Ralf-Dietrich Kahlke (Ed.)

The Pleistocene of Untermassfeld near Meiningen (Thüringen, Germany)

Part 5

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THE PLEISTOCENE OF UNTERMASSFELD NEAR MEININGEN (THÜRINGEN, GERMANY)

PART 5

Mit Beiträgen von

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Satz: Claudia Nickel (RGZM)

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Dedicated to the former Senckenberg director

Fritz F. Steininger

with our thanks for many years of support

FOREWORD

More than four decades of continuous excavation and research have been devoted to the Pleistocene deposit of Untermassfeld and its extraordinarily rich and diverse fossil content. The prepared and preserved finds comprise a total of 18,250 catalogued specimens or series and fill about 1000 drawers at the Senckenberg Research Station of Quaternary Palaeontology in Weimar. The corresponding research results produced by an international multidisciplinary team of scientists are available in five ongoing monograph volumes. The long-term Untermassfeld project was, in many ways, influenced by changing constellations in scientific policy. The character of the Weimar Quaternary palaeontology department, which was in charge of the overall project, changed from being an independent institute into a working group in a geoscientific institute in Jena, before becoming integrated into the Senckenberg Research Institute in Frankfurt a. M. Our special thanks go to the then director Fritz F. Steiniger, who strongly supported the interests of Quaternary palaeontological research in Weimar and the progress of the excavations in Southern Thuringia.

Over the years, the field, conservation, and evaluation work was carried out with the assistance of different funding models. For regular support we thank the Free State of Thuringia, represented by the Thuringian State Office for Heritage and Archaeology with its president Sven Ostritz (Erfurt, Weimar), the City of Meiningen, and the District of Schmalkalden-Meiningen. Assistance in setting up storage rooms in two newly occupied institute buildings during the years 2005–2009 was received from the Senckenberg Society for Nature Research, which was always generous in its support of the work on Untermassfeld. The palaeontological expert of a renowned national organisation for research funding, on the other hand, recommended as early as the early 1990s that the excavation work at Untermassfeld should be discontinued in the near future. If this advice had been followed, almost 9,000 Early Pleistocene vertebrate finds from a reliable stratigraphic context would not be available to researchers today.

Over the course of this long-term project, the technologies used for the recovery and documentation of the fossil material developed considerably. In addition to the use of efficient laser surveying technology in the field, find documentation was converted to digitally created excavation plans, allowing selective access of each individual specimen. The use of digital photography and, occasionally, applied computer tomography also improved the visualisation possibilities of the examined fossil material. A new impregnation method specifically for the Untermassfeld vertebrate fossils was also developed during the project in order to preserve the osteological material as permanently as possible. The following staff members of the Weimar Institute have been involved in the overall project since the publication of Part 4 of the Untermassfeld monograph (2020): Jessica Arnold (preparation), Susann Döring (photography), Bärbel Fiedler (editorial manuscript management), Evelin Haase (cataloguing, documentation, graphics), John-Albrecht Keiler (conservation technology, field management, funding), Frank Krause (technical support), Dennis Rössler (preparation), Sabine Schneider (finances), Gerald Utschig (collection management), Rebecca Michalik (preparation). Our heartfelt thanks go to all of them. It goes without saying that for the whole of the team the challenging work on the Untermassfeld project and the resulting collection, as well as the numerous collaborative relationships, was an enriching experience.

After the then Director General of the Römisch-Germanisches Zentralmuseum Mainz Konrad Weidemann † included Parts 1–3 of the Untermassfeld monograph in the RGZM's publication series (1997, 2001), it was Sabine Gaudzinski-Windheuser (Mainz, Neuwied) who later made the continuation of the Untermassfeld series possible. The printing of Parts 4 and 5 was financially supported by the Senckenberg Research Institute in Frankfurt a. M. within the framework of a cooperation agreement. We sincerely thank all those involved.

In addition to the description of a pathological finding, the present volume contains new research results on suids and elephantids and in particular on new findings from ursids and hyaenids, including an analysis of the bone modifications they caused. New results are also presented for all six felid species, micromammals, and cercopithecids. A synopsis on site origin, palaeobiodiversity, taphonomy, palaeoenvironment, chronostratigraphy and significance of the Untermassfeld fossil assemblage for western Palaearctic faunal history concludes the monograph. Since the treatises on the research results on Untermassfeld are now quite extensive, cross-references to further and more precise explanations are unavoidable. Corresponding citations are mostly provided with page and illustration references to enable the quick location of corresponding passages.

The manuscripts for Part 5 of the Untermassfeld monograph were kindly reviewed by Diego Jaime Álvarez-Lao (Oviedo), László Bartosiewicz (Stockholm), Marco Cherin (Perugia), Eric Delson (New York City), Helmut Hemmer (Mainz), Uwe Kierdorf (Hildesheim), Adrian Lister (London), Simon Parfitt (London), and one anonymous colleague. The majority of the texts were linguistically edited with expertise and much attention to detail by Christina Nielsen-Marsh (Leipzig). Claudia Nickel (Mainz) took care of the final editing and layout of the individual contributions in her usual meticulous manner.

Since the excavation site of Untermassfeld has now been secured against theft and associated destructive interventions, it would make sense to present the findings and current research results to a wider public. Perhaps in the future there will be the possibility of a permanent exhibition in Thuringia that focuses on the discoveries of Untermassfeld in an ecological context. In so doing, unique and irretrievable material, witnesses of life a million years ago, could be made accessible as tangible 3D reproductions. Other exhibits displaying the original specimens could also be made available to the viewer, and which might occasionally even permit handling. It is to be hoped that the site, its fossil content, and the knowledge gained from its study will form the basis, starting point, and inspiration for future palaeobiological research and museum experiences.

Weimar, January 2022 *Ralf-Dietrich Kahlke*

Untermassfeld research excavation, in-situ block preparation IQW 2014/41900 (Mei. 47209) with a polyspecific bone concentration embedded in channel lag deposits of Upper Fluviatile Sands [UFS(l)] from grid squares Q 21, 22, and 49 (Kahlke in this volume, Fig. 15, **Foldout III**), 2.14–1.90 m below site 0-level (see Kahlke 2020, Fig. 5a–b for images showing the block during excavation and its recovery by crane), 255 finds exposed (a few more than are visible in the excavation plan) including a skull of *Pseudodama vallonnetensis* (de Lumley, Kahlke, Moigne et Moullé) with its left antler (Breda et al. 2020) and a substantial part of the forequarter skeleton from a female *Acinonyx pardinensis pleistocaenicus* (Zdansky) (Hemmer and Kahlke in this volume), original find position faced in a south-westerly direction. – Dimensions of the preparation: 1.0 × 1.0 × 0.46 m.

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Breda, M., Kahlke, R.-D., Lister, A., 2020. New results on cervids from the Early Pleistocene site of Untermassfeld. In: Kahlke, R.-D. (Ed.), The Pleistocene of Untermassfeld near Meiningen (Thüringen, Germany). Part 4. Monographien des Römisch-Germanischen Zentralmuseums 40, 4, 1197–1249.

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in this volume. The Pleistocene of Untermassfeld – A synopsis of site origin, palaeobiodiversity, taphonomic characteristics, palaeoenvironment, chronostratigraphy, and significance in western Palaearctic faunal history, 1635–1734.

JELLE W. F. REUMER · RALF-DIETRICH KAHLKE

NEW RESULTS ON CERCOPITHECIDS FROM THE EARLY PLEISTOCENE SITE OF UNTERMASSFELD

Abstract

The scant sample of *Macaca sylvanus* from the Early Pleistocene locality of Untermassfeld (Thuringia, Germany) is increased by the recent finds of a deciduous right upper incisor and a left maxillary fragment bearing a partial tooth row with P^3-M^2 preserved. The material is described; it brings the number of recorded individuals to at least three. We refrain from giving a subspecific name for the Untermassfeld macaques due to the large overlap in size among European fossil records. *Macaca sylvanus* is among the least recorded large mammal species of the Untermassfeld fauna; their tree- and rock-climbing behaviour probably let them escape from occasional flooding.

1. Introduction

Barbary apes or macaques (*Macaca sylvanus*) are a rare but not uncommon element of many Early, Middle and even Late Pleistocene mammal faunas of the western Palaearctic (e. g., Kahlke 1961, 503; Franzen 1973; Delson 1974; 1980; Adam 1975; Fladerer 1991; Alba et al. 2008; 2011; 2016; Castaños et al. 2011; Sardella et al. 2015; Reumer et al. 2018). In all of the corresponding sites, macaque remains occurred in small numbers only and usually represent not more than one or a few single individuals.
After Thenius (1965) announced the identification of a *Macaca* phalanx from the early Middle Pleistocene of Voigtstedt as the first proof of a fossil macaque in Central Germany, Kahlke (1982, 943) reported the occurrence of this genus at the newly discovered site of Untermassfeld. A third, stratigraphically younger find from Central Germany was mentioned by Mania (1983, 159) from the late Middle Pleistocene of Bilzingsleben. Zapfe (2001) was the first to describe the *Macaca* excavated at Untermassfeld during the late 1970s and 1984.

2. Previous finds

After the discovery of the site of Untermassfeld in 1978, systematic excavations have been carried out in extended annual campaigns (Kahlke 1997; 2001a; 2001b; 2020). The unusually high concentration of verte-

brate carcasses and other necromass incorporated in fluviatile sediments was induced by the accumulating effect of a clastic mudflow fan influencing the riverine water flow (Ellenberg and Kahlke 1997; Kahlke et al. 2020). The huge amount of vertebrate remains from Untermassfeld represent one single contemporaneous fauna, assigned to Marine Isotope Stage (MIS) 31 (Kahlke 2001c; 2006; Maul et al. 2007; Kahlke et al. 2020; in this volume).

The first *Macaca* finds from Untermassfeld occurred during the 1979 field season. These are five elements [C inf. dex. IQW 1980/16 566 (Mei. 16 087)b, I_1 dex. IQW 1980/16 566 (Mei. 16 087)a, P_4 dex. IQW 1980/16 566 (Mei. 16 087)c, M_1 dex. IQW 1980/16 566 (Mei. 16 087)d, M_3 dex. IQW 1980/16 566 (Mei. 16 087)e, Zapfe 2001], which were recovered during rescue excavations (Kahlke 1997; 2001c, Fig. 8; 2006, Fig. 41). Their origin was most probably from the main bone bed of the site, the lower part of the Upper Fluviatile Sands [UFS(l); Kahlke 2006; Kahlke et al. 2020], that form the infill of an erosional channel. Another early macaque find, a relatively large M_3 dex. [IQW 1984/20 021 (Mei 16 541), Zapfe 2001], was found on 16 August 1984 in grid square Q 501, 0.08 m above the site's 0-level (Kahlke 2001c, supplement IX). This fossil certainly originates from the UFS(l). Following Zapfe (2001, 890) the hitherto discovered dental elements represent at least one male and one female individual.

3. New finds

3.1. Discoveries

During recent excavations, two additional *Macaca* specimens came to light. A deciduous right upper incisor IQW 2011/32 185 (Mei. 31 349) was found on 08 July 2010 in grid square Q 38, 2.42 m below the site's 0-level. A left maxillary fragment bearing a partial tooth row with P^3-M^2 preserved IQW 2013/41 540 (Mei. 36 886) appeared on 12 June 2012 in grid square Q 609, 1.99 m below the site's 0-level. Like the previous finds, both specimens originate from the channel filling of the site, i. e., from the fossil bearing lower part of the Upper Fluviatile Sands [UFS(l)].

For comparison we studied and measured material of extant *Macaca sylvanus* from the collections of the Institute of Special Zoology and Evolutionary Biology (Phyletisches Museum) of the Friedrich-Schiller-Universität Jena (PMJ) and a fossil from the private collection of Mr. and Mrs. Verhulsdonk, Nijmegen, The Netherlands (described in Reumer et al. 2018).

3.2. Description

3.2.1. Right upper milk incisor

This is a rootless deciduous incisor (**Fig. 1**), which was most probably naturally shed during tooth replacement. The incisal edge is sharp and bears a minute central boss (crenulation) that is slightly worn. The crown has a maximum mesio-distal width of 5.1 mm, lingual height 6.2 mm, buccal height 6.1 mm, maximum lingual-buccal thickness 4.1 mm. After the affiliation to a cervid was excluded (pers. comm. M. Breda to R.-D. K., November 2016), we compared the specimen with deciduous incisors of several neonate bovids and with that of extant macaques. The resemblance in both shape and size allows the identification of the tooth as a *Macaca sylvanus* right dI^1.

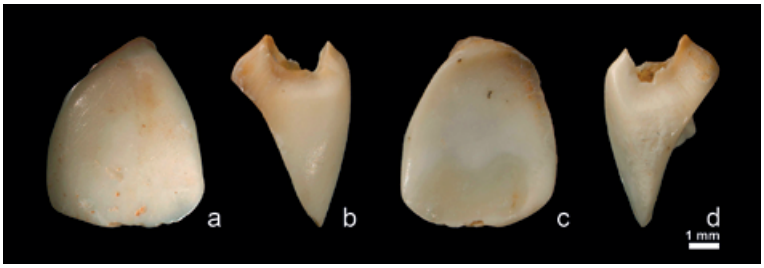

Fig. 1 *Macaca sylvanus* (Linnaeus), Untermassfeld. – **a–d** Right deciduous upper incisor (dI^1 dex.) IQW 2011/32 185 (Mei. 31 349), buccal, distal, lingual, mesial views.

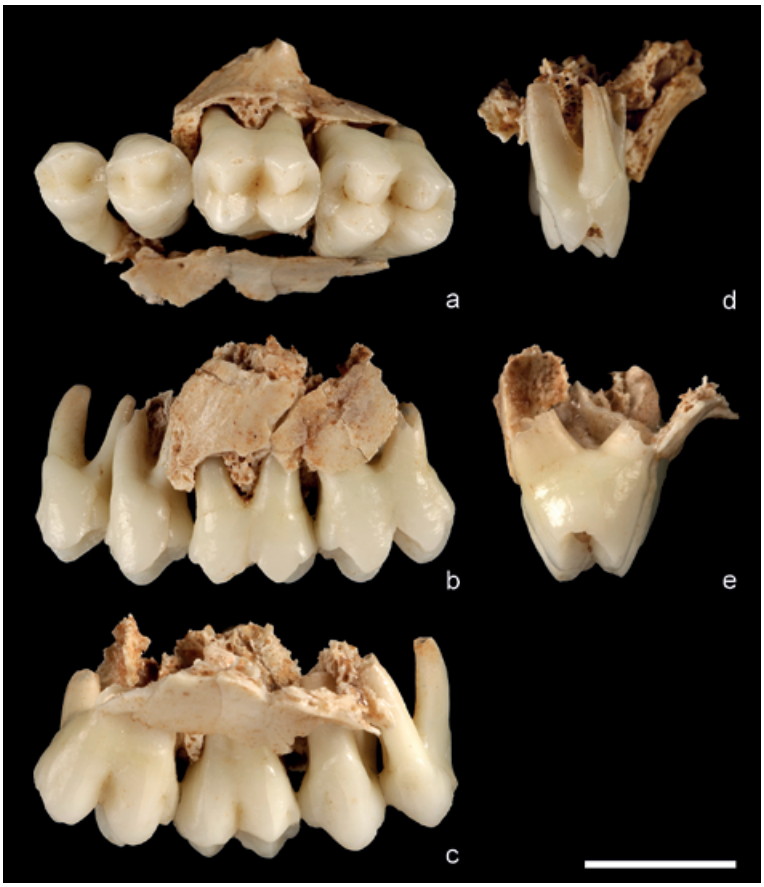

Fig. 2 *Macaca sylvanus* (Linnaeus), Untermassfeld. – **a–e** Left maxillary fragment IQW 2013/41 540 (Mei. 36 886) with P^3-M^2, occlusal, buccal, lingual, mesial, distal views. – Scale: 10 mm.

3.2.2. Left maxillary fragment with P^3-M^2

This maxilla (**Fig. 2**) is of a subadult individual; its permanent premolars are entirely erupted, but the roots of M^2 are still in the process of being formed and not yet fully developed. There is no detectable wear. All preserved elements, including P^3 and P^4, have three roots, one lingual and two buccal. Slight cingular structures can be discerned on the mesio-lingual side of the molars, most clearly so in M^2. Both M^1 and M^2 have a mesial (anterior) fovea that is slightly more pronounced than the distal (posterior) one. Measurements are given in **Tables 1**–**4** [L – length; W – maximum width; MW – mesial (anterior) width; DW – distal (posterior) width]; comparative measurements of the Quibas sample follow Alba et al. (2011).

specimen	L	W
IQW 2013/41540 (Mei. 36886), sin.	4.9	6.7
PMJ, Mam. 8020, sin.	5.4	6.7
PMJ, Mam. 8020, dex.	5.5	6.4
PMJ, Mam. 8021, sin.	5.3	6.5
PMJ, Mam. 8021, dex.	5.0	6.5
PMJ, Mam. 7387, sin.	5.5	6.4
PMJ, Mam. 7387, dex.	5.3	6.2
Quibas, GCP-CV4055, dex.	5.5	6.3
Quibas, Q05-Ec-87, dex.	5.2	6.3
Quibas, Q05-Ec-88, dex.	5.6	6.9

Table 1 P^3 measurements (mm) of *Macaca sylvanus*.

specimen	L	W
IQW 2013/41540 (Mei. 36886), sin.	5.8	6.9
PMJ, Mam. 8020, sin.	5.7	7.0
PMJ, Mam. 8020, dex.	5.4	7.2
PMJ, Mam. 8021, sin.	5.4	7.2
PMJ, Mam. 8021, dex.	5.2	7.0
PMJ, Mam. 7387, sin.	5.8	6.7
PMJ, Mam. 7387, dex.	5.4	6.7
Quibas, GCP-CV4055, dex.	5.3	6.8
Quibas, Q05-Ec-87, dex.	5.1	6.7

Table 2 P^4 measurements (mm) of *Macaca sylvanus*.

specimen	L	MW	DW
IQW 2013/41540 (Mei. 36886), sin.	8.3	7.7	7.3
PMJ, Mam. 8020, sin.	8.0	7.0	6.4
PMJ, Mam. 8020, dex.	8.2	7.0	6.5
PMJ, Mam. 8021, sin.	7.7	7.0	6.4
PMJ, Mam. 8021, dex.	7.5	7.3	6.5
PMJ, Mam. 7387, sin.	8.6		
PMJ, Mam. 7387, dex.	8.2	7.5	6.7
Quibas, GCP-CV4054, dex.	8.9	8.5	8.3
Quibas, Q05-Ec-87, dex.	8.4	8.0	
Quibas, Q05-Ec-88, dex.	8.0	7.9	7.8

Table 3 M^1 measurements (mm) of *Macaca sylvanus*.

specimen	L	MW	DW
IQW 2013/41540 (Mei. 36886), sin.	9.6	8.8	8.2
Coll. Verhulsdonk, 00177 HvH, dex.	8.9	8.3	7.8
PMJ, Mam. 8020, sin.	9.7	8.5	7.5
PMJ, Mam. 8020, dex.	9.6	8.7	7.6
PMJ, Mam. 8021, sin.	9.1	8.8	7.3
PMJ, Mam. 8021, dex.	8.9	8.6	7.4
PMJ, Mam. 7387, sin.	9.4	8.7	7.7
PMJ, Mam. 7387, dex.	9.2	8.6	7.9
Quibas, GCP-CV4054, dex.	9.1	8.9	7.7
Quibas, Q03-E-155b, sin.	9.8	9.6	8.5
Quibas, Q03-E-155a, dex.	9.6	9.3	8.3
Quibas, Q05-Ec-87, dex.	9.5	9.1	8.5
Quibas, Q05-Ec-88, dex.	9.2	9.5	8.6

Table 4 M^2 measurements (mm) of *Macaca sylvanus*.

4. Comparison and taxonomy

Order Primates Linnaeus, 1758
Suborder Haplorrhini Pocock, 1918
Parvorder Catarrhini É. Geoffroy Saint-Hilaire, 1812
Family Cercopithecidae Gray, 1821
Genus *Macaca* Lacépède, 1799
Macaca sylvanus (Linnaeus, 1758)

The literature provides ample discussions about the taxonomy of Pliocene to extant European macaques (e. g., Delson 1980; Fa 1989). Three fossil subspecies are commonly recognised from continental Europe (Szalay and Delson 1979; Sardella et al. 2015). There is a large overlap in sizes and no diagnostically clear-cut morphological difference between Pliocene *Macaca sylvanus prisca* Gervais, 1859, Late Plio- to Early Pleistocene *M. sylvanus florentina* (Cocchi, 1872), Middle-Late Pleistocene *M. sylvanus pliocena* Owen, 1846 and recent *M. sylvanus sylvanus*. In this framework Castaños et al. (2011, 819) noted the following about their Late Pleistocene *M. sylvanus* from Lezetxiki II cave: »The comparative morphometric study of the teeth with those of Plio-Pleistocene fossils and a sample of modern female macaques confirms the great size variability of this species and the absence of reliable criteria for the attribution of the specimen to either of the two subspecies recorded from the Pleistocene«. Similar remarks about the taxonomy were made earlier by Fladerer (1991), Rook et al. (2001), Zapfe (2001), and Alba et al. (2008; 2011). A complete revision of Plio-Pleistocene European *Macaca* is, however, well beyond the scope of the present paper. Here, we adhere with the near common opinion that European macaques, including the Untermassfeld material, belong to *Macaca sylvanus*; we wish to refrain from giving or suggesting any closer subspecific identification (for a discussion on the matter see also Reumer et al. 2018).

5. Discussion

5.1. Abundance of *Macaca* in the Untermassfeld fossil record

The fine scale documented field work at the site has produced a total of 14,291 large mammal remains (as of 01 July 2020). From this material altogether eight macaque fossils were identified (see sections 2. and 3.), which represent less than 0.06 % of the total. According to the discovered number of specimens, macaques are among the least recorded large mammal species of the Untermassfeld fauna [for minimum numbers of individuals (MNI) see Kahlke 2006, Table 9; in this volume, Table 8]. Most probably all finds originate from the same sedimentological unit, the UFS(l) (see sections 2. and 3.1.). This means the individual elements were deposited at the site during one single inundation event (on the origin of the Untermassfeld thanatocoenosis see Kahlke 2001c; 2006; Kahlke et al. 2020; in this volume). However, this does not prove a common date of death for the detected individuals with permanent dentition.
The isolated dI^1 (see section 3.2.1.) is evidently of a juvenile monkey. Furthermore, we have two right lower third molars, of two separate individuals of both sexes. These two molars are unworn, while the available M_1 IQW 1980/16 566 (Mei. 16 087)d is well worn. The other elements (upper tooth row, lower incisor, canine and premolar) can theoretically be combined with any of the mentioned third molars to form the remains of two individuals. The MNI is therefore three, including the juvenile. The actual number of individuals might be four if we consider the worn M_1 to originate from a different individual than the two third molars.

5.2. Habitat

Present-day Barbary macaques live preferably in mountainous areas with diverse vegetation, such as Mediterranean shrub (maquis), oak forests or conifer stands. The majority of animals nowadays live in stands of Atlas cedar (*Cedrus atlantica*), or in dryer ecosystems with dwarf palms (*Chamaerops humilis*) and oak (*Quercus*) (Blanco 1998). Blanco (l.c.) also mentioned the fact that the present habitat preference of macaques is the result of human persecution. This effect was absent during the Pleistocene, allowing for a broader habitat range. Haltenorth and Diller (1977) mentioned their preference for a rocky environment and forest with little undergrowth and noted that they prefer to sit in elevated spots as it »makes them feel safer«.
Near the site of Untermassfeld, along the flanks of the Werra river valley, there were rocky outcrops of Middle Triassic limestone (see geological map in Ellenberg and Kahlke 1997, Fig. 4) that could have been used by the animals. In addition, trees of a riparian forest (palaeolandscape reconstruction in Kahlke 2001c, 983; 2006, 87 f.; in this volume, 1719 f.) could have served the same purpose. Because of their climbing abilities, macaques were only marginally endangered by the inundation of the river valley and therefore only rarely represented in the thanatocoenosis.

6. Conclusions

Macaca sylvanus was a rare but palaeoecologically interesting element of the Untermassfeld fauna. Here we describe the latest finds, a right upper milk incisor, dI^1, and a left upper partial tooth row with P^3-M^2. The species found suitable conditions to inhabit the valley flanks and the riparian forest habitats along the Werra river. The macaques' tree- and rock-climbing behavior led to a low risk during riverine floods and thus to a relatively low representation in the preserved necromass. The new finds raise the number of recorded individuals to at least three.

Acknowledgements

We thank the Senckenberg teams for excavation and preparation of the Untermassfeld fossils. M. Breda (Ferrara) recognised the described milk incisor from within the cervid remains of the Untermassfeld collection during her stay in 2013 and first proposed its assignment to *Macaca*. Photographs were made by L. C. Maul (**Fig. 1**) and S. Döring (**Fig. 2**), E. Haase arranged the figures (all Weimar). J. Arnold (Weimar) and M. Krüger (Jena) arranged the access to the mammal collection of the Institute of Special Zoology and Evolutionary Biology of the Friedrich-Schiller-Universität Jena for morphometric comparisons. H. and K. Verhulsdonk (Nijmegen) allowed us to study the M^2 in their collection. E. Delson (New York) reviewed the paper and supported us by valuable hints and suggestions.

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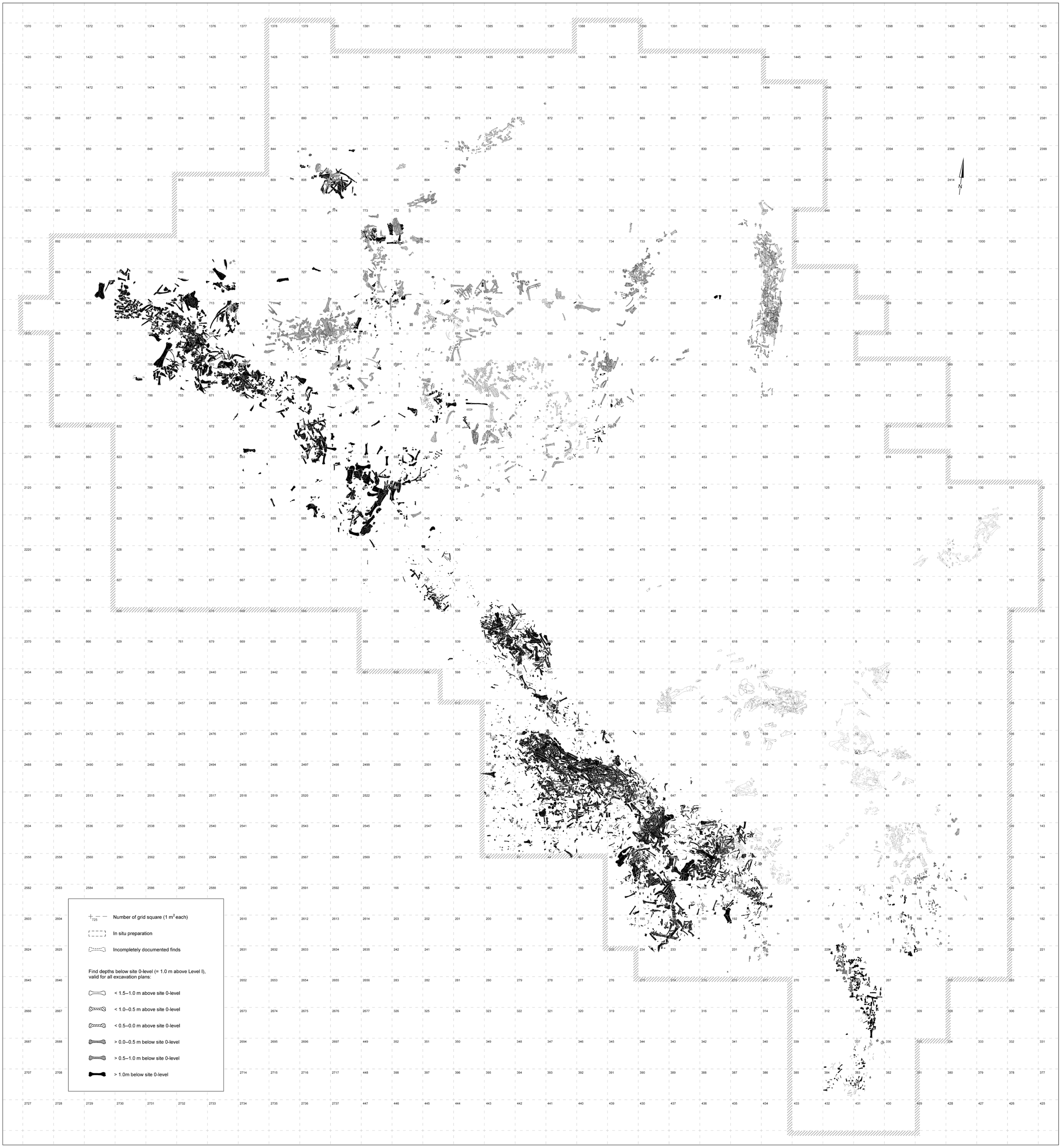

Untermassfeld research excavation, total area. Hatched border: Outer limit of the excavated area of the 1979–2018 field seasons. – Scale: 1:50 (Design: R.-D. Kahlke; drawing: E. Haase).

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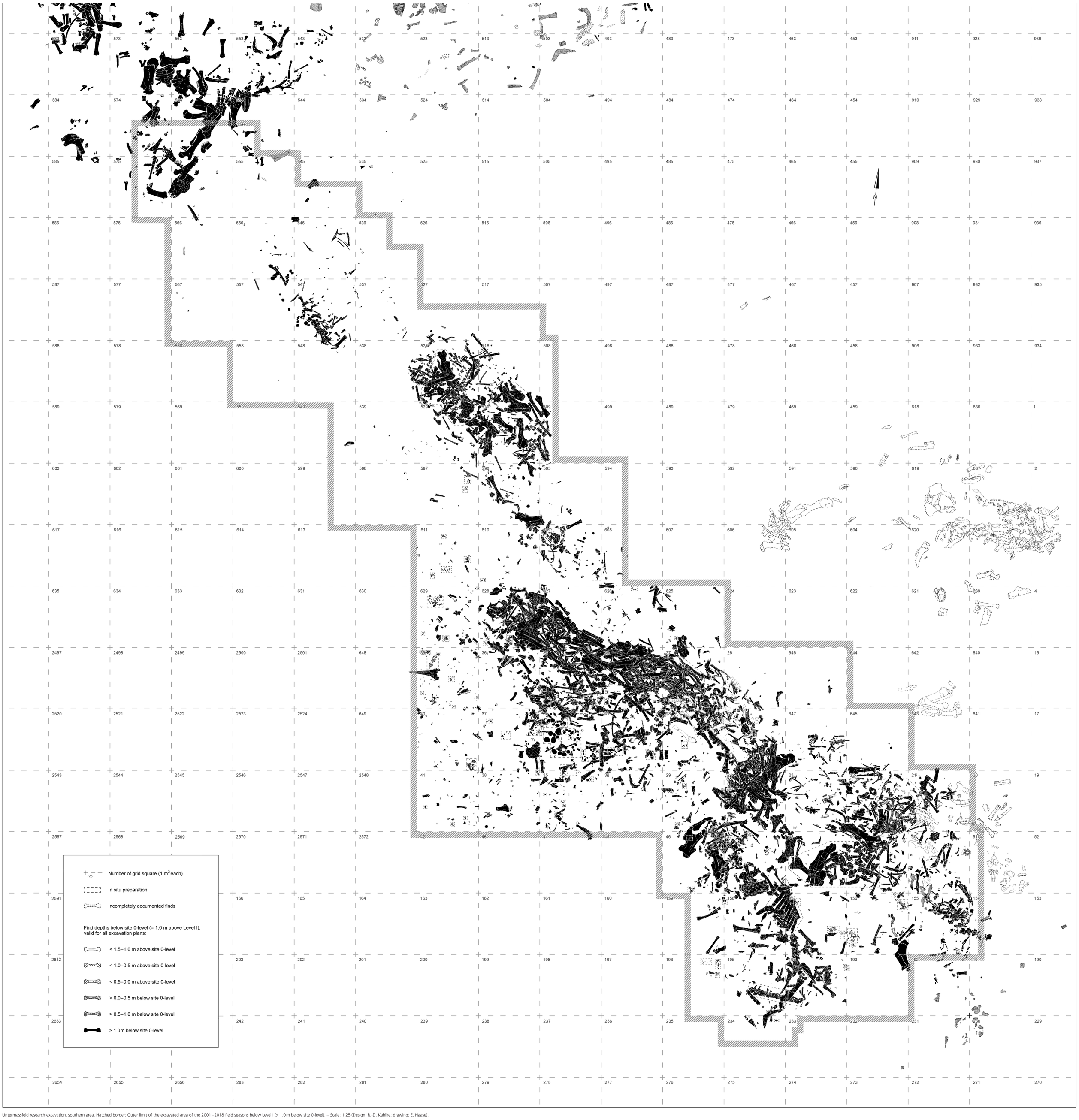

Untermassfeld research excavation, southern area. Hatched border: Outer limit of the excavated area of the 2001–2018 field seasons below Level I (> 1.0m below site 0-level). – Scale: 1:25 (Design: R.-D. Kahlke; drawing: E. Haase).