

Preface

The geological sequence in the Afar region of Ethiopia includes more than a kilometer-thick, stratified, fossiliferous sediments sampling the last six million years of vertebrate evolutionary history and provides one of the most important windows into our evolutionary past. The continuous fossil-bearing sedimentary sequence in this region is unparalleled by any other place in the world and has been a research target for a number of paleontologists for the last five decades. Since the discovery of Hadar in the late 1960s by the French Geologist Maurice Taieb and the subsequent initiation of paleontological field research at the site by the International Afar Research Expedition (IARE), a number of other projects have followed suit to extensively explore the region. Currently, there are more than eight paleontological and archeological research projects working in the Afar region; combined, they have yielded an uninterrupted fossil record documenting the last six million years of human evolutionary history with more than 12 early hominin species recovered thus far, some of them found only in the Afar region of Ethiopia.

The Woranso-Mille paleontological project is one of the relatively young projects working in the Afar region. Understanding the importance of locating new paleontological sites, one of us (YHS) initiated an extensive survey and exploration of the northern and central Afar region of Ethiopia in the fall of 2002 under a permit issued by the Authority for Research and Conservation of Cultural Heritage of the Ministry of Culture and Tourism of Ethiopia (ARCCCH). Exploration and survey largely relied on aerial photographs, satellite imagery interpretations, and air survey in order to identify sediments with paleontological potential, followed by foot survey covering vast areas. It was not until the end of the 2004 survey and exploration season that the paleontological potential of the Woranso-Mille area was identified.

The Pliocene deposits of the Woranso-Mille are unique because they represent a geological time period (3.6–3.8 Ma) that is poorly sampled in the eastern African geological sequence. Moreover, recent investigations have also identified sediments within the study area that are older than 4.3 Ma, as well as sediments that are younger than 3 Ma and older than 5 Ma. Paleontological research at Woranso-Mille in the last 10 years has largely concentrated on the fossiliferous deposits dated to between 3.5 and 3.8 Ma, largely to address the ancestor-descendant relationship that has been widely hypothesized between *Australopithecus anamensis* (4.2–3.9 Ma) and *Australopithecus afarensis* (3.7–3.0 Ma). Although a number of morphological analyses support this hypothesis, the paucity of hominin fossils from the time between 3.6 and 3.9 Ma has been a major obstacle to understanding their phylogenetic relationship. The Woranso-Mille paleoanthropological research project has contributed significantly to our understanding of middle Pliocene hominin phylogeny and systematics with the recovery of hundreds of hominin fossils of the appropriate age. These fossils emphasized the mosaic nature of the dentognathic and postcranial morphology of these early hominins and showed unequivocally that the middle Pliocene of eastern Africa was populated by a diversity of hominin species.

One of the most spectacular fossil discoveries from the Woranso-Mille study area is a partial skeleton of *Au. afarensis* (KSD-VP-1/1), the subject of this volume. The first element of the specimen was found in February 2005 and the rest of its elements were recovered from excavations conducted over 4 years following the initial discovery. Partial skeletons are extremely rare in the fossil record, with only four known from the entire Pliocene hominin fossil record. One of these partial skeletons, A.L. 288-1 (Lucy), was discovered at Hadar in 1974. This 3.2 Ma specimen assigned to the species *Au. afarensis* has been a subject of intense research and used as the major source of information to understanding the paleobiology of the species. However, it has also raised a number of debates particularly in relation to early hominin body size, shoulder girdle anatomy, thoracic shape, and locomotor adaptation of *Au. afarensis*.

KSD-VP-1/1, nicknamed *Kadanuumuu*, which means “big man” in the local Afar language, not only is a much larger individual but also has almost complete elements of the shoulder and pelvic girdles, along with ribs, cervical vertebrae, and elements of both the fore- and hindlimb that, for the first time, shed light on the cervical anatomy of early hominins and allow for a deeper understanding of limb proportions and locomotion in *Au. afarensis*. A preliminary analysis of KSD-VP-1/1 was published in 2010 in the *Proceedings of the National Academy of Sciences* that highlighted the significance of the specimen for understanding the paleobiology of *Au. afarensis*. This volume, however, presents a detailed description and analyses of all of the elements recovered, with additional data derived from computed tomography (CT), along with a better understanding of its geological, taphonomical, and paleoenvironmental context. This volume will contribute greatly to our knowledge of the postcranial anatomy of *Au. afarensis* and towards a better understanding of its overall paleobiology.

Field research conducted by the Woranso-Mille paleoanthropological project was made possible under a permit from the Authority for Research and Conservation of Cultural Heritage (ARCCH) of the Ministry of Culture and Tourism of Ethiopia, the Afar Regional State, and all of its district administrations. We would like to particularly acknowledge Mohammed Bilay (Administrator of Mille district) and Habib Wogris (Chairman of the Gega and Burtele sub district) for their support of the project. Thanks to Alemayehu Asfaw who found the first skeletal element of KSD-VP-1/1 and to the colleagues and students who participated in the excavation: Mulugeta Alene, Joshua Angelini, Erin Benson, Alan Deino, Stephanie Melillo, Hailay Reda, Liz Russell, Beverly Saylor, Gary Scott, and Robin Shultz. We are also grateful to the many field assistants from Addis Ababa and the Afar people at Waki and Waylateyta without whose participation the excavation of KSD-VP-1/1 would not have been possible. The Paleoanthropology Laboratory of the ARCCH made its laboratory and fossil storage space available and we are grateful for the support provided by the curators in the laboratory. Field and laboratory research of the Woranso-Mille project was supported by The Leakey Foundation, The Wenner-Gren Foundation, The National Geographic Society, Cleveland Museum of Natural History, and National Science Foundation (BCS-0234320, BCS-0321893, BCS-0542037, BCS-1124705, BCS-1124713, BCS-1124716, BCS-1125157, BCS-1125345).

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New Insights from KSD-VP-1/1

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