



Archaeological evidence for *Pott's disease* on historical populations: Tomb 05 at the Roman Circus *maqbara* as an example of social solidarity (Toledo, Spain)

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With 4 figures and 1 table

Abstract: World societies can often be characterized by their attitude towards elderly and illness. It is well known that most cultures were concerned about those who were not able to produce and take care of themselves. This brings to the development of social processes that involve such individuals within the community, resulting in groups who stick together, and at last, ensuring the survival of the group. The contextualization of many of those social processes might be studied through Physical Anthropology and Paleopathology. This paper presents tomb 05 (T-05) as a new case of probable tuberculosis in Toledo from the medieval *maqbara* of the Roman Circus that provides new paleoanthropological data to understand the treatment given to sick people in a sparsely studied context.

Keywords: Social solidarity; Paleoanthropology; Paleopathology; *Pott's disease*; medieval society; Muslim Toledo

Introduction

Tuberculosis is an infectious disease known since prehistoric times (Sager et al. 1972; Grmek 1983; Formicola et al. 1987; Canci et al. 1996; García-Guixé et al. 2009: 520). It became an epidemic with the increase in population density due to the emergence of large urban communities at the end of the Middle Ages (Roberts 2002: 111). The introduction of antibiotics and thoracic surgery from the second third of the 20th century reduced the morbidity, being finally eradicated at the end of the century (Roberts & Buikstra 2003). However, today it seems that it is taking certain boom, probably linked to the migratory processes, tourism, or the increase of other infectious diseases that cause the decrease in the organic defences (García-Guixé et al. 2009: 520).

The most common organs affected by the Tuberculosis (TB) are lungs, from where the infection can spread via blood to all organs in the body. But it might also develop TB in the lymph nodes and on the throat. When TB affects bones, it usually influences the vertebrae. This manifestation is called *Pott's disease* and occurs as a result of two or more vertebrae being affected by the tuberculosis bacillus.

The affected vertebrae are normally dorsal and sometimes lumbar. When the nutrition of the disc is interrupted, vertebrae start shortening and finally the column collapses. Then, the infection starts on the front of the vertebral body and expands from there. Once the process is well advanced it might cause medullary injury resulting in paraplegia due to the narrowing of the medullary canal.

It is known that in preantibiotic times, the *Pott's disease* was usually developed in 50–70% of cases during the first 10 years of life of children with TB (Ulrich-Bochsler et al. 1982). If the disease does not mean quick death during this first phase, the tuberculosis pathogens may be latent for decades, shaped encapsulated by calcified tissue, increasing life expectancy to 30–50 years (Powell 1988). During this long period, the Koch Bacillus might cause manifestations in other organs, compromising life expectancy more quickly. In this way, those individuals with worse immunological response would begin to develop early lesions. The reactivation of the disease will occur by a severe systemic stress (post-primary infection), with localized rupture and consequent dissemination by all human body affecting the bone, and causing acute tuberculosis in later years (Hoeprich 1977).

The aim of our study is to present the skeletal remains of an individual from the medieval Muslim cemetery of Toledo (Spain) suffering from TB. We have used this case to emphasize social solidarity in this period. The manuscript brings us new information of a pathological condition in the Iberian Peninsula during medieval times yet it is the first case documented in Toledo. Historical and cultural processes can be studied not only from written sources, but also from the study of skeletal remains. Both archaeological and anthropological analysis will help us to understand the social solidarity within this period.

Social evolution of care and palliative: The historical evidence of *Pott's disease*

Since prehistoric times, we have archaeological evidence of care and palliative undergoing some individuals by the family or the group to whom they belong. This type of care required of an active participation of the group to guarantee their subsistence (Reverte Coma 1992). These are the cases of the man from Chapelle-aux-Saints (France), or of the recent excavations at the site of Hemmaberg in Austria (Binder et al. 2016). The historical documentation of these palliative care increases as we have written sources corroborating them. We found a case of TB in a mummy of the 5th dynasty (Egyptian Middle Kingdom) belonging to a male individual aged 40–50 years (Strouhal 1988). This individual presents scoliosis due to tuberculosis involvement of 6 fused vertebrae (T8–L1). Despite the ankylosis, the individual was able to walk with foreign aid of a wood cane (Strouhal 1988).

As far as we are concerned, the Islamic world has always followed the idea to please the Prophet and Allah by showing affection and compassion and trying to help as far as possible to make life more dignified and tolerable (Larrivé 1995; Carballeira Debas 2012; Viguera Molins 2013: 69). As we move forward in time, we observe a special interest in caring for these disadvantaged groups. During the Christian period this special attention for the care of these groups will be within the framework of the dominant spirituality. So, comply with the prevailing dogma and redeem the spiritual guilt through Almsgiving and helping the underdog, might characterize a type of assistance that will improve over time, to reach the so-called State of well-being that is observable in many countries today (García Ballester 1987–1988: 109).

For that matter, ecclesiastical documents during medieval ages can help the historian to know issues such as poverty, diseases, old age or death (Valdeón Barúque 1998: 277). In the necropolis of the Cathedral of the Burgo de Osma, different groups in risk of social exclusion were maintained by the rest of the community (Herrerin & Garralda 2002).

In Spain, there are a number of scientific papers that document this type of TB condition. The Tomb 23 of Early Medieval cemetery of San Martín de Puentelarrá (Álava),

presents a young-adult male individual with an affection of the D12–L4 vertebrae and osteosclerotic reactions at the level of the first two vertebrae of the sacrum, creating an angle of 45° in the spinal column. Also the Visigoth settlement of El Tolmo de Minateda (Albacete) documented an adult female individual with destruction of the vertebral body of T8–12 and L1–3 with involvement in the rest of vertebrae presenting irregular lateral faces (De Miguel & Gutiérrez 2007). From the medieval necropolis of Sant Benet de Bages (Catalonia), four individuals out of 500 skeletons belonging to the 10th to 11th centuries AD, present vertebral lesions related to the tuberculosis disease. It is interesting to highlight one young female who presents an ankylosis of the segment D6–9, in bodies of D10 and D11 vertebrae, and an expanded spinal channel displaying a kyphotic curvature what indicates a strong case of *Pott's disease* (García-Guixé et al. 2007).

Historical background

To understand the study of T-05, we need to focus now on the influence of Muslim Empire in the Iberian Peninsula. Al-Andalus refers to the Iberian Peninsula territory under Muslim influence from year 711 to 1492. It became part of the medieval Islamic world when a Muslim army crossed the straits of Gibraltar, conquered the Visigoths and established an emirate depending on the Umayyad caliphate in Damascus (Reilly 1993). During several centuries different emirs ruled a vast part of the Iberian Peninsula autonomously until Umayyad ruler Abd al-Rahman III declared himself caliph in 929. This political system changes after two and a half centuries of relative stability. The dynasty crumbled in early 11th century due to disputes over succession in behalf of smaller independent states emerged called Taifa reigns. The Taifa period is a turning point on Muslim occupation because Christian pressure to the south started a massive reconquest of the territory (Molera & Vendrell-Saz 2001). First, conquering the Taifa of Toledo and its capital after a takeover pact signed by Christian Alphonse 6th and Taifa al-Qadir Kings in year 1085, and finishing four centuries later with the conquest of Granada by Catholic Monarchs in 1492. The geographical location of Toledo would allow them to articulate Al-Andalus joining the cities of the South (Granada, and especially Córdoba) with Zaragoza, favouring the process of Islamization (Fig. 1).

Medieval cemeteries of Toledo

Muslim occupation of the Iberian Peninsula has left a huge variety of influences ranging from cultural, economic and artistic to social behaviour. In terms of funerary practice the introduction of Muslim religion transformed the tradi-

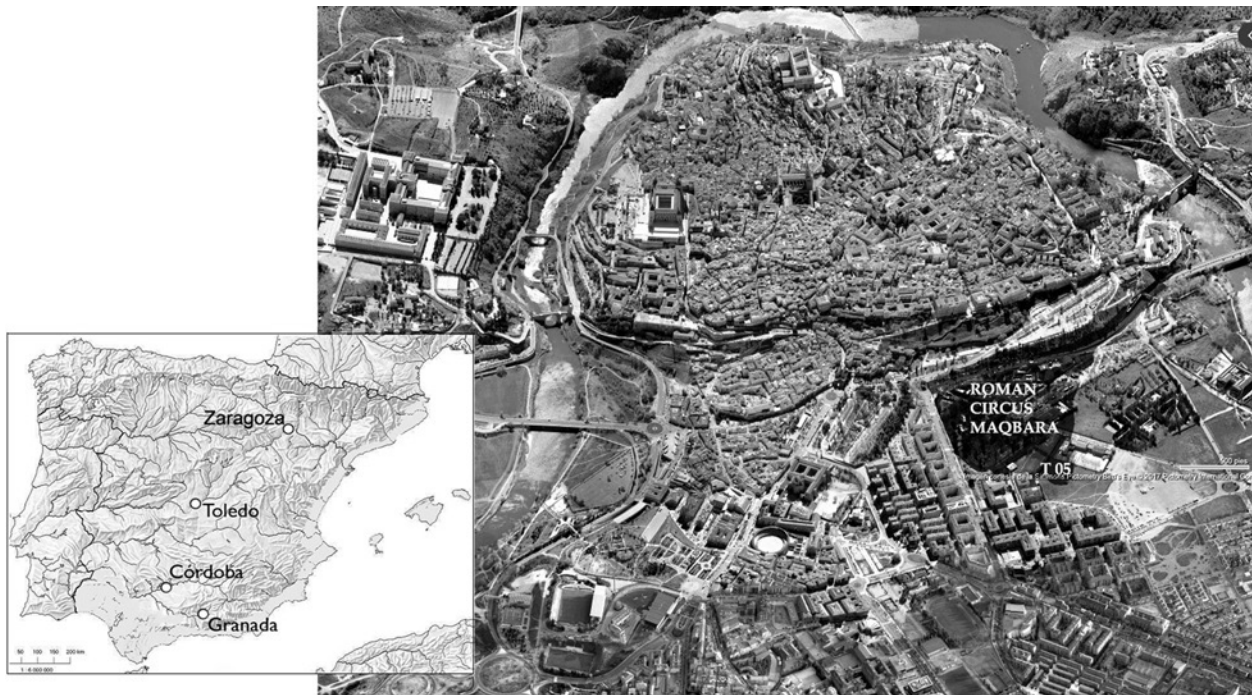


Fig. 1. Location map.

tional Christian rituals that characterized the Visigoth period. During medieval time, Toledo was considered city of three cultures for having Christian, Muslim and Jewish population living in the old city. As a result, it also had several religion's burial areas linked to specific locations outside the city walls: Muslim tombs between 711 to 1085 were distributed around the abandoned roman circus, the Vado gate and the Madrid Road. After the reconquest of the city in 1085, Christian cemeteries spread outside the city walls throughout Santa Leocadia de Afuera and San Eugenio, along with the church courtyards inside the city. On the contrary, Jewish cemetery was located far away from the city around the Cerro de la Horca (Ruiz-Taboada 2015) (Fig. 2).

The Roman Circus *maqbara*: The excavation

The Roman Circus necropolis has been excavated in various occasions; however, a comprehensive research project covering its entire surface is yet to be designed. Amongst the most significant publications is that of De Juan (1987), who identifies Muslim burials excavated in the geological substrate. He proposes different burial phases from Islamic (8th to 11th) to Christian (11th to 16th/18th centuries). In our case, the savage excavation of the year 2013 is consequence of the Santa Teresa neighbourhood urban development plan. This cemetery is distributed around the roman circus and its surroundings. This ludic monument was built for racing

chariots with an estimated capacity of between 15,000 and 30,000 spectators, with dimensions 423.10×100.80 m and an approximate area of 9,800 m², and which remained in use until the 4th century or early 5th (Ruiz-Taboada & Azcárraga Cámara 2016). During the first years of Muslim control, traders would place their stalls using the grades and later on, the area was used as a cemetery.

As mentioned before, the archaeological dig of the area is founded on the Santa Teresa's neighbourhood urban development project (UA34). Such project included the excavation of a wide surface area and trenches for street sewers. Consequently, most of the rescue intervention consisted of the excavation of two large units: the first (A) with dimensions 52×35 m and a surface of 1600 m² (where tomb 05 is located, Fig. 2); the second (B), 52×15 m and 780 m² surface. Additionally, the sewerage trench for streets or roads had a variable depth and a breadth of 1.60 m. Both the archaeological occupation and abandonment phases of the cemetery have been documented.

Description of the graves

The burials were dug into a dark brown silty soil. The silt levels are related to a possible lake area, which would have occupied part of this meadow foundation known as Vega Baja (Low Meadow). This lake or floodable area, whose origin is probably a spring recorded to the north of the site,

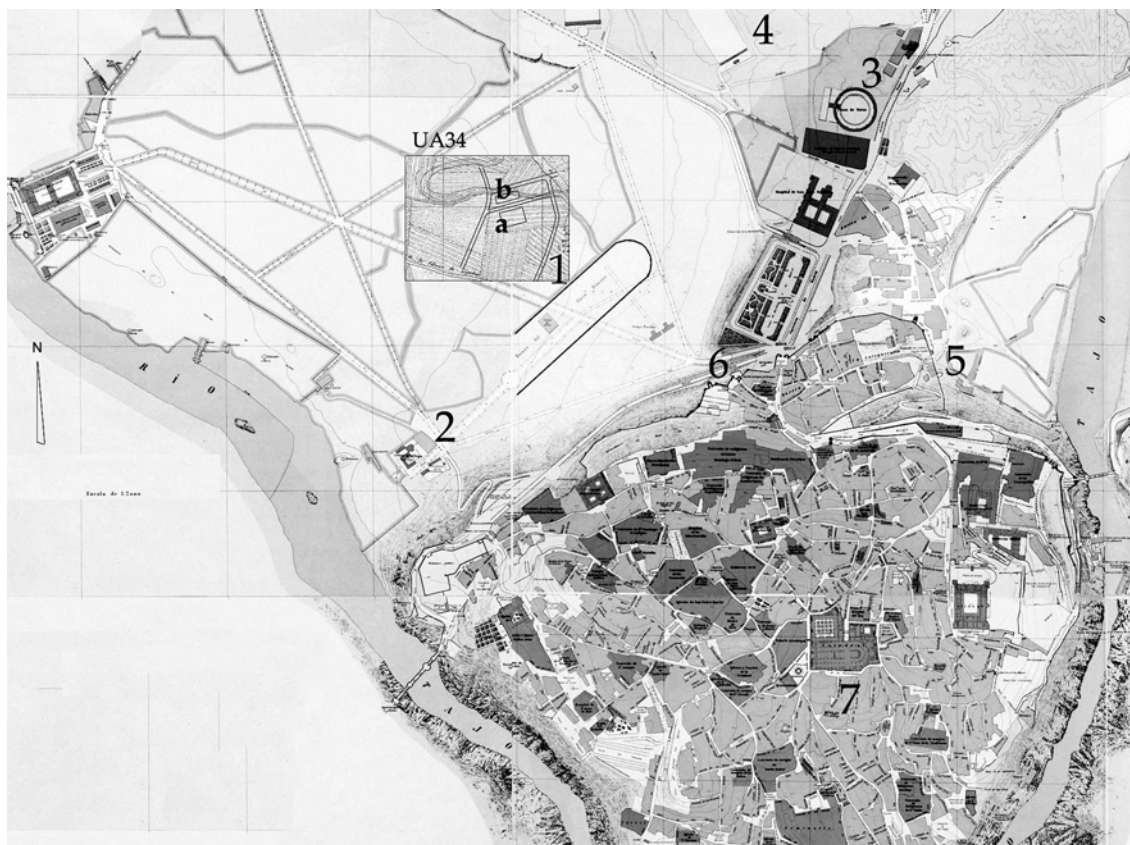


Fig. 2. Locations mentioned in the text after year 1909 topographic map. **1:** Roman circus Medieval Islamic cemetery at Vega Baja; **2:** Santa Leocadia de Afuera's cemetery; **3:** Madrid Road Muslim cemetery; **4:** Jewish cemetery; **5:** Puerta del Vado cemetery; **6:** Bisagra Gate; **7:** Old city.

would have progressively filled up with sediments until it was completely covered up. The date of this silting is estimated around the first millennium, as carbon dates for this sector of the cemetery range from 664–770 to 863–984 calibrated AD (Ruiz-Taboada 2015: 58). The location of this type of cemeteries in places associated to water is very frequent in the Islamic medieval world (Botella Ortega et al. 2005; Olcina Domenech et al. 2008: 220).

A total of 52 burials have been found in an excavated area of 350 m². Although the surface demarcation of these tombs has been lost, the vertical closing has been preserved in the form of stone slabs, curved tiles (*imbrices*), wood, small sized stones and fragments of bricks. According to Islamic funerary traditions the deceased must be laid in their graves facing Mecca, holding no grave goods. The corpse is placed in the pit, normally without a coffin, just wrapped in a shroud. It is placed in right lateral *decubitus* position, with the lower limbs slightly flexed, arms folded to the front over the pubic region and face to southeast (Ruiz-Taboada 2015). Most individuals are aged between 16–24 years, although 21 of the tombs correspond to children burials (Table 1). These burials can be found in an area defined by a wall 34.62 m

long and between 0.70 and 0.79 m broad and which must have acted as the cemetery limit on its northwest end (Fig. 3).

Tomb 05: anthropological description

The individual number 05 recorded in this excavation corresponds to a male individual in accordance to the Ferembach et al. (1980) sex diagnosis, with an estimated age of 16–24 years old (Lovejoy 1985; Brothwell 1981). He presented osteolithic injuries of infectious cause and a possible diagnosis of tuberculosis along the spinal column. It presents dorsal kyphosis with an approximate 78 degrees angle (Cobb's angle) with regards the normal spinal axis (being the norm a 20–40 degree angle), what would have caused a considerable reduction of his height (Fig. 4). The latter has been estimated in 165–167 cm from lower limb osteometric measurements (Mendonça 2000). Therefore, there is a difference of 45–47 cm between the value obtained from these measurements and the length of the skeletal remains, which can be explained by the forced posture caused by the severe kyphosis described.

Table 1. List of analyzed cases. We have followed dental formulas to estimate age of death: Schour & Massler (1941) for subadult individuals, and Lovejoy (1985) and Brothwell (1981) to estimate adult age at death. To estimate stature, we have used Mendonça (2000).

Tomb	Sex	Age	Stature
T-01	♂?	20–24 y	1.60–1.65 m
T-02	♂?	Adult	1.60–1.65 m
T-03		2 y ± 30 m	85 cm
T-04	♀?	6y ± 24m	1–1.10 m
T-05	♂	16–20y	1.35–1.40 m
T-06	♀	16–20y	1.50–1.55 m
T-07	♀?	16–20y	1.20–1.30 m
T-08	♂	20–24y	1.65–1.70 m
T-09	♀?	16–20y	1.60–1.65 m
T-10		0.5 m–1 y	< 50 cm
T-12		18 m ± 6 m	
T-13	♀	18–22y	
T-14		2 y ± 8 m	0.70–0.80 cm
T-15	♂	20–24y	1.60–1.65 m
T-16	♀	16–20y	1.50–1.60 m
T-17	♂	40–50y	1.60–1.65 m
T-18	♂	30–35y	1.65–1.70 m
T-19		5 y ± 16 m	1.20–1.30 m
T-20		Birth ± 2 m	37 cm
T-21	♂	35–40y	1.60–1.65 m
T-22		>14y	1.10–1.20 m
T-23		Birth ± 2 m	35 cm
T-24	♀	18–22y	
T-25		0.5m	55–58 cm
T-26		11 y ± 30 m	
T-27		18 m ± 6 m	

Tomb	Sex	Age	Stature
T-28	♀	35–40 y	1.60–1.65m
T-29		5 y ± 16 m	
T-30		4 y ± 12 m	1.15–1.20m
T-31	♀	20–24y	1.65–1.70m
T-32		<13 y	
T-33		1 y ± 4 m	65–70 cm
T-34		1 y ± 4 m	55–60 cm
T-35	♂	24–30 y	1.60–1.65m
T-36	♂	24–30 y	
T-37		Birth ± 2 m	
T-38		Birth ± 2 m	40 cm
T-45	♀	24–30 y	1.60–1.65m
T-46	♂	16–20 y	1.60–1.65m
T-47	♂	30–35 y	1.55–1.60m
T-48	♂	18–22 y	1.60–1.65m
T-49	♂?	20–24 y	1.60–1.65m
T-50	♂	18–22 y	1.60–1.65m
T-51	♀	30–35 y	
T-52	♀	16–20 y	1.60–1.65m
T-53	♂	Adult	1.60–1.65m
T-54	♂	35–40 y	1.60–1.65m
T-55	♀	18–22 y	1.55–1.60m
T-56		3 y ± 12 m	1.10–1.20m
T-57	♂	18–22 y	1.60–1.65m
T-58		Birth ± 2 m	0.40–0.50 cm
T-60		1 y ± 4 m	0.65–0.75 cm

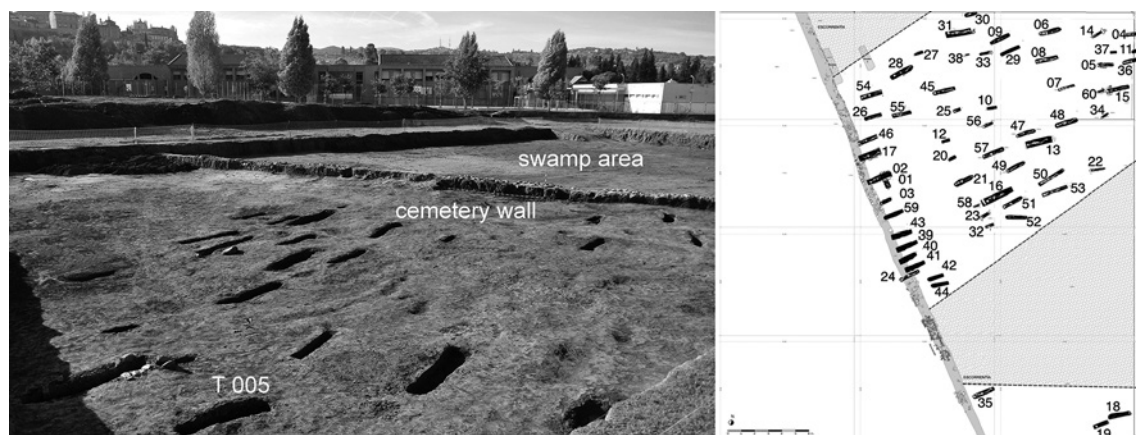


Fig. 3. General view of the excavated sector of the Roman Circus necropolis where tomb 5 can be found.

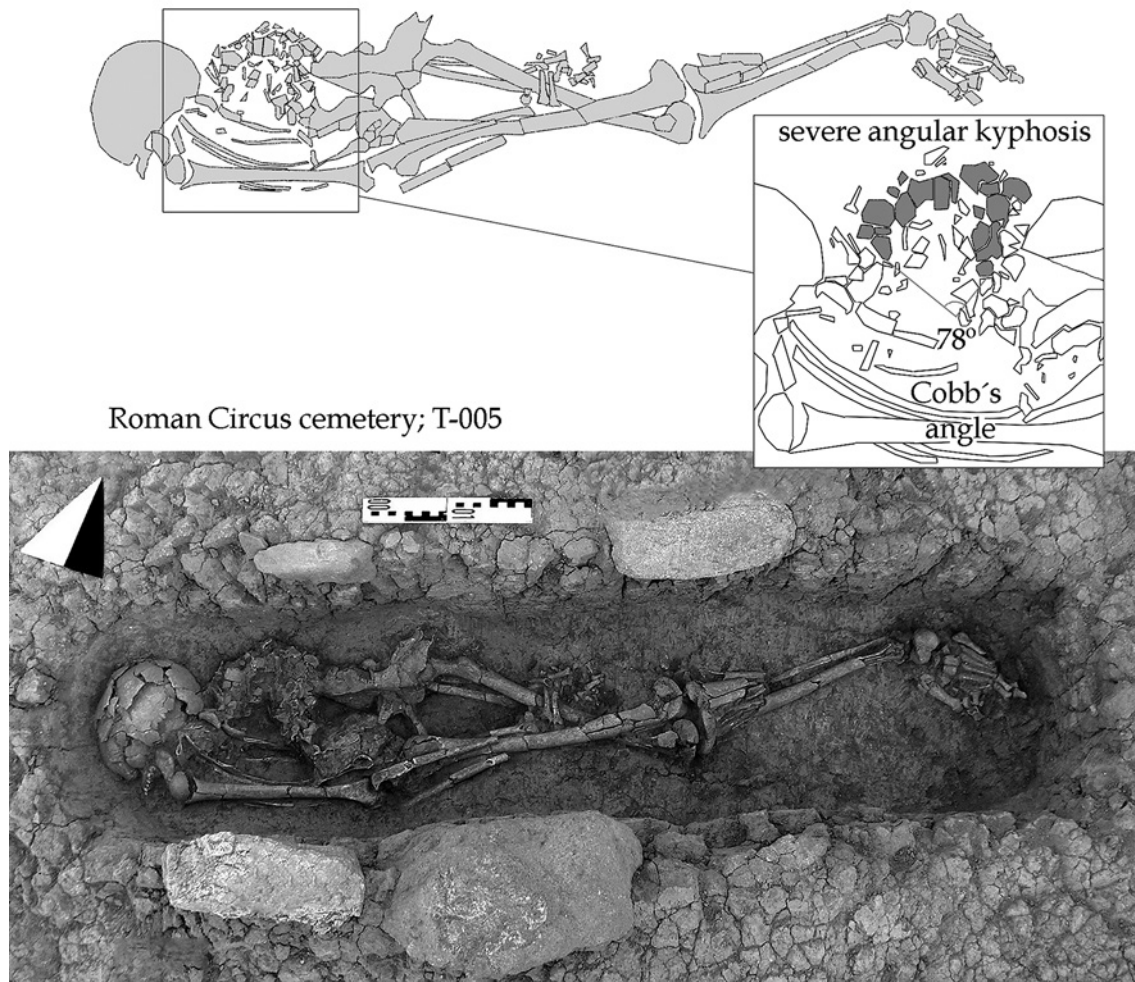


Fig. 4. Tomb 05 and detail of vertebral destruction in the dorsal and portions, resulting in kyphosis.

We observe that the length of the grave is made to measure, so the body was not intentionally forced to be placed in it. It is the first evidence of a pathological condition that leads us to think of a severe disease according to the following skeletal lesions.

Skeletal lesions

As a result of the cavitation of the vertebral bodies caused by the loss of bone mass, the bottom and top edges of the cervical-dorsal and dorsal-lumbar vertebral portions were destroyed. This led to a narrowing of the intervertebral disc space between them. It is particularly well observed when examining their back from a side, which allows us to see the retracted vertebrae that caused the collapse of the dorsal portion and its derived kyphosis. Unfortunately, the silty soil prevented the recovery of the skeleton, so we were not able to send the bones to the laboratory to bring them under fur-

ther analysis. It was impossible, under our circumstances, to consolidate the bones before their extraction. Nevertheless, a correct archaeological methodology in the field has provided us with a tool to recover an individual whose disease caused his death.

The photograph of the skeleton during excavation works reveals an anomaly in the spine, where the length of the trunk appears very small in proportion to the extremities (Fig. 4). We could appreciate in situ a slight deformation on some of their sheets suggesting their potential remodelling as a means of compensation, a biomechanics reaction to the kyphosis. This condition establishes another evidence leading us now to consider vertebral TB.

Other conditions

In addition, the presence of Enamel hypoplasia (EH) both in the near third of the crown of teeth 11–12 and 21–23,

indicate moments of acute disease in different moments near childhood and, consequently, prior to the death of T-05. Besides EH, there are not other visible lesions in the post-axial skeleton to consider.

Final remarks

The individual T-05 from the Roman Circus cemetery consists of a young male, aged 20–24. In our view, T-05 presents bone reactions that are compatible with a TB origin. In any case, the study would need the results of the DNA analysis of *Mycobacterium tuberculosis*, which could confirm the aetiology of the disease.

The disease is common in areas of poor general health and in poor and malnourished overcrowded societies. It is normally spread via respiratory (due to unhealthy conditions of habitability) or digestive infection (owing the intake of milk and derived from infected animals). In our case, we cannot confirm the presence of overcrowding, yet it was the enteral infection the most common in the Middle Ages.

The injuries suggest possible breathing difficulties as well as other nuisances arising from the same. We can imagine that this condition meant that tasks such as their own hygiene, food and work or even daily activities must have been a great difficulty for him. We can also imagine that he needed the care and attention they might receive from the group or family. This condition leads us to think of the importance of care and palliatives, and in the end, the probable social solidarity within the group until the death of T-05.

Thanks to this study, we know a little more about one individual who lived in the emergence of what centuries later would be known as the Toledo of the three cultures. His death has helped us to know better the circumstances in which his life came and wonder how support and compassion from their close relatives and the rest of the community might have responded.

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