

Pathological findings on remains of *Hippopotamus amphibius antiquus* DESMAREST, 1822 (Hippopotamidae, Mammalia) from the late Lower Pleistocene site of Untermaßfeld (Thuringia, Central Germany)

UWE KIERDORF¹ & RALF-DIETRICH KAHLKE²

¹ Institut für Allgemeine und Spezielle Zoologie, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 26-32, D-35392 Giessen, Germany
kierdorf@lindlar.de

² Forschungsstation für Quartärpaläontologie, Forschungsinstitut und Naturmuseum Senckenberg, Steubenstr. 19a, D-99423 Weimar, Germany
rdkahlke@senckenberg.de

Since 1978, a total of some 12,000 identifiable larger mammal remains have been found at the fluvial fossil site of Untermaßfeld (Werra Valley, Southern Thuringia, Central Germany) and included in an interdisciplinary study (R.-D. KAHLKE 1997a, 2001a, 2001b). The lithological features of the fossil bearing horizons indicate a succession of roughly similar high-flood events. A lace-like narrowing of the valley upstream of the excavation site produced a damming effect and intense associated turbulence, which accentuated the catastrophic impact on the fauna. Geological, palaeomagnetic and biostratigraphic evidence indicates an absolute age of approximately 1.05 Ma B.P. for the site (OIS 31, immediately above the onset of the Jaramillo polarity sub-zone). The recorded large mammal remains represent a MNI of 312, among them anatomically connected units (58.1 % of the NISP) and numerous isolated elements of a large *Hippopotamus amphibius antiquus* (description in R.-D. KAHLKE 1997b, 2001c). The accompanying fauna comprises Epivillafranchian taxa, such as *Bison menneri*, *Capreolus cusanooides*, *Cervus s.l. nestii vallonnetensis*, *Eucladoceros giulii*, *Stephanorhinus etruscus* (evolved), *Panthera onca gombaszogensis*, *Canis (Xenocyon) lycaonoides*, *Canis lupus mosbachensis* and others.

There is a basic understanding of viral, bacterial and protozoan diseases, metazoan parasites and metabolic anomalies of hippopotamuses (compiled by ELTRINGHAM 1999). Since hippo carcasses or skeletons have rarely been subjected to veterinary or palaeopathological analyses, relatively little is known about the skeletal and dental pathology of *Hippopotamus* (JACK & THACKER 1985; MILES & GRIGSON 1990).

Palaeopathological studies of animal

remains can provide useful information for the reconstruction of the prior behaviour of individuals and the living conditions of past populations (ROTHSCHILD & MARTIN 1993) and thereby also contribute to an understanding of the overall palaeoecological situation. As part of a research project on the palaeopathology of the large mammals from Untermaßfeld (see also R.-D. KAHLKE & KIERDORF 1997), the present contribution reports our findings on the skeletal and dental pathology of the *Hippopotamus* remains.

Pathological changes in jaws and teeth comprise: i) the presence of an extra alveolus in the right hemi-mandible of a juvenile, suggestive of a duplication of the (single-rooted) Pd₁, ii) minor traumatic lesions on the lingual enamel surface of the Pd₄ and the adjacent lingual mandibular bone surface from the same individual, iii) the presence of two enamel hypoplasias of presumably traumatic origin in a right M₁, iv) pathological root resorption in a right Pd₂, v) the occurrence of defects in the root furcation area of a right Pd₃, interpreted as a developmental abnormality, and vi) the presence of transverse grooves on two fragmentary lower canines, indicating minor disturbance in the rate of dental hard tissue formation by a systemic cause.

A spectrum of pathological joint alterations was observed in the postcranial material. In the limb elements of (at least three) adult individuals these changes included unevenness, eburnation and pitting of joint surfaces, the presence of cavitory bone lesions on the joint surfaces (subchondral osteolytic lesions) and the occurrence of marginal osteophytes (several cases) and a single central osteophyte. The spectrum of pathological joint changes suggests osteoarthritis (osteoarthrosis), a degenerative joint

disease, as the most probable cause. According to a widely held view, the principle causative agent leading to osteoarthritis is repeated mechanical trauma to a joint due to its overuse. Pathological changes resembling the osteoarthritic alterations in the limb elements were also observed on the dens of an axis, the costal facets of six thoracic vertebrae and the articular facets of two rib fragments from adult individuals. Osteolytic lesions, indicating degenerative changes of the discvertebral junction, were present on the caudal surface of the body of a thoracic vertebra from an adult individual.

The MNI of *Hippopotamus* from the excavated part of the Untermaßfeld fossil assemblage is 20. Nine of the recorded individuals are fully adult or even senile. The proportion of juvenile hippos with milk dentition (MNI = 11; 55 %) is much higher than in recent *Hippopotamus* populations (mortality patterns in the Untermaßfeld large mammal record are discussed by GAUDZINSKI & R.-D. KAHLKE subm.). The main cause of death among extant juvenile African hippos is separation from their mothers and subsequent drowning (ELTRINGHAM 1999). Given the reconstructed high-flood scenario that led to the formation of the site, it can be assumed that this was also the case for the juvenile Untermaßfeld hippos. The fossil remains of at least two of these juveniles (18 %) exhibit developmental or post-eruptive lesions in their

dentition that are unrelated to their presumed cause of death (i.e. drowning).

The presence of degenerative articular changes in the skeletons of adult *Hippopotamus* from Untermaßfeld is not surprising, given the large body mass of these individuals and the resulting high mechanical loads on their joints. It is assumed that the severity of these changes increased with animal age. A causal relationship between the joint lesions in at least three of the adult individuals (33 %) and their death cannot, however, be established with certainty. If the adult hippos were indeed flood victims, the individuals most probably drowned in areas of intense turbulence that are assumed to have existed upstream of the site. The amphibious lifestyle of hippopotamuses, also reconstructed for the large European Lower Pleistocene forms (R.-D. KAHLKE 1997b), allows some provisional assumptions. Thus, it is assumed that the joints experience reduced mechanical loads when animals are (partly) submerged and, therefore, supported by the buoyancy of the water. Conversely, when hippos emerge from the water to seek food on land, the loads on their joints increase markedly. We, therefore, hypothesise that the degenerative articular lesions observed in the *Hippopotamus* material from Untermaßfeld predominantly reflect the wear and tear on the joints during these periods spent out of the water.

- ELTRINGHAM, S.K. (1999): *The Hippos. Natural History and Conservation.* – 184 pp.; London (Academic Press).
- GAUDZINSKI, S. & KAHLKE, R.-D. (submitted): *The Blessing of a Great Flood: Differentiation of mortality patterns in the large mammal record of the Lower Pleistocene fluvial site of Untermaßfeld (Germany) and its relevance for the interpretation of faunal assemblages from archaeological sites.*
- JACK, S.W. & THACKER, H.L. (1985) *Degenerative joint disease in a Nile hippopotamus.* – *Journ. Amer. Veterin. Med. Assoc.*, **187**: 185; Chicago.
- KAHLKE, R.-D. (ed.) (1997a, 2001a, 2001b): *Das Pleistozän von Untermaßfeld bei Meiningen (Thüringen). Teil 1-3.* – *Monogr. Römisch-Germanisches Zentralmuseum*, **40** 1: I-VI, 1-418, pls. 1-67; **40** 2: I-VIII, 419-698, pls. 68-131, 1 app.; **40** 3: I-VI, 699-1030, pls. 132-151, 15 app.; Bonn (Dr. Rudolf Habelt GmbH).
- KAHLKE, R.-D. (1997b): *Die Hippopotamus-Reste aus dem Unterpleistozän von Untermaßfeld.* In: R.-D. KAHLKE (ed.), *Das Pleistozän von Untermaßfeld bei Meiningen (Thüringen). Teil 1.* – *Monogr. Römisch-Germanisches Zentralmuseum*, **40** 1: 277-374, pls. 45-62; Bonn (Dr. Rudolf Habelt GmbH).
- KAHLKE, R.-D. (2001c): *Schädelreste von Hippopotamus aus dem Unterpleistozän von Untermaßfeld.* In: R.-D. KAHLKE (ed.), *Das Pleistozän von Untermaßfeld bei Meiningen (Thüringen). Teil 2.* – *Monogr. Römisch-Germanisches Zentralmuseum*, **40** 2: 483-500, pls. 77-78; Bonn (Dr. Rudolf Habelt GmbH).
- KAHLKE, R.-D. & KIERDORF, U. (1997): *Diffuse idiopathische skelettale Hyperostose bei einem Bären (Ursus sp.) aus dem Unterpleistozän von Untermaßfeld bei Meiningen (Südthüringen, Deutschland).* – *Quartär*, **47/48**: 159-175; Bonn.
- MILES, A.E.W. & GRIGSON, C. (1990): *Colyer's variations and diseases of the teeth of animals. Revised edition.* – 672 pp.; Cambridge (Cambridge University Press).
- ROTHSCHILD, B.M. & MARTIN L.D. (1993): *Paleopathology. Disease in the fossil record.* – 386 pp.; Boca Raton (CRC Press).