Archaeological and palaeopathological study on the third/second century BC grave from Turfan, China: Individual health history and regional implications

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1. Introduction

The Baikal–Hokkaido Archaeology Project (BHAP: http://bhap.arts.ualberta.ca/project description) aims to explore prehistoric hunter-gatherer lifeways in Northeast Asia, through an intensive comparative analysis of two long-term regional trajectories of Holocene cultural and environmental change in the Lake Baikal (Russia) and Hokkaido (Japan) regions. BHAP promotes the examination of human and environmental records with high temporal resolution and the implementation of the individual life history approach (Weber et al., 2010; 2013) to archaeological research. The latter approach has been defined as a suite of laboratory and macroscopic methods which (i) give detailed information about individuals through examination of their skeletal remains in conjunction with archaeological and environmental contexts; (ii) provide insights into the variation of past human behaviour at the individual and community level; and (iii) allow robust comparison with the high-resolution records of past environments and with regional climate model simulations (Weber et al., 2010). Furthermore, comprehensive dating and detailed comparative analyses of cemetery complexes allow tracing the cultural dynamics,
interaction patterns, mobility and health of larger populations in a wider area (e.g. Weber et al., 2002). Infectious diseases like tuberculosis might be used as a proxy for human health and movement in the broader region (Roberts and Buikstra, 2003; Taylor et al., 2007; Suzuki et al., 2008).

Our paper presents an archaeological—palaeopathological case study from Turfan (western China). Although this area is located outside of the two focus regions of the special issue (Baikal and Hokkaido), it once belonged to the same cultural sphere and experienced intensive contacts and exchanges with the neighbouring regions (e.g. Di Cosmo, 2002; Parzinger, 2006). Following methodological principles of BHAP, the case study presented here combines detailed palaeopathological analysis of human skeletal remains with precise age determination and archaeological and regional contexts, demonstrating high potential of such studies in arid and semi-arid China. The current paper also presents an unusual early case of prosthetic leg use from western China. ‘Standing on one’s own feet’ is synonymous for self-sufficiency. An individual whose foot or lower leg is disabled or lost due to accident or disease ultimately needs cultural intervention for survival. Walking sticks or crutches are the simplest supporting tools helping to regain mobility, but they keep the hand and arm occupied. The use of a functional artificial shank allows the person to lead a close-to-normal life. Therefore, the invention of a prosthesis – a device to replace a missing or disabled limb – was a great advance in medical engineering. Considerations about the earliest use of leg prosthetic devices commonly start with indirect textual evidence, e.g. the Hegesistratus story recorded by Herodotus (484–425 BC) about an artificial wooden foot (Bliquez, 1996; Knoche, 2006), suggesting that foot prostheses were already known in the Graeco-Roman world in the fifth century BC (Finch, 2011). The oldest prosthetic of a big toe was reported by Nerlich et al. (2000) in Thebes, Egypt, dated around 950–710 BC.

To date, the oldest case of prosthetic leg use was discovered in Capua, Italy, in 1885 (Bourguignon and Henzen, 1885; Sudhoff, 1917; von Brunn, 1926) and dated to about 300 BC based on the typology of accompanying vases (von Duhn, 1887). The ‘Capua leg’ assigned to a man’s skeleton with right leg missing from the mid-calf had a wooden core and luxurious bronze sheeting, indicating the owner’s wealthy status. The device once acquired by the Museum of the Royal College Surgeons London was lost during the Second World War and its functionality has remained uncertain.

In China, historical texts report foot or leg amputation as one of the “five punishments” from the late second millennium BC onwards and a bronze figurine of an invalid with an amputated lower limb attached to a vessel is dated to about 900 BC (Shaughnessy, 1999). However, no examples of prosthetic devices or skeletons with healed amputations have been reported to date.

Midway between the Graeco-Roman and Chinese worlds a wooden peg-leg next to a well preserved human skeleton was excavated near Turfan in the Uygur Autonomous Region Xinjiang, China (Fig. 1). The Shengjindian archaeological site is assigned to the Subeixi (Subeshi) culture, conventionally dated to the first millennium BC (Chen, 2002; Han, 2007; Xinjiang, 2011). The current study discusses the construction details, wear, and numerical age of the leg prosthesis discovered at the Shengjindian site and pathological changes in the skeletal remains of its user.

2. Materials and methods

2.1. Grave setting and archaeological context

The Shengjindian graveyard (Fig. 1) is situated about 35 km east of modern Turfan on the upper terrace, which belongs to the valley crossing the ‘Flame Mountains’ in the eastern part of Tian Shan. The mean temperatures in Turfan are −9.5 °C in January and 32.7 °C in July. The annual precipitation is about 16 mm, reflecting an extremely dry climate (Domrös and Peng, 1988).

In total, 31 tombs were excavated at Shengjindian in 2006–2008. The current study is focused on the tomb 2007TSM2 (further named M2), which contained the wooden peg-leg found near the well preserved skeleton of its user. Construction of the tomb (Fig. 2) and grave goods (Fig. 3) match the general features of the whole graveyard and do not indicate an unusual social status of the deceased. Organics including reed- and wheat-straw mats and wooden beams covering the tomb opening were well preserved. Wheat straw and sand filled a 110 cm deep vertical shaft where the skeleton of a woman was found (Fig. 2A). The remains of the male invalid buried in a supine flexed position were found in a side chamber (Fig. 2B). Signs of a secondary opening indicate that the tomb was constructed primarily for the man, and the woman was interred later. Partially displaced or missing small bones of the man’s skeleton reported by the excavators likely resulted from this later opening.

The grave goods (Fig. 3) are limited in quantity and quality and include ceramic cups, a jar and a wooden plate placed next to the head, and fragments of two reflex bows and the peg-leg found right of the man’s body (Fig. 2A). The nearly complete skeleton of the man was available for palaeopathological investigation.

The whole graveyard including tomb M2 belongs to the Subeixi culture, associated with the Cheshi (Chü-shih) state known from Chinese historical sources (Sinor, 1990). Archaeological and historical data attest it as society with a developed agro-pastoral economy, that existed in and north of the Turfan Basin (Fig. 1) during the first millennium BC. The Subeixi weaponry, horse gear and garments (Mallory and Mair, 2000; Lü, 2001) resemble those of the Pazyryk culture (Molodin and Polos’mak, 2007), suggesting contacts between Subeixi and the Scythians living in the Altai Mountains.

2.2. Dating

For reliable age determination three samples from the peg-leg and seven other samples representing tomb M2 were submitted to the Radiocarbon Dating Laboratory at Peking University. The accelerator mass spectrometry (AMS) radiocarbon dates are provided in Table 1. Resulting radiocarbon dates were calibrated against the IntCal09 calibration curve (Reimer et al., 2009) using the SEQUENCE deposition model in the Bayesian software, OxCal (v4.1.5; Bronk Ramsey, 2008, 2009; https://c14.arch.ox.ac.uk/oxcal/OxCal.html).

![Fig. 1. Map showing the main physiographic features of the Uygur Autonomous Region Xinjiang in western China and the location of the Shengjindian (SJD) archaeological site (indicated by a black square).](image-url)
The fact that the man found in the tomb M2 died when he was ca. 60-year-old should be considered. According to Geyh (2001), some kind of ‘reservoir’ effect should be taken into account in such a case. Because the carbon in human bones is incorporated during the whole life, and mostly during the first 20 years, the average 14C signature in the bone, corresponds to the time well before the man’s death. For a ca. 60-year-old man the correction of about 30 ± 10 years is thus necessary (Geyh, 2001). Therefore, in calibrating 14C age of this bone, reservoir-correction of the IntCal09 calibration curve was used (for the 20-year-old woman, no correction was needed).

Taking into account archaeological background information, it is assumed that the sample BA10800 (female rib) must be younger than the sample BA10799 (male rib), and BA10799 must be younger than the seven wood samples BA10791–BA10797, which were grouped in PHASE of the SEQUENCE defined above. Thus, all samples in this PHASE were considered to be older than the next sample of the SEQUENCE (i.e. BA10799), but the order of calendar dates of individual samples within the PHASE remained unknown. The leather sample (BA101092), which shows oldest radiocarbon age of all was declared as independent of the other samples and calibrated individually.

The calibration results obtained with such assumptions are presented in Fig. 4. In this figure the light silhouette shows age distribution of calibrated 14C date treated as purely individual (i.e. independent of dates of other samples), and the dark silhouette shows modelled age distribution constrained by the conditions of SEQUENCE and PHASE as described above. Noticeably, the wood samples if calibrated individually show bimodal probability distribution with two maxima around 320 BC and between 200 and 500 BC (Fig. 4). However, the SEQUENCE model discriminates the younger maximum almost entirely, so calendar ages of the wood samples appear all around 320 BC, the calendar age of the male bone between 315 and 150 BC (95% confidence interval) and the calendar age of the female bone between 290 and 115 BC (95% confidence interval). After calibration, the ‘younger’ 14C dates of the analyzed wood samples match the ‘older’ calendar dates. This inversion correlates quite well with the shape of the calibration curve, which shows a distinct wiggle between ca. 2170 and 2240 14C BP (Reimer et al., 2009). The relatively old age of the leather sample might indicate its truly older age. It is easy to imagine that the leather piece was used for a long time before it was finally cut into stripes and attached to the peg-leg. Available publications reporting radiocarbon dates of leather samples from western Eurasia (van der Plicht et al., 2004; Hall et al., 2007; Pinhasi et al., 2010; Strydonck et al., 2010) do not indicate any technical difficulties with dating ancient leathers and recommend quite simple chemical pre-treatment of such samples. Whether the 14C date from the M2 tomb could be altered due to the technologically different leather-making process used in ancient China remains an issue for further research. This matter, however, does not influence analysis and results presented in the current study.

The considerations given above are valid if 14C dates of bones are not affected by the diet-caused reservoir effect, which might be significant. For example, Olsen et al. (2010) demonstrated that the radiocarbon dates on human bones from the Neolithic cemetery in NE Germany were up to 800 years older due to freshwater-influenced diet of the human population. However, the Shengjin-dian site is located in a dry area, where the lakes and rivers suitable for fishing are absent. The archaeological record also suggests a terrestrial diet for the local population and does not provide evidence for fishing.

3. Results and interpretations

3.1. The peg-leg owner

Based on the morphology of skull and pelvis (using the methods of Ferembach) the peg-leg owner was a man (Acsádi and Neméskeri, 1970; Ferembach et al., 1980). Cranial suture closure and tooth wear (Brothwell, 1981; Buikstra and Ubelaker, 1994), and the wear of Symphysis pubica (McKern and Stewart, 1957) suggest the age of 50–65 years old. Well preserved long bones allowed his body height to be estimated as 170.4–178.2 cm (Pearson, 1899; Breitinger, 1938; Cerny and Komenda, 1982). His left knee joint (Fig. 5) displayed complete bony fusion of femur, patella, fibula, and tibia, i.e. osseous ankylosis with fixation at 135° flexion and 11° internal rotation. A few different causes, such as inflammation in or around the joint, rheumatism or trauma, might have resulted in this most pronounced pathological change. Medical inspection of the fused leg bones using X-ray images (Fig. 5A) and computed tomography (CT) supported the elimination of fracture or other...
mechanical trauma of the knee joint as the cause. In the case of rheumatoid arthritis, more joints should be affected, but none of the others showed comparable lesions. Osseous ankylosis caused by inflammatory processes (Muirhead Little, 1909; Hadjistamoff, 1960; Kim et al., 2000; Bae et al., 2005) is often due to infection with either *Mycobacterium tuberculosis* or *Mycobacterium bovis*, both members of the *M. tuberculosis* complex (Kim et al., 2000; Teklali et al., 2003; Taylor et al., 2007). Infection may influence humans at a site of initial inoculation or spread throughout the body (Roberts and Buikstra, 2003; Lewis, 2011): for instance it commonly spreads to the lungs, but may also affect spine, hip joint and knee joints (Moon, 1997; Kim et al., 1999).

In the male skeleton, apart from the ankylosed knee joint, periostitis on the visceral surface of the ribs as a probable palaeopathological indication of pulmonary tuberculosis (Pfeiffer, 1991; Roberts et al., 1998; Mays et al., 2002; Santos and Roberts, 2006) has been observed on ribs two to eleven (right side more affected than left) (Fig. 6A). Necrotic lesions in combination with new bone formation between the fifth and sixth cervical vertebrae (Fig. 6B) may indicate skeletal tuberculosis infection (Pálfi et al., 1999; Table 1).

<table>
<thead>
<tr>
<th>Laboratory number</th>
<th>Grave number</th>
<th>Dated material/archaeological context</th>
<th>Radiocarbon date, ¹⁴C BP (±1-sigma)</th>
<th>Calibrated individual dates, BC (95% conf. interval)</th>
<th>Calibrated related dates, BC (95% conf. interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA10791</td>
<td>M2</td>
<td>Wood/plate</td>
<td>2115 ± 35</td>
<td>348-45</td>
<td>360-280</td>
</tr>
<tr>
<td>BA10792</td>
<td>M2</td>
<td>Wood/bow</td>
<td>2170 ± 55</td>
<td>380-59</td>
<td>388-216</td>
</tr>
<tr>
<td>BA10793</td>
<td>M2</td>
<td>Wood/bow</td>
<td>2140 ± 50</td>
<td>360-46</td>
<td>377-186</td>
</tr>
<tr>
<td>BA10794</td>
<td>M2</td>
<td>Wood/wedge</td>
<td>2185 ± 35</td>
<td>377-166</td>
<td>379-216</td>
</tr>
<tr>
<td>BA10795</td>
<td>M2</td>
<td>Wood/wedge</td>
<td>2155 ± 25</td>
<td>356-106</td>
<td>360-176</td>
</tr>
<tr>
<td>BA10796</td>
<td>M2</td>
<td>Wood/prosthesis</td>
<td>2135 ± 25</td>
<td>350-57</td>
<td>356-170</td>
</tr>
<tr>
<td>BA10797</td>
<td>M2</td>
<td>Wood/prosthesis</td>
<td>2145 ± 45</td>
<td>339-51</td>
<td>375-184</td>
</tr>
<tr>
<td>BA10799</td>
<td>M2</td>
<td>Bone/male rib</td>
<td>2190 ± 35</td>
<td>347-137</td>
<td>315-150</td>
</tr>
<tr>
<td>BA10800</td>
<td>M2</td>
<td>Bone/female rib</td>
<td>2235 ± 30</td>
<td>389-204</td>
<td>290-115</td>
</tr>
<tr>
<td>BA101092</td>
<td>M2</td>
<td>Leather/prosthesis</td>
<td>2300 ± 25</td>
<td>406-235</td>
<td>406-235</td>
</tr>
</tbody>
</table>

Fig. 3. Burial objects from the tomb M2 used for discussion and radiocarbon dating (Table 1), including (A, C) ceramic cups and (B) ceramic jar, (D, E) fragments of two reflex bows, (F) wooden wedge, and (G) wooden food-serving plate.
extremities show a similar maximum length (Table 2), indicating the osseous fixation happened after complete fusion of the epiphyses. The measurements of the midshafts of femur and tibia (Table 2) show almost no bone loss on the affected side, suggesting that the disability did not occur early in life.

X-ray radiographic images (Fig. 5A) allow the reconstruction of bone formation processes from bone remodelling within the inner structure of the bone, followed by depletion of the normal load lines of the bone and finally reduction of trabecular bone because the leg was not used for walking any more. CT scans do not provide any information beyond that supplied by the radiographs. The high degree of flexion of the lower limb made standing and walking on it unfeasible and horseback riding would have been greatly hindered, if not impossible, due to the internal rotation. The wooden peg-leg supported standing and short-distance walks. Pronounced muscle attachment sites on all bones indicate that the man remained physically active.

### 3.2. Technical characteristics of the peg-leg

The general appearance and details of the wooden peg-leg found in the tomb M2 are presented in Figs. 7–9. Being 89.2 cm long the device consists of three components (Fig. 7). There are a flat lateral thigh-plate stabilizer (width 8.8 cm, maximum thickness 2.5 cm), and a round distal peg (diameter 3.6 cm) made in one piece from softwood, likely poplar; robust sheep/goat horn to reinforce the tip of the peg; and a horse or Asiatic ass hoof as sink resistance, as a basket on ski poles. One side of the thigh plate (the inside) clearly shows the outline of the knee (Fig. 8A) and substantial thinning of the plate in its lower part (Fig. 8C) as a result of long-term rubbing. The surface of the outer side is dark and rough except for the shiny tape-end indicating covering by garment. These features show that the peg-leg was fastened to the outside of the left leg.

The top-end of the thigh plate has two holes with straight upward friction grooves likely accommodating a waist strap. At the transition from flat stabilizer to round peg the device was partly broken and repaired with a leather strap making use of the lowest of the lateral holes (Fig. 7B). The other six lateral holes on each side served to fasten it around the thigh. Some holes show remains of chisel-cut marks smoothed over time by the leather straps. How the prosthetic leg was secured against superior displacement from the weight that the user’s body placed on it with each step remains unclear. It does not appear that the pathological flexed knee was accommodated in a ‘cup’ or other structure, as stumps were in more recent industrially-manufactured prosthetic legs. Surely the thigh straps alone were not tight enough to resist superior displacement. The preserved straps (widths 0.5–1 cm) and deep downward friction marks on both the outer and inner faces (Fig. 9) permit a tentative reconstruction of fastening as follows. A single short strap was routed through two neighbouring holes, both ends coming out on the inside of the plate. One end was sliced in two; the other had a cut eyelet and linked up with a strap or button which might have been fixed to a thigh casing. In this way the stabilizer would be fastened to the thigh at six stable fixation points (three on each side). As no leather or wood thigh casing has been found in the grave the problem of fixation remains unsolved.

The distal peg end was forced into a straightened horn which must be of goat or sheep on account of its ring structure. Its pointed front side is bevelled from dragging over hard ground (Fig. 8D). A hoof was pulled over the horn and secured in place with a leather strap run through a horizontally drilled hole penetrating the horn (Fig. 8B, D). No metal was found in the device, even though bronze and iron were already in use in this society.

**Fig. 4.** Results of calibration of ¹⁴C dates of the samples from the tomb M2. Light silhouettes present calibration of independent ¹⁴C dates, dark silhouettes present calibration of related dates (details in the text). For the sample 10799, 30-yr reservoir-correction of the IntCal09 calibration curve was used. The 1-calibration of related dates (data in the text). For the sample 10799, 30-yr reservoir-correction of the IntCal09 calibration curve was used. The 1-calibration of related dates (details in the text).

**Fig. 5.** (A) X-ray radiographic image and (B) photograph of the flexed ankylosed left knee of the prosthesis owner from the tomb M2.
4. Discussion

The whole region of Xinjiang, including Turfan has an extremely dry and continental climate, which allows very good preservation of organic material (e.g. Wagner et al., 2009 and references therein). For decades, mummies from the Tarim and Turfan basins have attracted international attention (Mallory and Mair, 2000; Lü, 2001). Despite the extremely good preservation of human corpses and skeletons in archaeological excavations in Xinjiang, detailed palaeopathological studies are still rare (Schultz et al., 2007; Gresky et al., 2008; Wagner et al., 2011). The recently published archaeological and palaeopathological record of early first millennium BC mounted pastoralists from the Liushui cemetery in the Kunlun Mountains, south of Tarim basin (Wagner et al., 2011) and the current results obtained from the Shengjindian cemetery (this study), demonstrate the high potential of the non-destructive examination methods of human osteological remains (Katzenberg and Saunders, 2008) from western China and encourage application of the individual life history approach to the entire cemetery populations. This will allow new insights into the local and regional archaeological record and provide rich and comprehensive material for inter-regional comparisons with results generated by the Baikal-Hokkaido Archaeology Project.

The Shengjindian cemetery complex belongs to the late first millennium BC, i.e. a period when the Turfan depression in the eastern foothills of Tian Shan as well as the Lake Baikal region were part of the wide Inner Asian activity zone of the Xiongnu confederation of tribes with complex economy embracing pastoralism and sedentary agriculture, and recognised in the archaeological record by characteristic ornaments (e.g. Psarras, 1996), weaponry (e.g. Reisinger, 2010), and tomb constructions (Konovalov, 2008). The region south of Lake Baikal came under the control of the Xiongnu tribes about 200 BC (Parzinger, 2006). Their northernmost outpost — Ivolinskoe — discovered near Ulan-Ude, only 80 km from Lake Baikal (Davydova, 1985), was a permanent settlement with wooden houses and four rings of defence walls separated by water ditches. The inhabitants were involved in pottery making, bronze and iron casting, cultivated millet, barley and wheat, and kept sheep/goats, cows and horses, as well as pigs and dogs. By the late first millennium BC, the Xiongnu confederation was threatening the northern and western borders of dynastic China (e.g. Di Cosmo, 2002). Historical sources note that Turfan was the key area for both the Xiongnu and the Chinese in exercising control over eastern central Asia (Sinor, 1990). However, surprisingly little information is available about the society which inhabited the area. Subsistence practices, settlement patterns,

<table>
<thead>
<tr>
<th>Bone</th>
<th>Maximum length (mm)</th>
<th>Midshaft circumference (mm)</th>
<th>Transverse midshaft diameter (mm)</th>
<th>Sagittal midshaft diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Femur</td>
<td>475</td>
<td>470</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>Tibia</td>
<td>390</td>
<td>400</td>
<td>87</td>
<td>86</td>
</tr>
<tr>
<td>Fibula</td>
<td>380</td>
<td>385</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
burial customs, political and cultural contacts still need to be inferred from the archaeological record. Beside the already mentioned relationships to the Xiongnu and dynastic China, the contacts of the Cheshi state (Subeixi culture) with the Scythian Pazyryk culture of the Altai Mountains suggested by the similarities in weaponry (i.e. characteristic bows from M2 tomb), horse gear and garments (Mallory and Mair, 2000; Lü, 2001; Parzinger, 2006) should also be investigated.

An early case of a prosthetic leg from western China presented in the current study contributes to the knowledge of early medical practices in general and the use of limb prosthetics in particular. The shank of the man from Shengjindian was not amputated, but fully disabled. The peg-leg replaced the disabled limb and, therefore, deserves to be termed a ‘prosthesis’. The above mentioned Capua prosthesis was missing a thigh apparatus for secure fastening. Only a number of iron rods with holes at the proximal rim suggest fixing with straps at the waist band. Optically more than functionally, it restored the user’s physical integrity when sitting on a chair or riding a horse (Bliquez, 1996).

The burial context indicates that the user of the Turfan prosthesis was a commoner. Neither elegant nor made of precious materials, the device is unique in terms of technical design, robustness and functionality. Together with the reflex bows from M2 and other tombs it demonstrates the high woodworking skills of the society. Except that no stump was accommodated in the Turfan peg-leg and a horn plus hoof were used instead of iron for reinforcement of the tip, the ancient device resembles the industrially manufactured or home-made leg prosthetics used two thousand years later, for example after the American Civil War (1861–1865) and the First World War in Europe (1914–1919) (Lazenby and Pfeiffer, 1993; Knoche, 2006). The basic mechanical components: lateral stabilizer, leather straps, and peg are the same.

The pathological changes in skeletal remains reported here may add to knowledge of tuberculosis history (Roberts and Buikstra, 2003). In particular, Asian records of tuberculosis are still rare (Pechenkina et al., 2007). Fusegawa et al. (2003) identified *M. tuberculosis* DNA in adult and child skeletons from the wealthy graveyard near Turfan belonging to the same period (202 BC–200 AD) and cultural complex as the Shengjindian site. Their inference of an outbreak of tuberculosis was later called into question because no macroscopic skeletal lesions were found (Pechenkina et al., 2007). Suzuki et al. (2008) reported a case of spinal tuberculosis from Korea dated to the first century BC, relating it to population movements from China to Korea and Japan.

**Fig. 7.** Wooden leg prosthesis from the tomb M2. (A) Drawing of the inner face (attached to the body), and (B) drawing and (C) photograph of the outer face.
Furthermore, Taylor et al. (2007) could identify *M. bovis* DNA in human remains from southern Siberia dated to 360–170 BC. Together with the published results, our evidence shows a wide frontier of disease. Archaeologically and textually known for an increase in residential mobility and the spread of complex pastoralism and mounted warfare in Eurasia between the Black Sea and the Korean Peninsula (Wagner et al., 2011), the first millennium BC may therefore be crucial for the spread of tuberculosis into eastern Asia.

5. Conclusion

This article reported the oldest known fully functional leg prosthesis. It was found in a grave of a male individual in Xinjiang, China, radiocarbon-dated to about 300–200 BC. He probably suffered from tuberculosis infection that resulted in rib and vertebral lesions but, most remarkably, in osseous ankylosis of the left knee. Similar to modern-era cases of below-the-knee amputation, the missing (in this case, disabled) shank was replaced by an externally fitted prosthesis. It is the oldest preserved material evidence of a fully functional leg prosthesis. The simple but effective construction of wood, sheep/goat horn, horse/ass hoof, and leather strikingly resembles the peg-legs manufactured from the late 19th to the mid-20th century in America and Europe. Heavy traces of wear on the prosthesis and the absence of muscle atrophy of regions of the skeleton other than the affected leg indicate an active lifestyle for several years after the leg became immobile.

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