1 The Bioarchaeology of Cardiovascular Disease

Introduction

Michaela Binder

In February 2010, I was crouching down in a subterranean tomb chamber at the archaeological site of Amara West in modern Sudan, excavating the human skeletal remains of people that had lived some 3000 years ago. Suddenly, I came across fragile tubular objects made of a whitish substance arranged almost like a string of beads parallel to the femur of a middle-aged woman (Figure 1.1). The unassuming little tubes were carefully collected, wrapped in scraps of acid-free tissue paper, packed in cardboard boxes used for Sudanese matches and labelled 'calcified arteries?'. Together with the excavated skeletal remains, they were later – courtesy of the National Corporation for Antiquities and Museums of Sudan – shipped to the British Museum in London for further scientific analysis within the framework of my PhD research at Durham University under the supervision of Charlotte A. Roberts, the co-editor with myself of this book. Over the course of several more excavation seasons at Amara West, the number of little boxes containing these objects labelled 'calcified arteries?' grew, resulting in a first paper published in the *International Journal of Paleopathology* in 2014. Drawing on clinical knowledge, new evidence from mummy studies that had just been published (e.g. Allam et al., 2009; Thompson et al., 2013), anatomical data and three-dimensional modelling, they were presented as the first evidence of calcifications resulting from cardiovascular disease (CVD) associated with human skeletal remains from an archaeological site (Binder & Roberts, 2014).

When the paper was published in 2014, it created an unexpectedly large amount of public interest, including media coverage in the USA, Canada, the UK, Russia, Japan and continental Europe. Reporters were not so much interested in the archaeology of the site, but the fact that CVDs were clearly not a modern phenomenon related to twenty-first century living but had already plagued humans 3000 years ago. An equally extensive media response had already been observed when the Horus team evidence of atherosclerosis in mummies from four different archaeological populations had been released a year prior to our paper in the *International Journal of Paleopathology* . With CVDs rising to become the number one cause of death worldwide, these studies had apparently hit a nerve in Western societies. Within the context of the developing field of evolutionary medicine (Nesse & Stearns, 2008; Stearns et al., 2010; Alcock, 2012; Plomp et al., 2022), the potential relevance of results from palaeopathological studies became evident for discussions about CVDs today.

https://doi.org/10.1017/9781108648561.002 Published online by Cambridge University Press

Figure 1.1 Remnants of a calcified artery in a burial at Amara West (Sudan) in situ upon recovery. Source: courtesy of the Trustees of the British Museum.

1.1 The 2015 AAPA Symposium

With the archaeological evidence from Amara West and increasing interest in studying CVDs in mummified human remains, Charlotte Roberts and I felt it timely to bring together experts from different areas to discuss current knowledge of CVDs in past human populations and thus we organised a half-day symposium 'The Bioarchaeology of Cardiovascular Diseases' at the 84th Meeting of the American Association of Biological Anthropology[1] in St Louis, Missouri on 26 March 2015.

The aim of the symposium was to bring together experts in palaeopathology, forensic anthropology, biomolecular archaeology and evolutionary medicine to discuss current knowledge of CVDs in past human populations, including new research perspectives, recovery strategies and taphonomy, and to highlight the modern relevance of the insights gained from the data. Additionally, with the presentation at the symposium of recent results from burials containing skeletal remains, the potential for preservation of evidence of CVDs was highlighted, with the aim of increasing awareness to the possibilities and research potential of detecting CVDs in and with archaeological human remains. The symposium featured seven invited papers as well as a discussion led by Niels Lynnerup (University of Copenhagen) and Albert Zink (EURAC, Bozen). The papers presented in the 2015 symposium form the basis of this

[1] Formerly the American Association of Physical Anthropology; the name was changed in 2020.

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book. Several more researchers were also invited to contribute to provide as full a reflection as possible of the current spectrum of bioarchaeological research on CVDs in past human populations. Amidst two career changes, one retirement, one child and a global pandemic, its realisation took somewhat longer than anticipated. However, with an increasing interest in studying the occurrence of diseases in the past to understand their background and evolution, we feel it remains highly relevant to a range of disciplines, including clinical and evolutionary medicine, palaeopathology, forensic anthropology, fieldwork in archaeology, and medical history.

1.2 Organisation of This Volume

The papers in this volume are organised into three thematic sections: Evidence from Mummified Tissues, Cardiovascular Diseases Associated with Human Skeletal Remains, and Contemporary Perspectives (Figure 1.2). In order to provide a comprehensive medical, biological and evolutionary framework for the papers in this volume, Charlotte Roberts opens the volume with an outline of the complex clinical, pathophysiological and epidemiological background of CVDs and a review of the range of sources available to the study of CVDs in bioarchaeology, including both direct and indirect evidence.

The section on mummy studies starts with a review chapter by Gino Fornaciari and Raffaele Gaeta that summarises the developments in the study of CVDs in mummified human remains through the use of histological analysis of cardiovascular tissues. Drawing upon their extensive research experience, they present examples from different chronological and geographical backgrounds. Randall Thompson and colleagues present an updated version of the ground-breaking Horus study first published in 2009 (Allam et al., 2009) that set the path for the systematic study of CVDs in skeletal and mummified human remains. In their chapter, new evidence is presented, including a larger subset of Egyptian mummies, and confirms earlier observations that CVDs were present in humans regardless of their social status throughout the past 5000 years. Over the past decade, the team from the British Museum's Department of Ancient Egypt and Sudan led by Daniel Antoine has conducted an extensive multidisciplinary research programme including state-of-the-art CT scanning and three-dimensional visualisation of their collection of mummies to reveal the life histories of the individuals they once were. Naturally, this also led to the repeated discovery of evidence of CVDs in the majority of the mummies they were studying. In their contribution to the book, they summarise their results, discuss the differences between different generations of CT scanners and call for a more systematic approach when analysing the prevalence of CVDs in past human populations. The research group led by Albert Zink studying the 5300-year-old ice mummy Ötzi were the first to approach the topic from a palaeogenetic perspective, identifying genes linked to a genetic predisposition to CVD. In their contribution, their results are discussed within the context of host–environment interactions in order to add to our understanding of the genetic risk factors for CVDs.

https://doi.org/10.1017/9781108648561.002 Published online by Cambridge University Press

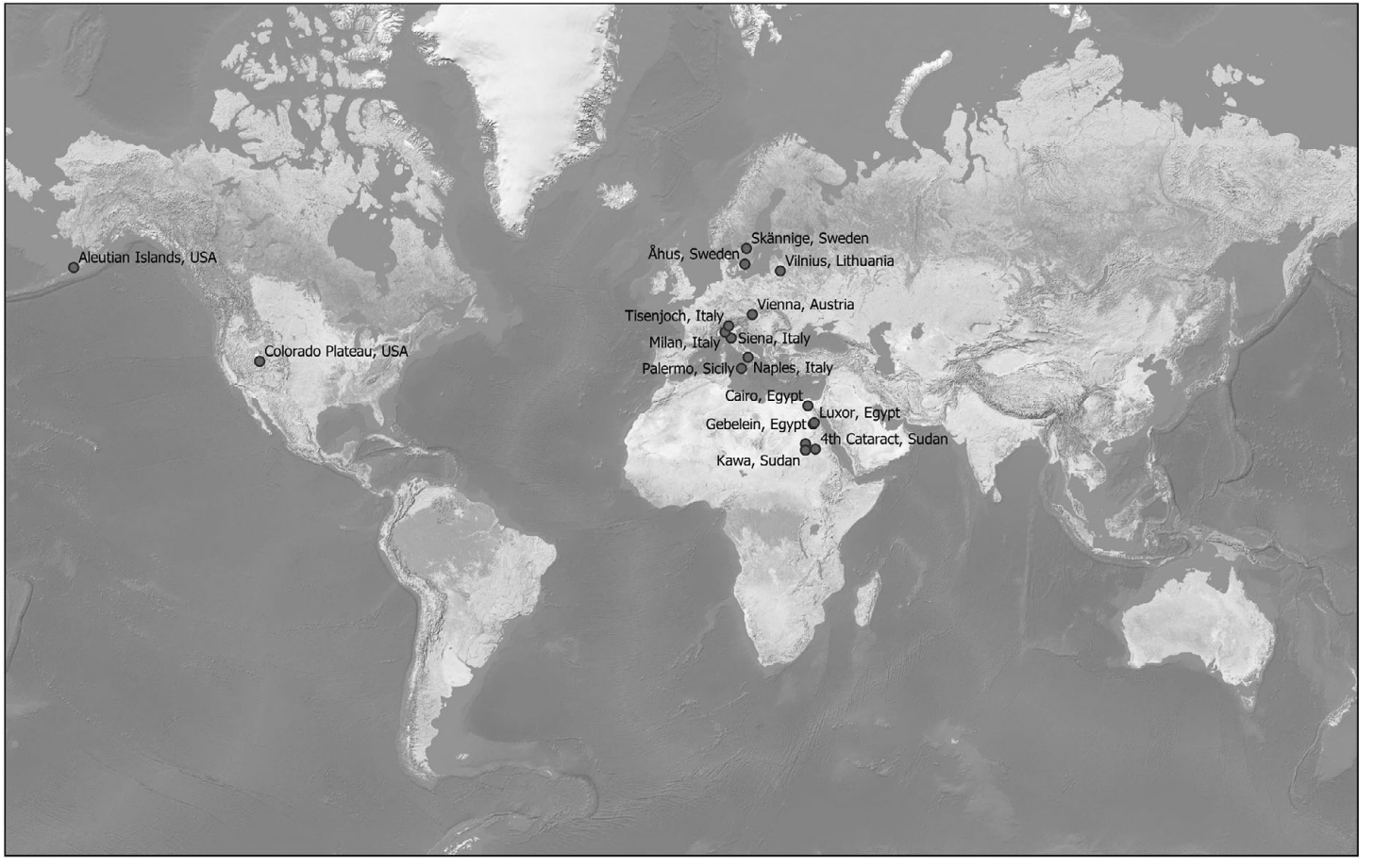

Figure 1.2 Map showing locations of sites discussed in this volume (basemap: ESRI World Physical Map). (A black and white version of this figure will appear in some formats. For the colour version, please refer to the plate section.)

The second section of the book is concerned with evidence related to CVDs recovered from and with human skeletal remains. In contrast to mummy studies, these have not been considered in bioarchaeological research until fairly recently due to difficulties in recognition, identification and recovery of pathological calcifications resulting from CVDs. This section for the first time brings together the small number of studies available to date. It hopes to raise awareness in the discipline of archaeology in general (e.g. excavators who are not bioarchaeologists), and particularly inspire bioarchaeologists. It also emphasises the need to look for the, often tiny, objects during excavation and analysis, and to use the data in bioarchaeological research as a means to broaden the spectrum of diseases considered when addressing morbidity and mortality in past human populations. In the first paper of this section, Michaela Binder and Charlotte Roberts present new calcified objects from the archaeological site of Amara West in Sudan alongside those already published in 2014. A second collection of calcifications related to CVDs from an archaeological context comes from medieval Sweden. Caroline Arcini and colleagues discuss their findings within the context of historical data from archival sources detailing dietary habits and living conditions, highlighting that the risk factors for developing CVDs were prevalent in medieval society just as much as in today's societies. Drawing upon one of the world's largest collections of historical pathological objects collected for teaching purposes in Viennese hospitals between the seventeenth and nineteenth century, the Narrenturm in Vienna, Karin Wiltschke-Schrotta and colleagues further present a selection of different calcified objects related to CVDs. These are intended as a visual guide for researchers to draw attention to the wide range of objects potentially arising from CVDs. In order to explore potential reasons for the lack of evidence of calcifications arising from CVDs, Michaela Binder and Charlotte Roberts summarise current knowledge about the biological background of arterial calcification and discuss it within the context of archaeological taphonomy. That evidence for CVDs in human skeletal remains is not only confined to calcifications within the cardiovascular system is outlined in the chapter by Daniel Antoine and Tony Waldron. They present examples of vertebral changes related to two abnormalities of the vertebral arteries, tortuosity and aneurysm.

The final section entitled Contemporary Perspectives combines contributions approaching the topic of this book from two very different angles. Providing a forensic perspective, Lucie Biehler-Gomez and colleagues examine calcifications from 72 individuals with a documented medical history from the twentieth-century Milano Cemetery Skeletal Collection. Their results, including macroscopic, histological and scanning electron microscopy/energy dispersive spectrometry, provide a tool for forensic anthropologists and bioarchaeologists alike to reconstruct individual biographies. Finally, even though the contributions in this volume show that CVDs were widespread throughout the world in a wide range of chronological periods, ethno-medical research by Randall Thompson and colleagues on the Tsimane people in the Bolivian Amazon provides evidence that populations with low levels of CVDs nevertheless do exist. With subsistence based on fishing, hunting, gathering and farming as well as a generally active physical life, the Tsimane lifestyle

represents a counterpoint to many ancient and modern societies. Thus, overall, the insights gained from this project provide a deeper understanding of CVD data for both the past and present.

The editors hope that this volume will (1) establish a baseline of CVD data from human remains that ranges from forensic contexts to archaeological skeletons and mummies; and (2) emphasise that despite accepted wisdom that few diseases affect the bones and teeth of skeletons, with more nuanced and reflective approaches, including carefully excavating those remains, anything is possible!

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https://doi.org/10.1017/9781108648561.002 Published online by Cambridge University Press