



# Interpreting osteoarthritis in bioarchaeology: Highlighting the importance of a clinical approach through case studies from prehistoric Thailand



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## ABSTRACT

Osteoarthritis has a multifactorial aetiology. Despite this, and the incomplete understanding of the exact pathogenesis of osteoarthritis, many bioarchaeologists continue to attempt to link the prevalence of osteoarthritis with past behaviour and activity. This study aims to investigate the true impact of osteoarthritis on the people of prehistoric Ban Non Wat, northeast Thailand (1750 BCE to 500 CE). Through the analysis of the prevalence of osteoarthritis in each major joint and some individual case studies, the impact of this disease is detailed with reference to their social and physical environment. Two hundred and twenty nine adult individuals (45 Neolithic, 141 Bronze Age and 43 Iron Age) from Ban Non Wat with one or more major joint observable were assessed for the presence and extent of osteophyte development, subchondral porosity and eburnation. The results showed no significant differences in prevalence across time or sex across the 2250 years represented by these skeletons. Although not significant, osteoarthritis was consistently high in elbows and knees across the Neolithic and Bronze Age phases, with the Iron Age not providing robust data. Four individuals with the most severe polyarticular osteoarthritis are detailed, indicating the varied nature of the disease and its potentially disabling effects on quality of life. This study reviews the most up to date clinical science to highlight that the study of osteoarthritis in past populations can be used to investigate disability and quality of life.

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## 1. Introduction

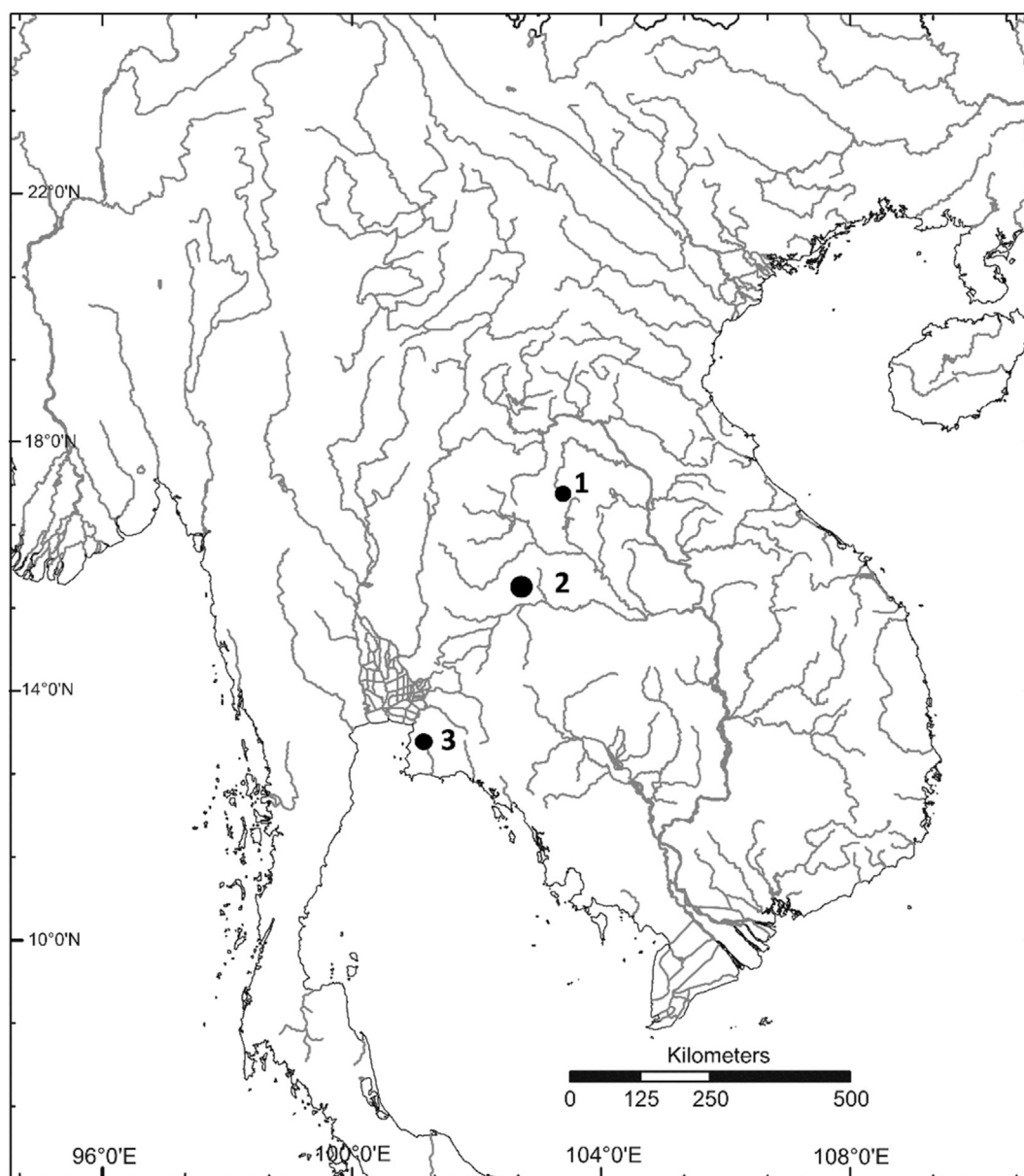
Osteoarthritis is one of the most ubiquitous diseases in modern communities and ancient human skeletal samples (Jurmain 1999; Weiss and Jurmain 2007). It has a multifactorial aetiology with age, genetic predisposition, trauma to joints, obesity, and some types of repetitive activities all considered risk factors (Brandt et al. 2009a). However, this complex aetiology and an incomplete understanding of its exact pathogenesis has led to a paucity of research into osteoarthritis in prehistoric collections over the last decade or so. Recently there has been a slight resurgence of interest in osteoarthritis in prehistory that aims to emphasise the usefulness of analysing osteoarthritis when it is fully contextualised with the archaeological evidence (for example Eng 2016; Klaus et al. 2009; Lieverse et al. 2007, 2016; Weiss and Jurmain

2007). Clinical evidence clearly indicates the multifactorial nature of the development and progression of the disease (eg. Arden and Nevitt 2006; Hunter 2011) and more recent bioarchaeological studies are beginning to move away from directly linking osteoarthritis with physical activity (eg. Molnar et al. 2011).

This study aims to draw attention to the impact of osteoarthritis on the quality of life of the community of prehistoric Ban Non Wat, northeast Thailand (Hunter 2011; Jones 2013) through the integration of current clinical literature with osteoarthritis patterns. The Ban Non Wat skeletal collection spans the Neolithic, Bronze Age and Iron Age periods (1750 BCE to 500 CE) (Higham and Higham 2009) (Fig. 1). The aim is to analyse this large skeletal record and place results within the demographic, archaeological and environmental context in order to obtain holistic information on community health and prehistoric society (Jurmain 1999; Pearson and Buikstra 2006; Weiss and Jurmain 2007). This study moves the analysis of osteoarthritis away from the interpretation of behaviour and activity in the past, towards a consideration of the impact of this debilitating disease on quality of life. As an example of this impact, people suffering knee osteoarthritis have been observed changing the way in which they walk, including reducing speed and

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**Fig. 1.** Map of Southeast Asia indicating the location of sites mentioned in this study. 1. Ban Na Di, 2. Ban Lum Khao and Ban Non Wat, 3. Khok Phanom Di.

range of motion (Messier et al. 2016), impacting their ability to contribute to their community as they had previously. Additionally, osteoarthritis is not typically a fatal disease, which means sufferers can be in a state of disability for some years reducing their quality of life for a significant period of time (Busija et al. 2010; Hunter 2011). This issue is also discussed, particularly with reference to polyarticular osteoarthritis, through a selection of case studies from Ban Non Wat.

### 1.1. Osteoarthritis and its significance for past populations

Osteoarthritis is characterized by the loss of bone, in the form of pitting or erosive lesions typically on the joint surface, and the gain of new bone, in the form of intra-articular or marginal osteophytes (Rogers and Waldron 1995). Severe cases often display eburnation, a polishing of the reciprocal articular surfaces of the joint. Osteoarthritis has a well-established positive correlation with age (Waldron 1994; Weiss and Jurmain 2007) but it is not an inevitable consequence of aging (Anderson and Loeser 2010). Hunter (2011) estimated that approximately two thirds of people with osteoarthritis are aged <65 years.

While causal definitions of osteoarthritis have been a source of great debate, it is generally agreed that the expression of the disease could be defined as the joint's attempt to repair itself after a failure of some aspect of the synovial joint structure (Brandt et al. 2009a). As to what causes the failure of the joint structure in the first place can vary, but certainly its expression is believed to be multifactorial and the result of the interplay between certain environmental and genetic factors (Herrero-Beaumont et al. 2009; Loughlin 2001; Peach et al. 2005). Brandt et al. (2009a: 82) believe that “the evidence argues powerfully that all OA [osteoarthritis] is primarily driven by mechanical stress on the joint”. However, the cause of that mechanical stress can also be complex from a genetic abnormality in the structure of the joint to repetitive activities. Thus mechanical stress will not induce osteoarthritis in everyone. Therefore directly linking activity to osteoarthritis alone is not possible in a skeletal sample, particularly when occupational or medical history is limited or unobtainable.

Heritability estimates suggest that at least half the variation in susceptibility to disease in a population is explained by genetic factors, though it can vary between different joints (Spector and MacGregor 2004). The effects of a genetic predisposition to osteoarthritis could be

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