



## Proximal interphalangeal joint ankylosis in an early medieval horse from Wrocław Cathedral Island, Poland



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### ABSTRACT

Animal remains that are unearthed during archaeological excavations often provide useful information about socio-cultural context, including human habits, beliefs, and ancestral relationships. In this report, we present pathologically altered equine first and second phalanges from an 11th century specimen that was excavated at Wrocław Cathedral Island, Poland.

The results of gross examination, radiography, and computed tomography, indicate osteoarthritis of the proximal interphalangeal joint, with partial ankylosis. Based on comparison with living modern horses undergoing lameness examination, as well as with recent literature, we conclude that the horse likely was lame for at least several months prior to death. The ability of this horse to work probably was reduced, but the degree of compromise during life cannot be stated precisely.

Present day medical knowledge indicates that there was little likelihood of successful treatment for this condition during the middle ages. However, modern horses with similar pathology can function reasonably well with appropriate treatment and management, particularly following joint ankylosis. Thus, we approach the cultural question of why such an individual would have been maintained with limitations, for a probably-significant period of time.

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## 1. Introduction

Descriptions of paleopathological changes in equine remains from various sites and times are fairly frequent in zooarchaeological literature (Thomas and Locock, 2002; Daugnora and Thomas, 2005; Onar et al., 2012; Markovic et al., 2014). However, there are few detailed descriptions concerning etiology and pathophysiology of those changes (Bartosiewicz and Bartosiewicz, 2002; Janeczek et al., 2010; Janeczek et al., 2014; Lignereux and Bouet, 2015). Where possible, it is desirable as well to consider and interpret paleopathological findings in a socio-cultural context.

Hippodromes in large Roman/Byzantine towns, such as Constantinople and Sirmium, strongly influenced how horses were used in ancient times; these human activities likely increased the

prevalence of post-traumatic skeletal pathology (Onar et al., 2012; Markovic et al., 2014). In medieval castles such as Malbork (northern Poland), horse spinal pathologies reflected the prevailing art of war (Pluskowski et al., 2009). Also of note, periods of starvation (e.g., city sieges) fostered the otherwise rare consumption of horse meat (Chrószcz et al., 2015).

Archaeological and zooarchaeological investigations at Wrocław Cathedral Island in western Poland are among the recognized sources of knowledge about human-animal-environment relationships in large medieval cities. This report describes pathological changes of the first (proximal) and second (middle) phalanges and the proximal interphalangeal joint of a medieval horse. The specimens were found at an archaeological site located at Wrocław Cathedral Island.

We assessed pathologies of these skeletal remains by comparing them with modern horses, using macroscopic observation, radiography, computed tomography, and recent veterinary medical literature. The observations provide contextual information about equine husbandry and functions of horses during the early middle ages.

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Fig. 1. The location of Wrocław in central Europe.

## 2. Materials and methods

### 2.1. Archaeological site

The specimens were retrieved from the archaeological site located near St. Giles Street at Wrocław Cathedral Island, Ostrów Tumski, Poland (Fig. 1). Wrocław Cathedral Island, located between branches of the Odra River, was the earliest medieval habitation in the Wrocław polymorphic urban complex (Fig. 2). The crucial point of its history was in 1000 CE, when the diocese was founded by Bolesław the Brave, King of Poland (Žerelik, 2002; Mrozowicz et al., 2006).

The Wrocław stronghold on Cathedral Island was older, dated to the early 10th century (Piekalski, 2010a,b; Chrószcz et al., 2015; Limisiewicz et al., 2015; Pankiewicz, 2015a,b). The St. Giles excavation area was located on the north side of the aforementioned street. The remains of the first stronghold wall (second half of the 10th century) have been identified within the older cultural layers (Pankiewicz, 2015b).

The equine artifacts (No. 385) were found within the cultural layer (C1–C2) that is dated to the third quarter of the 11th century. The specimens lay between neighboring dwellings that were established after the fall of the older stronghold. This area was part of a ducal borough located east of the first ducal castle and surrounded with bulwark from the end of the 10th century (Pankiewicz, 2015a).

Between the 11th and 13th centuries CE, Wrocław included both pre-urban and urban centers within its inhabited area. The western part of Cathedral Island became the location of the Silesian Ducal Court; the eastern part encompassed the bishops' and feudal properties (Žerelik, 2002; Mrozowicz et al., 2006; Piekalski, 2010a,b; Pankiewicz, 2015b).

During the whole of the middle ages, Cathedral Island never became incorporated into the medieval city. The area was inhabited by a mixture of autochthonic and allochthonic populations that probably were strongly differentiated, both socially and economically (Młynarska-Kaletynowa, 1986; Žerelik, 2002; Mrozowicz et al., 2006; Pankiewicz, 2015b).

### 2.2. Specimens

The remains were unearthed during the years 2000–2001 by the Institute of Archaeology, University of Wrocław. The artifacts were elaborated by the Division of Animal Anatomy, Wrocław University of Environmental and Life Sciences. The visual-comparative analysis was done according to Lasota-Moskalewska (2008), and confirmed based on the method of Nickel et al. (2003).

The remains were identified as the proximal and middle phalanges (*os compedale*/compedal bone and *os coronale*/coronal bone) of the digit of the left thoracic limb. The osteometric analysis was done using methods introduced by von den Driesch (1976). Macroscopic changes were described initially. Subsequent radiographic examination was performed from lateromedial and dorsopalmar projections using a FireCR Veterinary CR Scanner® (3DISC Europe ApS, Lillerød, Denmark), which also allowed comparison with radiographic changes observed in modern living horses undergoing lameness examination. The computed tomography (CT) was performed using a Somatom Emotion® 16 slice scanner (Siemens, Erlangen, Germany), to help visualize the detail of sagittal, axial, and coronal cross-sections of examined bones and the proximal interphalangeal joint.

The animal bone assemblage was described as post-consumption remains, so identified because of fragmentation

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