



# An unusual exostotic lesion of the maxillary sinus from Roman Lincoln



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## ABSTRACT

This report provides a differential diagnosis of an exostotic bony lesion within the left maxillary sinus of a Romano-British (3rd to 4th century AD) adult male from Newport, Lincoln. Macroscopic, radiographic, and cone beam computed tomography (CBCT) analyses suggest that the lesion is likely of odontogenic origin. The overall size of the lesion and areas of sclerosis and radiolucency, together with its hypothesised odontogenic origin, suggest that the lesion represents a chronic exostotic osteomyelitic reaction to the presence of odontogenic bacteria. While modern case studies of odontogenic maxillary sinus osteomyelitis are noteworthy, published cases of this condition are extremely rare in an archaeological context and may be underreported due to the enclosed nature of the sinuses. Such infections may have serious implications for individual and population health, and non-destructive investigation should be considered in cases where significant maxillary caries are present.

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## 1. Introduction

Diseases of the paranasal sinuses occur frequently in modern day populations, affecting both the young and old alike (Farman and Nortjé, 2002; Bell et al., 2011). Chronic or recurrent low-grade infections of the maxillary sinus are aetiologically diverse, with triggers ranging from environmental irritants to allergy and respiratory tract infections (Spector, 1992; Corren and Rachelefsky, 1994; Osur, 2002). Around 10% of clinically reported cases have odontogenic aetiologies, such as periapical infections (Brook, 2006; Mehra and Jeong, 2008). The anatomical proximity of the maxillary dentition to the sinus is an important factor in the development of odontogenic sinusitis (Ugincius et al., 2006).

Inflammatory osseous responses to pathogenic processes, including those affecting the maxillary sinuses, have been observed in the skeletal remains of many past populations (Boocock et al., 1995; Merrett and Pfeiffer, 2000; Roberts, 2007). The often chronic nature of mucosal infection increases the likelihood of changes to bone occurring within the sinus cavities (Ortner and Putschar, 1981; Roberts, 2007). However, it is generally assumed that the actual frequency of past sinusitis is underestimated due to the enclosed nature of the sinuses (Boocock et al., 1995). An exostotic lesion of the type observed in this case is very uncommon in modern

clinical literature (Tovi et al., 1992; Moretti et al., 2004). It is rarer still in archaeological literature, but, as with sinusitis, the potential for underreporting must be considered. We present this case to highlight the potential for maxillary caries to produce significant extra-oral lesions and to strongly urge future studies to consider non-destructive screening of individuals with extensive caries.

## 2. Materials and methods

Excavations conducted in 2010 by Archaeological Project Services at Newport, Lincoln revealed a small assemblage of skeletal remains ( $n = 11$ ), with six individuals being securely dated to the early second to middle fourth centuries AD (Kendall, 2011). Within a few decades of the Roman conquest (by around AD 61), Lincoln had become established as a large military centre for the Second and Ninth Legions (Jones, 2003). Following the departure of the army in c. AD 78, Lincoln was converted into the military veteran settlement (*colonia*) of *Lindum* (Jones, 2003; Peachey, 2011). *Lindum* was later to develop into an important regional centre, becoming the capital of the province *Britannia Secunda* by the end of the third century (Mann, 1998).

The site was located immediately west of Ermine Street, a major Roman thoroughfare linking London (*Londinium*) and York (*Eboracum*), some 650 m to the north of the *colonia's* north gate in the Newport suburb. In line with Roman burial law (Toynbee, 1971), this site likely represents one of a number of extramural burial grounds, and reflects a northward spread of settlement

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**Table 1**  
Skeletal dental presence/absence chart for SK611, after Buikstra and Ubelaker (1994). Top line = maxillary teeth; bottom line = mandibular teeth. Key: Number = tooth present; X = lost antemortem; \ = lost postmortem; R = root only.

Right	1	2	X	\	R	\	R	8	\	10	11	12	R	\	15	16	Left
	32	31	30	29	28	27	26	25	24	23	22	21	R	19	18	17	
Right																	Left

along Ermine Street beyond the *colonia* walls (Peachey, 2011). The concentration, stratigraphic sequence, and general north-south alignment of graves suggests that the cemetery may have evolved from an *ad hoc* burial site in the middle 2nd century to a small, organised roadside cemetery serving the 3rd and 4th century *colonia* (Kendall, 2011). Skeleton 611 (hereafter SK611) was interred supine on a northwest-southeast alignment in a coffin with a serrated iron object believed to be a saw.

Osteological analysis was performed using standard methodology (following Buikstra and Ubelaker, 1994; Brickley and McKinley, 2004). Age-at-death and sex were estimated based on age-related degeneration of the auricular surface and pubic symphysis (Lovejoy et al., 1985; Brooks and Suchey, 1990) and morphological features of the pelvis and skull (Phenice, 1969) respectively. Pathology was identified and described using standard macroscopic methods, with orbital lesions being recorded by the method of Stuart Macadam (1991). An exostotic lesion of the maxillary sinus, which forms the focus of this paper, was examined macroscopically and radiographically (GE Medical MPX 10; General Electric Wauwatosa, USA set to 70 kVp at 0.500 m. As, with a Carestream Point-of-Care digital CR reader; Rochester, USA) in the Department of Archaeology at Durham University, and CBCT (NewTom VGi; QR Verona, Italy) was carried out at the School of Dental Sciences, Newcastle University.

Destructive histological analysis of the lesion was not performed due to considerations of fragility and risk-benefit balance. Histological evidence may add confidence to a differential diagnosis where microscopic features are pathognomonic, but it is rarely possible to reach a definitive diagnosis based on histopathology alone, due to the similarity of histological features between distinct diagnostic entities (Eversole et al., 2008; Silva and Wasterlain, 2010). With this constraint in mind, a differential diagnosis was attempted based upon macroscopic, radiographic, and CBCT evidence.

### 3. Results

SK611 was estimated to be a male aged between 25 and 35 years at the time of death. His skeletal remains were largely complete, with good bone preservation (Fig. 1). However, SK611's full remains were not excavated due to the diagonal truncation of his grave by the limit of excavation. Overall skeletal pathology for SK611 was low. Observed postcranial pathologies were limited to bilateral sacralisation and osteophytosis affecting the lower thoracic and lumbar vertebrae. Cranial and dental pathologies were observed in greater abundance. SK611 exhibited grade 2 bilateral cribra orbitalia and suffered from poor dental health. His mandibular teeth were slightly misaligned, with evident overcrowding. Table 1 presents a skeletal dental presence/absence chart for SK611. Two maxillary and eight mandibular teeth had enamel hypoplastic defects. All extant teeth displayed flecked to medium concretions of calculus. Large carious lesions were present on eight teeth (2, 5, 13, 15, 16, 18, 19, and 20), four of which were associated with periapical lesions and drainage sinuses (15, 16, 18, and 19). Six periapical lesions were observed in total (tooth numbers 3, 4, 15, 16, 18, and 19), all with accompanying drainage sinuses. All periapical lesions were associated with either carious or unobservable (lost antemortem or postmortem) teeth.

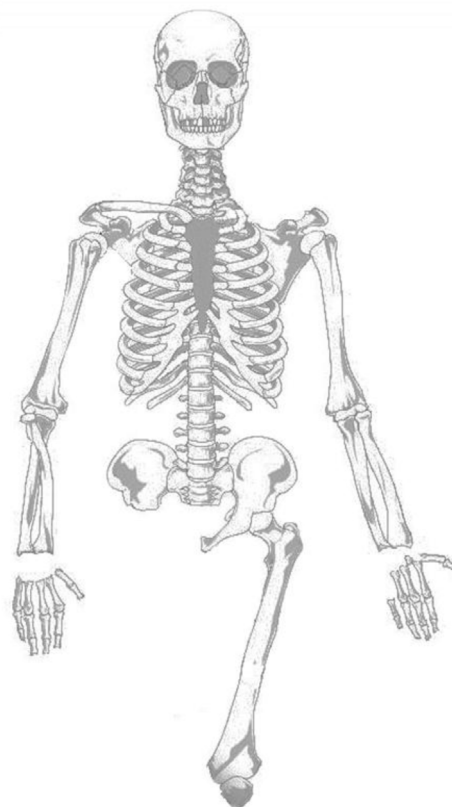


Fig. 1. Elements present in skeleton 611.



Fig. 2. Anterior view of SK611 skull with asymmetrical concave contour of maxilla (arrowed), and inset showing detail of contour.

Pathological bone changes were observed near the left maxillary molars. The zygomatic process of the left maxilla exhibited extensive porosity with remodeling deposits of woven and transitional new bone located inferior to the infra-orbital foramen and immediately superior to teeth 15 and 16, (Fig. 2). This area of remodeling was concave, producing a notable asymmetry between the right and left sides of the face. A lingual drainage sinus, measuring approximately 30 mm in diameter, was recorded in association with tooth 16 (Fig. 3).

Directly superior to tooth 16, an amorphous, coral-like, exostotic bony lesion, measuring a maximum of 20 mm in breadth and

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