithecines and *Homo habilis* specimens from East Africa.....45
The Nariokotome *Homo erectus* skeleton (KNM-WT 15000).....46
2.2.3. *Fossil hominins in lacustrine and fluvial context: summary*.....47

Chapter 3. Materials.....50

1. HOMININ REMAINS.....50
1.1. *Individuals*.....50
1.2. *Taxonomic attribution*.....51
1.3. *Stratigraphic provenance of the hominin remains*.....52
2. NON-HOMININ FAUNAL REMAINS.....53
3. OTHER TYPES OF REMAINS.....54
3.1. *Coprolites*.....54
3.2. *Millipedes*.....54
3.3. *Insect pupae*.....55
3.4. *Molluscs*.....55
3.5. *Seeds*.....55
3.6. *Organic residues*.....55

Chapter 4. Methods.....56

1. EXCAVATIONS, PREPARATION AND RECORDING.....57
1.1. Excavation methods.....57
1.2. Laboratory preparation methods.....59
1.3. Virtual exploration of blocks of calcified sediment.....60
1.4. Digital record of the excavation and preparation.....61
1.5. Taxonomic attribution and cataloguing of the fossil remains.....61
1.5.1. Taxonomic identification.....61
1.5.2. *Cataloguing of the hominin and non-hominin faunal remains*.....62
1.5.3. Creation of the database.....62
2. CLASSICAL VERTEBRATE TAPHONOMY: THE TRIPLE APPROACH.....63
2.1. Introduction.....63
2.2. Palaeontological approach.....64
2.2.1. *Quantitative units: definitions*.....64
2.2.2. Fragmentation.....65
2.2.3. *Breakage pattern*.....65
2.2.4. *Joints, articulations and disarticulation sequence*.....66
A few definitions.....66

Persistent joints and articulations in the human skeleton.....67
Unstable joints and articulations in the human skeleton.....68
Disarticulation order in quadruped mammals.....68
The Malapa fossils: “true articulation” and “anatomical proximity”.....70
2.3. Physical approach.....70
2.3.1. *Introduction*.....70
2.3.2. *Methods used for the analysis of bone surface modifications*.....70
2.3.3. Hominin damage.....71
2.3.4. Carnivore damage.....73
2.3.5. *Rodent damage*.....75
2.3.6. Other mammalian species damage.....76
Chimpanzee damage to bone.....76
Suid damage to bone.....77
2.3.7. Bird of prey damage.....78
2.3.8. Insect damage.....81
Introduction.....81
Species that modify bones.....82
Types of damage.....82
Invertebrate damage to bones: experimental approach.....84
2.3.9. Trampling.....85
2.3.10. Damage caused by abiotic agents.....86
Weathering.....86
Root etching.....86
Water abrasion.....87
2.4. Spatial approach.....87
2.4.1. Introduction: background.....87
2.4.2. Medical CT and microfocus CT scanning of hominin bones.....88
General introduction: principles and applications of the method.....88
Scanning of the Malapa remains.....90
2.4.3. 3D renderings of hominin remains produced using Avizo software.....91
Introducing the Avizo software.....91
Creation of 3D renderings.....91
2.4.4. Direction and inclination.....91
Definitions.....91
Estimation of the direction and the inclination of the fossils.....92
Estimation of the movement and distances between the bones.....92
2.4.5. *Refitting hypotheses*.....93
Distinction between direct and indirect evidence.....93
Direct evidence for the position and the orientation.....93
Direct evidence for the orientation only.....93
Indirect evidence for the position and/or orientation.....94
2.4.6. *Creation of a 3D hypothetical model for refitting the hominin remains in the deposit*.....95
3. FORENSIC SCIENCES.....96
3.1. Definition.....96

3.2. Forensic anthropology....97
3.2.1. *Creation of the discipline and definition*....97
3.2.2. *Applications and objectives*....97
3.3. Forensic archaeology....98
3.3.1. *Creation of the discipline and definition*....98
3.3.2. *Applications and objectives*....98
3.4. Forensic taphonomy....99
3.4.1. *Creation of the discipline and definition*....99
3.4.2. *Applications and objectives*....99
4. DEFINITION OF A NEW CONCEPT: PALAEOFORENSIC TAPHONOMY....100
4.1. Definition and objectives....100
4.1.1. *General definition*....100
4.1.2. *Differences with traditional vertebrate taphonomy and with biostratinomy*....100
4.1.3. *Why "palaeo-forensic"?*....102
4.1.4. *In which case can it be applied?*....102
4.1.5. *Objectives and implications*....103
4.1.6. *Methodology*....104
4.2. Death and burial postures of fossil vertebrates....104
4.2.1. *Introduction*....104
4.2.2. *Palaeontological contexts*....105
"Curled-up" posture....107
Straight or reflexed spinal curvature....108
Opisthotonic posture....108
"Dorsal up" posture....109
"Belly up" posture....110
"Head up" posture....111
4.2.3. *In archaeological sites*....111
Burial position....112
Death position....114
4.3. The early hominin fossil record and Malapa....115

Chapter 5. Contextual information about the site and the fauna....116

1. GENERAL SETTING OF THE MALAPA SITE....116
1.1. Geographical location....116
1.2. Discovery of the site....117
1.3. Geology of the area....118
1.4. Ecology of the area....118
2. PRESENTATION OF THE SITE....119
2.1. Geomorphology....119
2.2. Geology....119
2.3. Formation of the cave and sedimentary deposits....123
2.3.1. *Opening of the cave and bone accumulation*....123
2.3.2. *Geological evidence for a debris flow*....124
2.4. Dating methods and age of the deposits....125
3. NON-HOMININ FAUNAL MATERIAL: GENERAL PRESERVATION....126

3.1. Composition of the faunal spectrum....127
3.2. General preservation....129
3.2.1. *Articulations*....129
True articulations....129
Anatomical proximities....131
3.2.2. *Complete and near complete bones*....135
3.2.3. *Antimeric sets of bones*....135
3.2.4. *Representation of skeletal elements*....135
3.3. Modifications of the bone....137
3.3.1. *Modifications by abiotic agents*....137
Bone weathering....137
Manganese precipitation....137
Calcite crystal growth....139
Red colour staining....140
Sedimentary compaction....142
Decalcification....142
3.3.2. *Modifications by biotic agents*....143
Trampling....143
Root growth....143
Carnivore damage....143
Rodent damage....144
Bird of prey damage....144
Invertebrate damage....145
Ancient anthropogenic damage....149
3.4. Non-hominin faunal material: summary about the state of preservation....149

Chapter 6. State of preservation of the hominins....151

1. DEGREE OF COMPLETENESS....151
1.1. Percentage survival....151
1.1.1. *MH1*....154
1.1.2. *MH2*....154
1.2. Fragmentation....154
1.3. Breakage pattern....155
1.3.1. *MH1*....155
1.3.2. *MH2*....155
2. DEGREE OF ARTICULATION....156
2.1. True articulations....156
2.2. Anatomical proximities....158
3. PRE- AND POST-DEPOSITIONAL DAMAGE....160
3.1. MH1 skeleton....160
3.1.1. *Modifications by abiotic agents*....160
Manganese precipitation....160
Bone weathering....161
Calcite crystal growth....161
Red colour staining....161

Sedimentary compaction.....162
Decalcification.....162
3.1.2. *Modifications by biotic agents*.....162
Trampling.....162
Root growth.....162
Carnivore, bird of prey, rodent and anthropogenic damage.....162
Invertebrate damage.....163
3.2. MH2 skeleton.....166
3.2.1. *Modifications by abiotic agents*.....166
Manganese precipitation.....166
Bone weathering.....166
Calcite crystal growth.....167
Red colour staining.....167
Sedimentary compaction.....167
Decalcification.....167
3.2.2. *Modifications by biotic agents*.....167
Trampling.....167
Root growth.....167
Carnivore damage.....168
Bird of prey, rodent and anthropogenic damage.....171
Invertebrate damage.....171
4. COMPARISON BETWEEN THE TWO INDIVIDUALS IN TERMS OF PRESERVATION.....172
4.1. General preservation.....172
4.1.1. *Similarities*.....172
4.1.2. *Differences*.....173
4.2. Bone surface damage.....173
4.2.1. Similarities.....174
Pre-burial processes: near absence of biotic damage.....174
Post-depositional processes: manganese and sedimentary pressure.....175
4.2.2. *Differences*.....175
Pre-burial processes: weathering and invertebrate damage.....175
Post-depositional processes: red traces, decalcification and crystals of calcite.....176

Chapter 7. Reconstruction of the burial posture of the hominins.....178

1. STRATIGRAPHIC ORIGIN OF THE HOMININ REMAINS.....178
1.1. MH1 *in situ* remains.....178
1.2. MH1 *ex situ* remains.....179
1.2.1. "Clavicle block".....179
1.2.2. Right femur.....181
1.2.3. *"Skull block"*.....182
1.2.4. *"Ilium block"*.....183
1.2.5. *Block UW88-B051*.....183
1.2.6. *Other remains*.....186
1.3. MH2 *in situ* remains.....187

1.4. MH2 *ex situ* remains joining *in situ* specimens.....189
1.4.1. "Scapula fragment block".....189
1.4.2. *Mandible fragments*.....191
1.5. MH2 *ex situ* remains (provenance in the deposit unknown).....191
1.5.1. "Pelvis block".....191
1.5.2. "Ankle block".....191
1.5.3. "Thoracic vertebrae block 1".....191
1.5.4. "Thoracic vertebrae block 2".....192
1.5.5. "Lumbar vertebrae block".....192
1.5.6. Other remains.....192
2. POSITION, DIRECTION AND INCLINATION OF *IN SITU* HOMININ BONES.....194
2.1. MH1: cranial remains and metatarsals.....194
2.2. MH2: "arm block".....194
2.2.1. *Position in the deposit*.....194
2.2.2. Direction.....194
2.2.3. Inclination.....195
3. POSITION, DIRECTION AND INCLINATION OF HOMININ REMAINS INSIDE *EX SITU* BLOCKS.....197
3.1. MH1: skull.....197
3.2. MH1: bones from the "skull block".....199
3.3. MH1: bones from the "clavicle block".....199
3.4. MH1: bones from block B051.....199
3.5. MH2: *ex situ* remains.....199
4. GENERAL ORIENTATION OF THE GEOLOGICAL UNIT (FACIES D).....200
5. TRANSPORT AND MOVEMENT OF THE HOMININ REMAINS.....200
5.1. Distances between MH1 remains.....200
5.1.1. 3D distance between the vault fragments and the incisor and canine.....200
5.1.2. 3D distance between the metatarsals and the vault fragments.....201
5.1.3. Movement affecting specimens found in ex situ *blocks*.....201
5.2. Distances and direction of transport between the MH2 remains.....202
5.2.1. Estimation of distances.....202
5.2.2. Estimation of the movement inside MH2 "arm block".....204
5.3. Distance MH1-MH2 remains.....206
5.3.1. 3D distance between MH1 vault fragments and north corner of the "arm block".....206
5.3.2. 3D distance between MH1 vault fragments and south corner of the "arm block".....206
5.3.3. 3D distance between MH1 vault fragments and west corner of the "arm block".....207
5.3.4. 3D distance between MH1 vault fragments and east corner of the "arm block".....207
5.3.5. 3D distance between MH1 metatarsals and north corner of the "arm block".....207
5.3.6. 3D distance between MH1 metatarsals and south corner of the "arm block".....207
5.3.7. 3D distance between MH1 metatarsals and west corner of the "arm block".....207
5.3.8. 3D distance between MH1 metatarsals and east corner of the "arm block".....208
5.4. Distance with other *in situ* hominin remains.....208

6. POSITION, DIRECTION, ORIENTATION AND MOVEMENT OF THE *IN SITU* HOMININ REMAINS: SUMMARY.....209
7. Refitting of hominin remains.....211
7.1. Positioning the reference points and other *in situ* remains.....211
7.2. Refitting MH1 remains.....212
7.2.1. Step 1: joining the "skull" and "ilium blocks".....212
7.2.2. Step 2: refitting the "skull block" and the "ilium block" into the deposit.....213
7.2.3. Step 3: refitting the "clavicle block".....214
7.2.4. Refitting the right femur.....218
7.2.5. Refitting the bones from block UW88-B051.....220
7.3. Refitting MH2 remains.....220
7.3.1. Step 1: refitting the "scapula fragment block".....220
7.3.2. Step 2: refitting the loose remains (ankle, pelvis, sacrum, vertebrae, left carpals).....221
Cervical vertebra (UW88-96).....221
Position of the legs and implications for the refitting of the ankle, sacrum and right ilium.....222
"Thoracic vertebrae blocks" 1 and 2.....224
Left carpals.....224
7.4. Areas of probability for the remains.....225
7.5. Completion of the 3D model.....228

Chapter 8. Detailed description of the taphonomy of the hominins.....233

1. GENERAL TAPHONOMY OF THE FAUNAL ASSEMBLAGE.....233
1.1. A multi-stage scenario: introduction.....233
1.2. Primary deposit: bone accumulation in various parts of the cave system.....233
1.2.1. *Contribution by carnivores*.....233
Carnivore collected assemblage and cave use by carnivores: theoretical model.....233
Carnivore-collected assemblage and cave use by carnivores: the fossil evidence.....234
1.2.2. Natural death-trap scenario.....236
Bone accumulation through a pit-fall: theoretical model.....236
Bone accumulation through a pit-fall: the fossil evidence.....236
Description of the type of death trap.....238
1.2.3. Contribution to the fossil assemblage by other biotic and abiotic agents.....238
Hominins.....238
Other biotic agents.....239
Gravity and rainfall.....239
1.3. Resedimentation to a lower part of the cave system by a debris flow: what is the evidence?.....239
1.3.1. *Geological evidence*.....239
1.3.2. Taphonomic evidence.....240
Bone surface modification.....240
Skeletal element representation.....241

Spatial distribution of the bones....241
1.3.3. Single chamber versus several chambers?....242
Inputs from different parts of the cave system....242
Were MH1 and MH2 moved from where they fell ?....243
1.3.4. *Discussion: problems encountered with the debris flow hypothesis*....243
2. TAPHONOMY OF THE ADULT FEMALE MH2....247
2.1. Mode of accumulation in the deposit....247
2.2. Time of exposure and state of decomposition before burial....248
2.2.1. Decomposition rate: the theory....248
2.2.2. Indications from the fossils....250
Weathering stage....250
State of articulation....251
Insect damage....252
Summary....254
2.3. Evidence for natural mummification....255
2.3.1. *Mummification process: definition and required conditions*....255
2.3.2. *Evidence of natural mummification in the fossil record*....256
2.3.3. *Favourable conditions for natural mummification at Malapa*....256
2.3.4. The case of MH2: what is the evidence?....257
2.4. Final burial position....257
3. TAPHONOMY OF THE JUVENILE MALE MH1....261
3.1. Mode of accumulation in the deposit....261
3.2. Time of exposure and state of decomposition before burial....261
3.2.1. *Weathering*....262
3.2.2. *State of articulation*....262
3.2.3. *Insect damage*....262
3.2.4. *Summary*....263
3.2.5. *Did MH1 and MH2 enter the cave at the same time*?....264
Weathering stage....264
Degree of articulation....265
3.3. Final burial position....266
4. TAPHONOMY OF MH3, MH4, MH5 AND MH6....269
4.1. Introduction....269
4.2. Excavation bias....269
4.3. Different accumulation processes....269
4.4. Different timing of burial....270

Chapter 9. Implications for the past and for the future: discussion of the results....271

1. WHERE ARE THE MISSING REMAINS?....271
1.1. MH1 missing remains....271
1.1.1. *Right hand*....272
1.1.2. *Left arm*....272
1.1.3. *Lower limbs*....272
Feet....272
Tibiae....273

1.1.4. *Sacrum*.....273
1.2. MH2 missing remains.....273
1.2.1. *Left leg and pelvis*.....274
1.2.2. *Skull and first cervical vertebrae (atlas and axis)*.....274
Hypothesis 1: disarticulation of the skull before disturbance by debris flow.....275
Hypothesis 2: disarticulation of the skull due to debris flow.....275
Discussion.....275
1.2.3. *Left upper limb*.....276
2. REATTRIBUTION OF SOME REMAINS.....277
2.1. MH1 metatarsals.....277
2.2. MH2 fibula shaft fragment.....278
3. TECHNICAL GUIDELINE FOR FUTURE EXCAVATION OF *IN SITU* DEPOSITS.....279
4. RESEARCH PERSPECTIVES.....281
4.1. Future applications of the palaeoforensic approach.....281
4.2 Unsolved research questions about the taphonomy.....282
4.2.1. What happened to the fragmentary hominins?.....282
4.2.2. Was there really a debris flow?.....283
4.2.3. What is the exact nature of the role played by insects and who are they?.....283
4.2.4. Where are the other primates?.....284
Comparison with other Plio-Pleistocene cave deposits.....284
Hypotheses to explain the absence of non-hominin large primates at Malapa.....287

General conclusion.....294

References.....297

List of figures

Figure 1.1. Cartoon illustrating the proposed hypothesis for the mode of accumulation of MH1 and MH2 (after Dirks *et al*., 2010).....8
Figure 2.1. Location of the fossil deposits in the Cradle of Humankind, South Africa, including localities in the Cradle of Humankind (CoH): Bolt's Farm (BF), Cooper's (C), Drimolen (D), Gladysvale (Gl), Gondolin (Go), Haasgat (H), Luleche (L), Kromdraai (K), Minnaars (M), Malapa (Mal), Motsetse (Mo), Plovers Lake (PL), Sterkfontein (S), Swartkrans (Sw); and outside of it: Buffalo Cave (B), Makapansgat (Ma), and Taung (T) (modified after Kuman and Clarke, 2000; Berger and Lacruz, 2003 and Adams *et al*., 2007b).....16
Figure 2.2. Early hominin fossil localities in Central and East Africa (after Egeland *et al*., 2007, modified). The localities mentioned in the text are highlighted in red.....47
Figure 3.1. 3D reconstruction of Pit 1 at the Malapa site showing the mined area and the provenance of the hominin *in situ* remains (image: courtesy of D. Conforti, Optech company, modified).....53
Figure 4.1. Position of the reference points used for the total station.....58
Figure 4.2. Disarticulation order observed amongst Topi carcasses, illustrated on a cow skeleton, from 1 (first elements to disarticulate) to 21 (last elements to disarticulate) (from Hill, 1979a).....69
Figure 4.3. Principles of computer-assisted technology applied to palaeontology and palaeoanthropology (from Zollikofer *et al*., 1998).....89
Figure 5.1. The Malapa fossil deposits (north view).....116
Figure 5.2. The Malapa fossil deposits (view from the west).....117
Figure 5.3. Surrounding landscape (north of the site).....119
Figure 5.4. NE-SW cross-section of the site showing the different sedimentary facies together with the two flowstones (from Pickering *et al*., 2011).....120
Figure 5.5. Five facies identified within the deposit in Pit 1 (from Dirks *et al*., 2010, modified). Most hominin remains come from Facies D (in yellow with green cross-lines on the figure).....121
Figure 5.6. Geological facies and organisation of the deposit in both Pits 1 and 2 (from Pickering *et al*., 2011).....123
Figure 5.7. Examples of articulated non-hominin faunal remains. A: specimen UW88-747, *Dinofelis* sp. articulated right ankle; B: specimen UW88-739, *P. brunnea* articulated ankle; C: UW88-650, bovid articulated foot; D: specimen UW88-769, rabbit pelvis articulated with the sacrum and the last lumbar vertebrae; E: specimen UW88-528, bovid articulated intermediate and distal phalanges and one sesamoid; F: no specimen number, bovid intermediate and distal phalanges; G: specimens UW88-751-756, bovid metatarsal, first phalanx and sesamoids.....130
Figure 5.8. Examples of articulated non-hominin faunal remains in blocks. A: one bovid femur, two tibiae, and one talus in block UW88-B848; B: bovid thoracic vertebrae associated with bovid ribs, one humerus and an ungulate mandible with teeth, in block UW88-B375; C: bovid humerus articulated with a radio-ulna, in block UW88-B051.....131

Figure 5.9. Examples of non-hominin faunal remains in anatomical proximity. A: specimens UW88-1156 to 1160, bovid left ankle; B: specimens UW88-1259a to 1259c, large bovid carpals; C: specimens UW88-720-722, bovid atlas, axis and third cervical vertebra; D: specimens UW88-782 and 783, hyaenid phalanges; E: no specimen number, bovid ribs articulated with a thoracic vertebra; F: specimen UW88-781, rodent skull and associated mandible. Scale bar = 5 cm.....133
Figure 5.10. Examples of non-hominin faunal remains in near articulation, still embedded in calcified sediment. A: mammal ribs in block UW88-B1043; B: bovid humerus and associated scapula in block UW88-B243; C: bovid ribs in block UW88-B152; D: small mammal lumbar vertebrae, no specimen number; E: upper part of a small carnivore skeleton, no specimen number.....134
Figure 5.11. Percentages of survival for each body part for the non-hominin faunal assemblage (ungulates and carnivores).....136
Figure 5.12. Different degrees of manganese dioxide covering observed on the bones (from left to right: slight, slight to moderate, moderate, moderate to heavy, and heavy).....138
Figure 5.13 Comparison of degree of manganese perimineralization according to the provenance of the remains (decalcified sediment, in orange, versus calcified sediment, in light pink).....139
Figure 5.14. Different types of calcite crystal growth in non-hominin bones. Top: inside spongy bone; middle: inside the medullary cavity, and bottom: inside cracks in cortical bone.....140
Figure 5.15. Examples of red traces (macro- and microscopic level, on different bones).....141
Figure 5.16. Examples of specimens distorted by sedimentary overburden. A: bovid scapula (UW88-1266); B: unidentified rib fragment from block UW88-B808 (no specimen number).....142
Figure 5.17. Carnivore pitting on a bovid rib shaft fragment (specimen UW88-878).....144
Figure 5.18. Invertebrate modifications of type 1 (boring and associated furrow) on a bovid calcaneum.....145
Figure 5.19. Different types of invertebrate damage of type 2 observed on the non-hominin faunal remains. A: deep intersecting striations; B: parallel striations; C: intersecting striations associated with pits; D: same, zoomed in; E: star-shaped pits; and F: small boreholes.....146
Figure 5.20. Distribution of the invertebrate modifications (type 2) according to the provenance of the remains (decalcified versus calcified sediment) (str. = striations).....147
Figure 5.21. Distribution of the remains bearing invertebrate damage according to weathering stage.....148
Figure 5.22. Heterogeneity of the faunal material; A: highly weathered and decalcified bovid femur; B: non-weathered, well-preserved bovid sacrum; C: articulated bovid ribs and thoracic vertebrae; D: extremely fragmentary unidentifiable bones covered with manganese, recovered from decalcified sediment.....150
Figure 6.1. Remains of MH2 (left) and MH1 (right). The bones in blue are the ones identified in an unprepared block (UW88-B051) and attributed to MH1 (dark blue: anatomical identification certain; bones in light blue: anatomical identification uncertain). Modified from Berger, 2012.....153

Figure 6.2. Percentages of complete (dark blue) and fragmentary bones (light blue) for MH1 and MH2.....155
Figure 6.3. Hominin (MH2) articulations preserved. A: antepenultimate, last lumbar vertebrae and piece of the sacrum, B: right ankle, C: thoracic vertebrae, D: sacrum and last lumbar vertebrae, E: patella and proximal tibia.....157
Figure 6.4. MH2 anatomical proximities. A: right hand bones, B: thoracic vertebrae, C: fragment of the right scapula associated with the right clavicle, and D: arm block containing the right scapula, right humerus and right first rib (below the scapula).....159
Figure 6.5. Insect modifications of type 2 on MH1 right upper incisor (specimen UW88-29).....164
Figure 6.6. Invertebrate modifications on MH1 left ilium (specimen UW88-102) and left ischium (specimen UW88-14).....165
Figure 6.7. MH2 first right rib showing possible carnivore tooth pits. A: provenance of the rib, below the scapula in the arm block; B and C: pits 1 and 2 observed on the caudal (B) and cranial (C) surfaces of the rib and illustrated here on the printout.....170
Figure 6.8. Invertebrate modification observed on a fibula shaft fragment (specimen UW88-84) belonging to MH2.....171
Figure 6.9. Modifications of the surface of MH1 and MH2 fossils, caused by biotic and abiotic agents (the data are presented as a percentage of remains affected by each type of modification).....173
Figure 6.10. Comparison of MH1 and MH2 specimens according to the weathering stages (dark green: stage 1; light green: stage 2, following Behrensmeyer, 1978).....175
Figure 7.1. Position of *in situ* MH1 remains in Facies D (image: courtesy of D. Conforti, Optech Company, modified).....179
Figure 7.2. "Clavicle block" on the day of discovery showing the right clavicle UW88-1 on one side (left) and a fragment of the right mandible UW88-2 (right) on the other (image: courtesy of L.R. Berger).....180
Figure 7.3. Partially prepared upper part of the "clavicle block" showing the mandible (UW88-8) next to the ulna (UW88-3) and the cervical vertebra (UW88-9). Scale bar = 5 cm.....181
Figure 7.4. Lee Berger at Malapa holding the block containing the proximal femur UW88-4 and a modern femur for comparison (image: courtesy of L.R. Berger).....182
Figure 7.5. Superior view of the "skull block" showing the partially prepared skull (UW88-50) and the right humeral shaft (UW88-42). Scale bar = 10 cm.....182
Figure 7.6. View of the "ilium block" showing the distal right humerus (UW88-88) on the left and the left ilium (UW88-102) on the right.....183
Figure 7.7. Bones preserved inside the block of calcified sediment UW88-B051 attributed to MH1, from the top (A) to the middle of the block (D), shown as snapshots of the CT-scanner data realized with Avizo.....184
Figure 7.8. Bones preserved inside the block of calcified sediment UW88-B051 attributed to MH1, from the middle (A) to the lower part of the block (D), shown as snapshots of the CT-scanner data realized with Avizo.....185
Figure 7.9. Position of the MH2 "arm block" *in situ* in Facies D (image: courtesy of D. Conforti, Optech Company, modified).....187

Figure 7.10. Superior view of the "arm block" (UW88-B043) showing the right scapula, first and second ribs, humerus, and distal radius and ulna.....188
Figure 7.11. Left: scapula on top of the first rib (UW88-198), manubrium (UW88-172) and rib UW88-154. Right: exposed rib (UW88-154) and manubrium (UW88-172) after preparation.....189
Figure 7.12 Upper part of the "scapula fragment block" showing the incomplete scapula fragment (bottom; UW88-56) and the right clavicle (top right; UW88-38).....190
Figure 7.13. Bottom part of the "scapula fragment block" showing the right hemi-mandible (UW88-54) and the cervical vertebra (UW88-83; top left corner of the block).....190
Figure 7.14. "Thoracic vertebrae block 1".....192
Figure 7.15. Orientation and inclination of the bones from the "arm block".....196
Figure 7.16. Cross-section (view from the top, see image of the top illustrating where the orthoslice is taken from) of the skull showing the sediments inside the vault (the white line indicates the limit between the two types of sediments, and the white arrows indicate the inclination of the sedimentary laminae) (images: courtesy of K. Carlson, modified).....198
Figure 7.17. Layer overlying Facies D, above where the MH1 vault fragments were recovered. Note the horizontal lamination of the sediments, reminiscent of cross-bedding (image: courtesy of P. Dirks).....200
Figure 7.18. Distance distal humerus to distal femur (reconstruction of MH2 remains in their anatomical position).....205
Figure 7.19. Distance between the medial side of the scapula and the vertebral end of the second right rib.....206
Figure 7.20. Inclination of the "arm block" inside the deposit and distance between the MH1 and MH2 *in situ* remains.....210
Figure 7.21. All *in situ* remains in the grid (XZ view). MH1 remains are represented in blue, MH2 remains in orange.....211
Figure 7.22. Refitting of the "skull block" and the "ilium block".....212
Figure 7.23. Refitting of the group skull-right humerus-left ilium (MH1) in the deposit (view from the south).....214
Figure 7.24. MH1 clavicle and associated bones in their original position in the "clavicle block" (left: lateral view; right: superior view).....215
Figure 7.25. MH1 skull and right humerus embedded in the block. Note the narrowness of the calcified sediment below the humerus. Scale = 10 cm.....217
Figure 7.26. MH1 right humerus, in block. Note the thinness of the block below the humerus. Scale bar = 5 cm.....218
Figure 7.27. Position and orientation of the right femur in the "arm block".....222
Figure 7.28. Different possible areas in which MH1 and MH2 remains can be refitted (green: MH1 skull-humerus-ilium; purple: MH1 "clavicle block"; blue: MH1 femur; pink: MH2 loose remains).....226
Figure 7.29. Hypothetical refitting of MH1 and MH2 remains within the deposit.....227

Figure 7.30. Simplified schematic cross-section of the position of the hominin remains inside the deposit.....228
Figure 7.31. Final 3D reconstruction (planimetric view of the site together with the 3D renderings of MH1 and MH2 remains).....229
Figure 7.32. Close up of the hominin remains inside the deposit; plan view (dark gold on the right: MH1 remains; light gold on the left: MH2 remains).....230
Figure 7.33. Close up of the hominin remains inside the deposit; north-western view (dark gold on the right: MH1 remains; light gold on the left: MH2 remains).....231
Figure 7.34. Close up of the hominin remains inside the deposit; western view (dark gold on top: MH1 remains; light gold at the bottom: MH2 remains).....232
Figure 8.1. Stage 1: bone accumulation in the primary deposits (den occupied by the brown hyaena, and talus cone at the bottom of the vertical death trap). View from the south.....245
Figure 8.2. Stage 2: primary bone accumulations are transported by the debris flow to the lower secondary deposit. View from the south.....246
Figure 8.3. Stage 3: present state of the deposits, after erosion of the upper part of the cave system. View from the south (the lighter brown layer, on top of the sequence, is consistent with Facies F, which deposited after the debris flow event).....247
Figure 8.4. Burial position of MH2, viewed from the top (left: hypothetical burial position, before displacement and including the missing bones; right: burial position as recovered from the deposit, including only the bones that have been found).....259
Figure 8.5. Burial position of MH1 in the deposit, viewed from the top (upper left corner: burial position as recovered from the deposit, including only the bones that were found; bottom: hypothetical burial position, before displacement and including the missing bones). The bones in blue are the ones identified inside the unprepared block UW88-B051.....267
Figure 9.1. Position in the deposit of the *in situ* fibula shaft fragment (A: specimen UW88-202, attributed to MH2) and metatarsals (B: specimen UW88-22; C: specimen UW88-16; attributed to MH1), in relation to MH1 and MH2 remains (viewed from the south).....279
Figure 9.2. Abundance of hominin and non-hominin primates in Plio-Pleistocene fossil-bearing cave deposits from the Cradle of Humankind, in terms of minimum number of individuals (Br: Breccia; HG: Hanging Remnant, JC: Jacovec Cavern, LB: Lower Bank, M: Member, Old: Oldowan; StW: Sterkfontein).....287

List of tables

Table 2.1. Age ranges of the different hominin taxa identified in the Cradle of Humankind, together with the localities where they were found.....18
Table 2.2. Accumulating carnivore agents proposed for the primate remains in some cave sites from the Cradle of Humankind.....22
Table 2.3. Extinct species of large carnivores present in Plio-Pleistocene sites from the Sterkfontein Valley.....27
Table 2.4. Small carnivore species whose remains have been recovered in the Plio-Pleistocene cave deposits of the Cradle of Humankind.....29
Table 2.5. Dimensions and flow velocity of the recirculating flumes used in the experimental bone transport in water studies.....33
Table 2.6. Transport potential of skeletal elements considered in the literature.....36
Table 2.7. Velocity (cm/s) recorded in the literature for each skeletal element.....37
Table 2.8. Transport potential and mean velocity (cm/s) for each complete, disarticulated skeletal element (after Voorhies, 1969; Boaz and Behrensmeyer, 1976; Coard and Dennell, 1995).....38
Table 2.9. Summary of the preservation of some early hominins recovered in Central and East Africa.....48
Table 3.1. Identifiable fauna from Malapa (after Dirks *et al.*, 2010; Kuhn *et al*., 2011 ; Val *et al*., 2011 ; Harstone-Rose *et al*., 2013).....54
Table 4.1. X,Y and Z coordinates of the reference points.....58
Table 4.2. Bone categories used in the database for faunal remains.....63
Table 4.3. List of persistent, unstable and interlocking unstable joints and articulations in the human skeleton (after Duday *et al*., 1990; Maureille and Sellier, 1996; Duday, 2009).....68
Table 4.4. Different types of carnivore damage on bone.....74
Table 4.5. Birds of prey for which information exist in terms of bone accumulation and damage.....79
Table 4.6. Description of insect damage associated with pupation chambers of dermestid beetles.....83
Table 4.7. List of insects and gastropods used in the experiment.....85
Table 4.8. Different weathering stages affecting bones (from Behrensmeyer, 1978).....86
Table 5.1. Faunal diversity in different cave deposits from the Cradle of Humankind (microfauna not included).....127
Table 5.2. Quantitative data on the faunal material from Malapa to date, with estimates of the NISP, the MNE and the MNI for each order. Molluscs and invertebrates are not considered.....128
Table 5.3. Weathering stages observed in the non-hominin faunal assemblage.....137
Table 5.4. Extent of the manganese dioxide coating on the non-hominin bone surfaces.....138
Table 5.5. Comparison of degree of manganese dioxide mineralization according to the provenance of the remains (decalcified versus calcified sediment).....138

Table 5.6. Invertebrate modifications of type 2 observed on the fossil remains, according to the provenance of the remains (decalcified versus calcified sediment).....147
Table.5.7. Invertebrate damage, according to the weathering stage of the fossils.....148
Table 6.1. Percentage survival for each element per individual.....152
Table 6.2. Articulations preserved in MH2.....158
Table 6.3. Manganese coating on MH1 bones.....161
Table 6.4. Manganese coating on MH2 bones.....166
Table 6.5. Dimensions (respectively: mean and range) of the possible tooth pits observed on MH2 right first rib and MH3 femur (in mm) and dimensions of tooth pits experimentally produced by different class-sized carnivores (data from Selvaggio and Wilder, 2001, and Domínguez-Rodrigo and Piqueras, 2003).....168
Table 6.6. Weathering stages of MH1 and MH2 remains (in percentage).....175
Table 7.1. Direction and inclination of the MH2 skeletal elements present in the "arm block"....195
Table 7.2. Distances between *in situ* MH1 and MH2 remains.....209
Table 7.3. List of possibilities concerning the position of the "clavicle block".....216
Table 8.1. Decomposition stages for human cadavers (from Vass, 2001 and Duday, 2009).....249
Table 8.2. Species of insects found on carcasses and mentioned in the text.....253
Table 9.1. Hypothetical location of the missing hominin remains.....277
Table 9.2. Extinct and extant papionins found in deposits from the Cradle of Humankind.....285
Table 9.3. Abundance of hominin and non-hominin primates (NISP/MNI) in Plio-Pleistocene faunal assemblages from the Cradle of Humankind.....286