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San Martino di Lundo (Trento) Grave 1. Case study of an individual introducing possibilities markers of horse riding

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Abstract. It is here presented the case of a male adult skeletal individual of around 30-35 years of age, who was buried between the 5th and 6th century A.D. in the oratory of Monte San Martino (Trento). The markers of habitual and occupational stress have been confronted with those related to the so called "knight syndrome". This analysis includes also the study of the deficiency and paleopathological conditions of the individual, in order to define if the entire biological profile of the subject could be compatible with repeated horse riding activity.

Key words: Trentino, anthropology, paleopathology, knight syndrome

Introduction

The fortified site of Monte San Martino (1) is located in the Western part of Trentino, in Lomaso, a district of the municipality of Comano Terme (Trento). The site is built on the top of a huge outcrop of rock, at 985 meters above sea level and rises to 200 meters above the valley floor. From 2000 to 2015, the summit of the mount was interested by eleven excavations, which found out the remains of a fortified settlement and an oratory close to the perimeter of the walls (Archaeological intervention and excavations are under the direction of Cavada E (Provincia Autonoma di Trento, Soprintendenza per i Beni Culturali, Ufficio Beni Archeologici). Since 2008 a Memorandum of Understanding has been signed with the Kommission zur Vergleichenden Archäologie Römischer Alpen-und Donauländer della Bayerische Akademie der Vissenschaften of Monaco). In the Middle Ages, this oratory function was a church for pilgrims passing through the site.

The site is surrounded by a continuous wall, that structurally suggests a significant construction effort. It has been proposed to identify the site of San Martino with the *castrum Ennemase* (2) mentioned by Paolo Diacono. Nevertheless, this interpretation is not unanimously accepted by the scientific community (3).

This study is part of the writer's master's thesis: "Ritualità funeraria ed evidenze antropologiche nel Sommolago fra V e VII secolo d.C. I casi studio di San Martino di Lundo, San Cassiano e Ippolito a Riva del Garda e di San Giovanni al Monte ad Arco", supervisor Possenti E, Dipartimento di Lettere e Filosofia, Università degli Studi di Trento, a.a. 2016/2017. The osteological materials are part of the agreement reched between the Soprintendenza dei Beni Culturali di Trento and the Università degli Studi di Trento, stipulated during Pangrazzi C PhD's. The new analysis of the osteological material has been realized in the B. Bagolini laboratory in the Dipartimento di Lettere e Filosofia dell'Università di Trento.

The oratory of San Martino (4), which was built with local materials on a stone flat space, presents a main structure and a lateral one. The latter consists of an open space, which was probably uncovered, surrounded by walls (Fig. 1). The main structure measures 16,7x7,5 meters and is divided into two different spaces. The first one measures 30 m^2 and the second one 60 m^2. The biggest space is delimited, on its eastern side, by a semicircular apse, which is 6 meters large and 3,7

meters depth. There have been found few remains of the ground floor, which in this period, at least in the biggest space, was probably covered by a red limestone.

The primary burials in the oratory are seven (Fig. 1): three infants whose sex has not been estimated (grave 7, grave 2 and grave 3), two adult males (grave 1 and grave 4) and two mature adults (grave 5 and grave 6). Four tombs were found in the biggest space, two in the smallest one and one *suggrundaria* close to the northern side of the apsidal extrados. Moreover the bones of other three subjects, which were found in the fill of grave 4 and grave 5. These remains belong at least to one adult and two infants. These last two were found in grave 4. The subjects in grave 1 and grave 2 (Fig. 2), located in front of the apse, could be related to the construction of the building. The choice of a privileged area for their burials may be a signal of their relevant status. The subjects were buried in different kinds of graves. The individuals of the grave 1 and of the grave 2 were buried in coffins of wood.

The body found in grave 1 is lying down on his back with the skull in right *norma lateralis*, at a height higher than the post cranial bones. His arms are flexed, with the hands on the pelvis, while his legs are stretched and parallel.

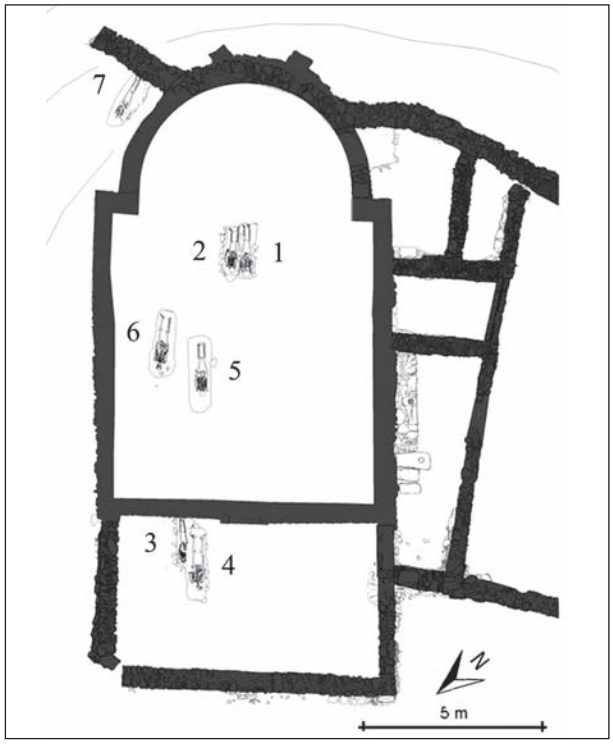

Figure 1. Map of the oratory and position of the burials (5)

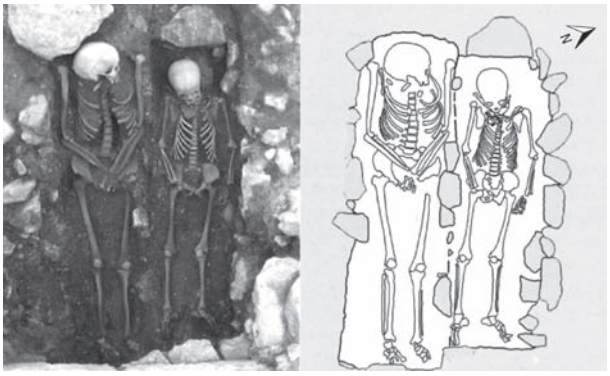

Figure 2. Photography and planimetry of hte Grave 1 (on the left) grave 2 (on the right)

The first part of this work aims at analysing the deficiency, occupational and paleopathological conditions of the subject in grave 1, while the second part of the study focuses on the so called "knight syndrome", in order to verify with the help of anthropological analysis the peculiar condition of the individual within the site of Monte San Martino.

Materials and methods

The subject of grave 1 is in a good state of preservation, maintains an excellent consistency of the bone tissue, has a high completeness and presents a low fragmentation index. All these characteristics permitted an optimal overall study (Fig. 3).

Skeletal sex was assessed by the morphological characters of the skull (5, 6) and by the morphology (7) and measures (8) of the *os coxae*. The skeletal age at death was obtained by the analysis of synostosis of cranial sutures (9), eruption and development of the tooth (10), degenerative phase of the fourth rib (11, 12, 13), evaluation of degeneration of auricular surface (14) and pubic symphysis (15). The measurements of long bones allowed to calculate the individual's height (16) and some anthropometric indexes specifically targeted for this study. Subsequently, it was evaluated the traumatic evidences (17) and the degree of expression of *cribra orbitalia* (18) of *cribra cranii* (19) of *cribra palatina* and periostitis (20). The analysis of

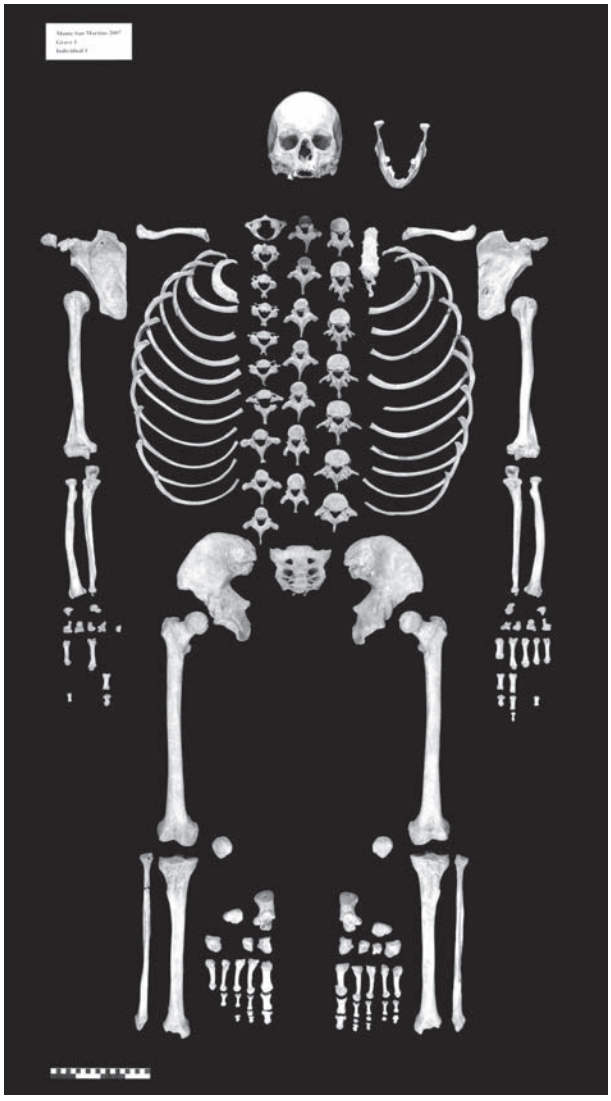

Figure 3. Subject of grave 1. Photograph: Paolo Chistè, Dipartimento di Lettere e Filosofia, Università degli Studi di Trento

the individual continued with the evaluation of skeletal muscle markers (21, 22, 23) related to the most important movements of the locomotor system and with the assessment of osteoarthritis (24). The analysis of occupational stress and skeletal muscle markers was combined with the study of the traits of the so called "knight syndrome (25).

The term "knight syndrome" refers to a series of bony changes which, if detected simultaneously, may indicate that the individual did horse riding during his life. In this context, the term "knight" does not refer to a social status but only to the relationship of the subject with this practice. The first studies that have considered these aspects were carried out on individuals from populations traditionally devoted to horse riding, which rode horses regularly and for a long time. The first studies on this subject were the ones of Pálfi (26) (on Hungarian horse archers) and Miller (27) (on Omaha and Ponca tribes of North America). For many authors (28, 29, 30, 31) the most important feature in the analysis of the rider is the development of the markers, and generally of the *linea aspera*, of the femur. Some authors (32) focused in particular on the acetabular region, which over the years has been reconsidered as one of the most important areas to determine if one individual has been horse riding. These authors demonstrated that the ovalization of the acetabular region, together with the modification of its superior border, may indicate a subject devoted to horse riding. In addition, according to other authors (25), an individual who has been familiarity with this activity can be identified by looking at his adductors, which are the most involved muscles in this practice, and, in particular, at their expression at the level of the ischio-pubic branch.

These studies present two shortcomings. On the one hand, they are not able to define the time necessary to develop the markers linked to horse riding. On the other hand, the skeletal muscle and occupational markers taken into account are not uniquely related to this practice.

Finally, age is a very important factor in the development of bone modifications. In this regard, it is often complex to evaluate mature and senile subjects, due to the changes that the skeleton undergoes during the process of senescence (30).

Results

The subject of grave 1 of the oratory of San Martino presents skeletal male sex and skeletal age at death of about 30-35 years and is approximately 172 cm tall. The ^{14}C analysis of a sample bone of the individual, which was recalibrated for the present study (Fig. 4), allowed setting his calendrical age (1560±30) in a chronological interval. This interval covers one of the following periods; from 429 to 493 A.D. or from 510 to 518 A.D., or from 528 to 541 A.D., with a confi-

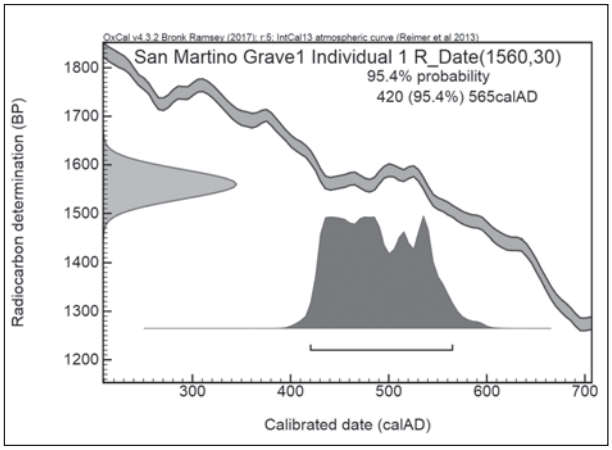

Figure 4. Calibration of a radiocarbon age (y-axis) to a radiocarbon date (x-axis). The date was calibrated using the OxCal v4.3.2 program

dence limit of 68.3%, equal to 1σ. The time interval identified by taking into consideration 2σ goes from 421 to 563 A.D. (33).

The individual reports a single trauma, i.e. a fracture at the level of the twelfth left rib. This is well repaired by a thick bone callus, which indicates that the traumatic event occurred well before the death of the individual. There is no evidence of *cribra orbitalia*, while it can be detected first degree *cribra cranii* and *palatina*. The expression of periostitis shows second degree on the lateral side of the proximal third of both femurs and on the right fibula. In the remaining long bones of the lower limbs, it can be noticed a spread periostitis of first degree. The development of skeletal muscle markers shows severe expressions with regard to the movements of the head and shoulders. Upper and lower limbs do not show the same level of expression. Furthermore, there is no evidence of a preferential use of the right or the left side of the body (Tab. 1).

The subject shows an average pilastric index in both femurs [R=108, 1; L=107, 45]. The right femur is platimeric [78, 83], while the left one is iperplatimeric [73, 58]. The robustness of the femurs [R=12, 65; L=12, 89], as well as those of the tibias [R=21, 32; L=21, 55], amounts on average values.

Osteoarthritis is mild in the upper extremities, while the lower portion of the skeleton is interested by stronger evidences. The vertebral column has been placed in anatomic order to evaluate its curvatures. The arthritic degeneration of each intradiscal and articular surface of each vertebra was evaluated. These values have been translated graphically in order to highlight the situation of the column in the saggital and the coronal planes (Fig. 5).

A facet joint with the atlas can be noticed on the basilar part of the occipital bone. Moreover, the atlas shows an impression on the right anterior arch (Fig. 5). This evidence, which is placed in the insertion areas of the lateral rectus muscle of the head, may be the first step toward an atlanto-occipital assimilation developed at the point where atlas and occipital bone touch each other during the flexion of the neck (34). Literature is divided between a congenital malformation (35, 36) and the effect of a stress (37). This evidence is accompanied by the posterior arch cleft (Fig. 5). This characteristic can be probably explained by a congenital anomaly (35, 38) often accompanied, as in this case, by the bifid spinous process of the axis (39) (Fig. 6). It is possible to propose a relationship between the cleft of

Table 1. Analysed movements and relative values. Right and left side of the body

Movement	R	L
Head – flexion, lateral tilt, rotation	2,2	1,7
Head – extension	2,6	2
Shoulder – lifting, lowering	2,1	2
Arm – adduction, abduction	0,8	0,8
Arm – extension, flexion	1,6	1,6
Forearm – extension, flexion	1	1
Forearm – rotation	1,5	1,5
Thigh – internal and external rotation, extension, flexion, adduction, abduction	1,3	1,4
Leg – extension, flexion	1,8	1,8
Foot - extension	1,4	1,5

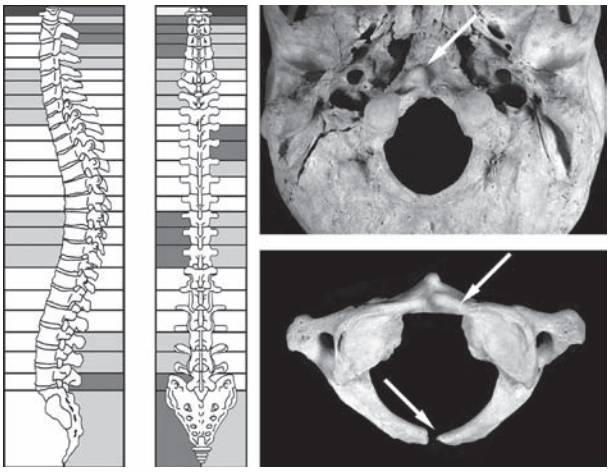

Figure 5. Graphic representation of the degeneration of the vertebral column. darker grey represents the most degerated areas (on the left). Facet joint with the atlas on the occipital bone (in the top right corner). Impression on the right anterior arch and posterior arch cleft of the atlas (in the bottom right corner)

C1 and the unilateral compression of the left articular facets of C2, C3, C4, C5 due to stress during flexion and rotation of the neck joined to the vertical pressure (37). The thoracic portion exhibits a unilateral compression on the right side of articular facets of T4, T5, T6 and on the left side of T9, T10, T11. The lumbar portion, as regards L3, L4, L5 shows a compression of bodies in the postero-anterior sense, especially for L5. The L5 inferior left articular facet is widely expanded, as well as the left articular facet of S1. It has also been detected an incomplete spina bifida at level of S5 and S4 (35-46) (Fig. 6). The subject shows several traits that can be related to congenital malformations, like spina bifida occulta, cleft C1 and the bifid spinous process of the axis, while less clear is the evaluation of the possible beginning of atlanto-occipital assimilation. The cervical spine is compromised by a stress which originates in the neck flexion movement, concentrated on the left side portion in opposition to the articular facets between the atlas and occipital.

The values of the enthesopathy show how in the subject of grave 1 the insertions related to horse riding are almost always present and particularly appreciable in many cases. The skeleton does not show any evidence of a preferential use of the right side than the left one (Tab. 2).

Figure 6. Bifid spinous process of the axis (on top). Incomplete spina bifida at level of S5 and S4 (below)

As previously noted, the condition of the vertebral column is very compromised, also due to the age of the individual, especially in the cervical and thoracic traits. The lumbar portion shows clear signs of lumbar hyperlordosis (Fig. 7). The study of articular changes showed a strong arthritic degeneration at the level of the distal articular surface of the first right metatarsal (Fig. 7). Moreover, the ovalization of both the acetabulum has also been detected (Fig. 8). This condition is accompanied in both cases by an arthritic degeneration of the upper part of the acetabular surface (Fig. 8). The acetabulum osteoarthritis is evident at the level of the inferior articular surface, where it developed a particularly strong marginal lipping (Fig. 8). An arthritic situation was also detected at the level of both foveas. Both femoral necks are affected by a clear iliac impression that degenerates into a cribrotic area in the right bone.

Table 2. Analysed bone insertions and relative values. Right and left side of the body

Bone and insertion	R	L	
Os Coxae			
Biceps femoris	2	2	
Semitendinosus	1	1	
Semimembranosus	0	0	
Adductor magnus	1	1	
Gluteus maximus	3	3	
Gluteus medius	2	2	
Gluteus minimus	2	2	
Femur			
Linea aspera	1	1	
Adductor magnus	1	1	
Adductor longus	1	1	
Adductor brevis	1	1	
Lateral gastrocnemius		2	2
Medial gastrocnemius		3	3
Iliopsoas 2	2		
Pectineus 1	1		
Gluteus maximus	2	2	
Gluteus medius	1	2	
Gluteus minimus	1	2	
Obturator externus	1	1	
Patella			
Quadriceps femoris	1	1	
Calcaneus			
Triceps surae	3	/	

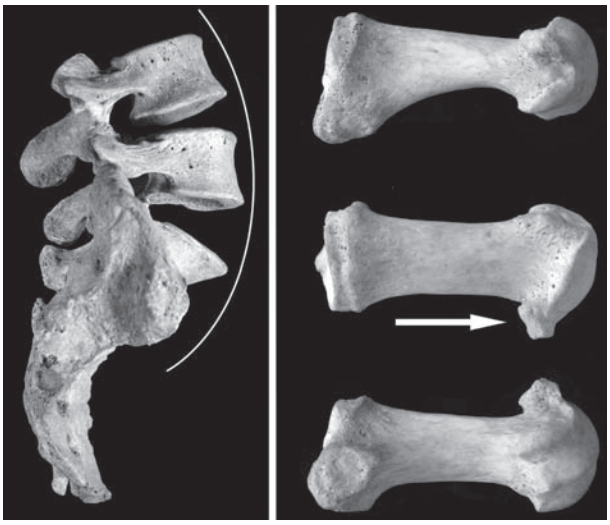

Figure 7. Lumbar hyperlordosis of the lumbar trait (on the left) Arthrosic degeneration of the first right metatarsal (on the right)

Conclusions

Considering his age, the subject of grave 1 presents very compromised cervical and thoracic traits. Although the cervical vertebrae do not show evidence of herniation, melting, crushing or compressions, they are seriously degenerated. Many hernias and crushing

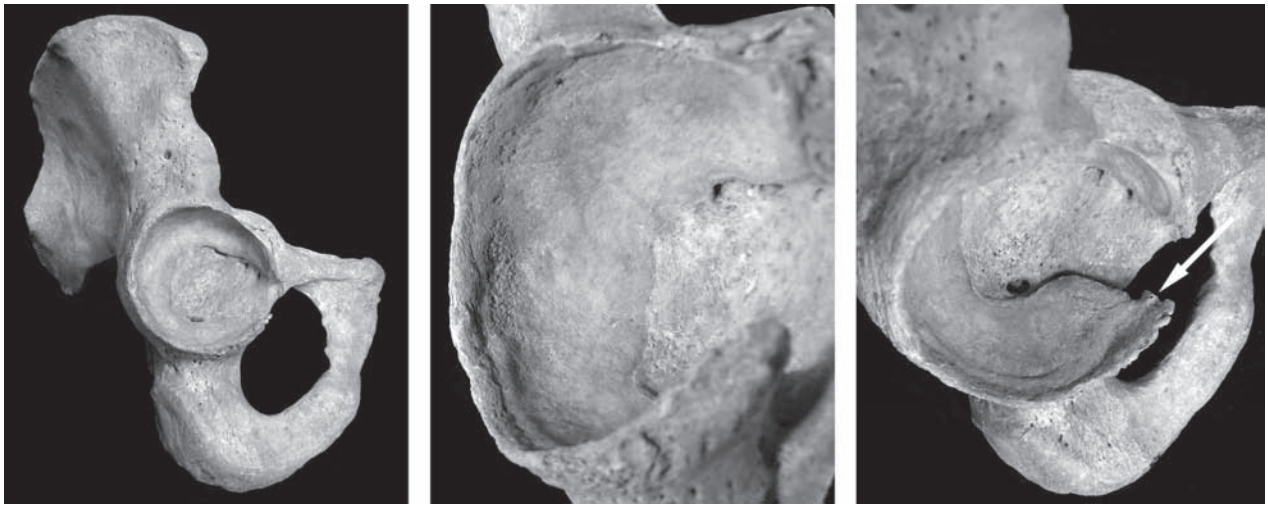

Figure 8. Ovalization of the right acetabulum (on the left). Arthrosis of the right acetabular surface (in the middle). Marginal lipping of the right acetabulum (on the right)

vertebrae can be noticed on the thoracic trait. Hyperlordosis is present in the lumbar trait. In this regard, the absence of osteoarthritis may suggest a postural etiology. This severe degenerative situation, which is mainly localized in the cervical and thoracic spine, does not seem to be due to a generalized arthritic condition of the skeleton, also because the places where arthritis occurs are few and well concentrated in certain districts. In particular, the upper limbs are not affected by this condition. The analysis of skeletal muscle markers allows to highlight an intense use of the muscles linked to the head and the shoulders. The same cannot be said for the muscles of the arms. The lower limbs are characterized by a marked use, especially with reference to the relative values of extension and flexion of the legs and of extension of the feet. The femurs meric index indicates a strong bio-mechanical stress of the upper portion of the legs. The situation detected with the help of the skeletal muscle markers is also confirmed by the analysis of periostitis. It can be affirmed that the subject does not show a severe pathological or deficiency situation.

The analysis of the "traits of the knight" has shown that the related enthesopathies are present in a consistent way and has allowed to identify almost all articular modifications related to horse riding. In the absence of particular arthrosis and pathological conditions, the individual shows an abnormal degeneration of the column, connected to a postural anomaly and to a particularly significant use of the lower limbs. All these elements, combined with the identification of the traits of the "knight syndrome", could support the hypothesis that the subject did repeated riding activities.

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