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## News and Views

## Probable carpometacarpal and tarsal coalition from Baouso da Torre Cave (Italy): Implications for burial selection during the Gravettian

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## Introduction

In the past, authors have recognised selective funerary practices during the Upper Palaeolithic according to sex, age-at-death, social status, pathological conditions, or possible family ties (e.g., Formicola, 1988, 2007; Mussi et al., 1989; Alt et al., 1997; Oliva, 2000; Henry-Gambier, 2001, 2008; Pettitt, 2006). In this short communication, we report three pathological conditions, which may be genetic in origin, observed in two Gravettian skeletons from the same cave, Baouso da Torre, in Italy. This discovery once again raises the issue of the nature of relationships among Upper Palaeolithic burials.

## Materials

Baouso da Torre is one of the caves of the Balzi Rossi, a major Italian Palaeolithic locality on the Mediterranean coast. In 1873, Rivière found three single burials in this cave (Rivière, 1887). Two of these skeletons were subsequently lost and re-discovered in 2008, more than 80 years later (Villotte and Henry-Gambier, 2010). The collagen content from BT1 and BT3, as well as for BT2 (curated in the Musée d'Archéologie Nationale, Paris), was too low to obtain

reliable radiocarbon dates, but the archaeological context indicates that an Upper Palaeolithic date is assured and a Gravettian date (28–22 ka) for these skeletons is likely (Mussi, 1986, 2001; Henry-Gambier, 2001; Villotte and Henry-Gambier, 2010). The preservation of the osseous remains of BT1, BT2, and BT3 is relatively good, but numerous bones are missing (Table 1). Sex and age-at-death of these three individuals were recently reassessed (Villotte and Henry-Gambier, 2010; Villotte et al., in press). BT1 and BT2 are both males; BT1 is a young or mature individual (20–49 years old) and BT2 is a young adult (20–29 years old). BT3 is an unsexed adolescent. These new assessments confirm previously published estimations of sex (Rivière, 1887; Verneau, 1906) and detail the age-at-death of the adults.

## Results

Pathological changes in the hind foot and wrist were noted. The anterior process of the left calcaneus of BT1 is abnormally elongated (Figs. 1 and 2) with a maximum height of 11.5 mm, a maximum breadth of 15 mm, and a maximum length of 8.5 mm (measured from the anterior articular surface for the cuboid bone). The anterior margin of this elongation is broken. In a normal calcaneus there is no finger-like protuberance here. The protuberance is oriented towards where the navicular bone would have been during life, although this bone has not survived. This individual also displays abnormal bossing of the dorsal part of the base of the right second metacarpal (Fig. 3). Pitting is present on the proximal face of this bossing. Unfortunately, the right calcaneus and the left second metacarpal, as well as the navicular and trapezoid of both sides, are missing. The feet and right hand of BT2 were not preserved, but the left hand is present. A carpal boss, formed by an abnormal dorsal bossing of the left trapezoid and the base of the left second metacarpal was also found in this individual (Fig. 3). Pitting, filled by sediment, is present on the proximal face of the bossing of the metacarpal base. The feet of BT3 are not pathological, but the hand bones are not preserved.

## Discussion

Osseous modifications like those seen in BT1 and BT2 have previously been related to tarsal (e.g., Leonard, 1974; Fopma and

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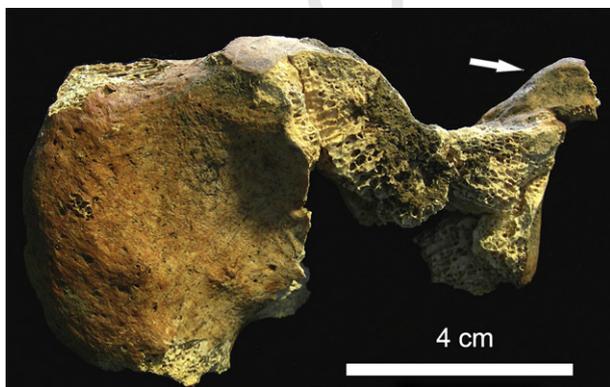
**Table 1**  
Inventory and state of preservation of the skeletal remains.

Specimen	Skeletal elements present and state of preservation
BT1	Neurocranium (ff), face (ff), thoracic vertebrae (1f), ribs (ff), scapulae (-/ff), humeri (f/d), radii (f/-), carpals (3i/-), metacarpals (3i-f/1f), phalanges (9i-d/2d), coxal bones (ff/-), femora (f/d), patellae (i/-), tibiae (d/f), calcanei (-/f), other tarsals (2i/1i), metatarsals (3i-d/3i-f), phalanges (2i/2i).
BT2	Neurocranium (f), face (ff), mandible (f), cervical vertebrae (2d), ribs (ff), scapulae (f/f), clavicles (i/f), humeri (i/d), radii (f/i), ulnae (f/i), carpals (-/7i-f), metacarpals (-/5i-d), phalanges (5i/9i), coxal bones (-/d), femora (d/d), tibiae (d/f), fibulae (f/-), tali (i/-), phalanges (1i/-).
BT3	Neurocranium (ff), face (ff), sacrum (ff), humeri (d/-), ulnae (f/-), coxal bones (-/ff), femora (f/d), patellae (-/i), tibiae (-/ff), tali (f/i), calcanei (d/f), other tarsals (1f/4i-d), metatarsals (2d-f/3i-f), phalanges (3i/5i-f).

The state of preservation of the remains is reported separately for bones from the right and the left sides, respectively. -: missing, i: intact; d: damaged; f: fragmented; ff: very fragmented (according to Alciati et al., 2005).

Macnicol, 2002) and carpometacarpal (Nakamura et al., 2001; Alemohammad et al., 2009) coalition. Coalition in the foot or wrist can be due to bone, cartilage, or fibrous tissue connecting two bones that would normally not be connected. Of the three, osseous coalition will be most easily seen in archaeological specimens, as the bony bar itself will be preserved. Cartilaginous and fibrous coalitions can be identified by changes to the shape of the surfaces, often associated with pitting, in the classic locations where coalitions tend to occur (Case and Burnett, in press).

Reported cases of calcaneonavicular coalition in archaeological material are mainly of the non-osseous type (Case and Burnett, in press). In these cases, the anterior border of affected calcanei is usually sharply angled and irregular, and some bones exhibit a finger-like protuberance at the lateral part of the lesion. This lateral tubular elongation of the anterior process of the calcaneus is called the “anteater nose sign” in radiology, and it is seen in patients with osseous or non-osseous calcaneonavicular coalition (Fopma and Macnicol, 2002; Chapman, 2007). The anterior border of the left calcaneus of BT1 does not display any irregularity except the tubular projection. Based on the size of the protuberance, and by analogy with observations from living patients and cadavers (Leonard, 1974: Figure 5; Fopma and Macnicol, 2002: Figure 4; Solomon et al., 2003: Figure 3; Lysack and Fenton, 2004: Figures 2–4), a diagnosis of a bony calcaneonavicular coalition for BT1 is most likely. Calcaneonavicular coalition is considered an uncommon condition today (Fopma and Macnicol, 2002), but



**Figure 1.** Medial view of the left calcaneus of BT1. The arrow indicates the bony projection (“anteater nose sign”) from the calcaneus to the navicular (which has not survived).



**Figure 2.** Plantar view of the left calcaneus of BT1. Close-up of the anterior part of the bone showing the anterior articular surface (bottom of image) and the bony projection.

recent studies on skeletons (Case and Burnett, in press), cadavers (Solomon et al., 2003), and patients with foot pain (Lysack and Fenton, 2004; Nalaboff and Schweitzer, 2008) indicate prevalence rates between 1 and 9%. Calcaneonavicular coalition leads to a stiff flat foot that, in some individuals, is also painful. It arises as a congenital failure of segmentation of the primitive mesenchyme or, more rarely, as an acquired trait (Fopma and Macnicol, 2002). A secondary synostosis due to trauma, inflammatory arthropathy, neoplasm, or osteonecrosis is unlikely in the case of BT1 due to the lack of any other pathological change in the bones and joints. Thus, a diagnosis of a congenital calcaneonavicular coalition can be posited.

Patients with a symptomatic carpal boss complain of pain in the affected hand (Alemohammad et al., 2009). Degenerative osteophyte formation, trauma, microtrauma, and persisting os styloideum among the suspected causes of the condition (Carter, 1941; Curtiss, 1961; Artz and Posch, 1973; Conway et al., 1985; Maquirriain and Ghisi, 2006). Recently, an 18% incidence of a carpal boss associated with a partial carpometacarpal coalition of the second ray was found in a general cadaver population, and it was suggested that the carpal boss could be an incomplete (fibrous or fibrocartilaginous) congenital coalition (Nakamura et al., 2001; Alemohammad et al., 2009). Although a bony protuberance located at the dorsum of the wrist can have different causes, the discovery of both a congenital calcaneonavicular coalition and a carpal boss in the same individual, as well as two individuals with a carpal boss in the same cave, support the hypothesis of a congenital partial carpometacarpal coalition for BT1 and BT2. The presence of pitting of the dorsal part of both bosses further reinforces this diagnosis. Another hypothesis is that the dorsal bossing represents a normal morphological variant of the second metacarpal during the Upper Palaeolithic. This seems less probable as this morphology has not been described previously for this time period.

Congenital calcaneonavicular coalition is thought to be an unifactorial disorder of autosomal dominant inheritance (Wray and Herndon, 1963; Leonard, 1974; Fopma and Macnicol, 2002). This report of the oldest known case to date – the previous one was dated to the Late Neolithic (Silva, 2005) – indicates that similar genetic mutations were present in the Upper Palaeolithic gene pool. However, neither carpal nor carpometacarpal anomalies were recognised in modern patients with tarsal coalition, except in such conditions as symphalangism, phocomelia, or hemimelia (Leonard, 1974). These conditions are not present in the Baouso da Torre remains. Therefore, the mutation that produced segmentation



**Figure 3.** Upper images: Bases of three 2nd metacarpals. From left to right: BT1's right 2nd metacarpal shows dorsal bossing and pitting filled by sediment, and a normal right bone, for comparison, showing no dorsal bossing or pitting. Lower image: lateral view of 2nd metacarpal articulation with the trapezoid of BT2, showing a carpal boss. Scale markers indicate 1 cm.

defects for BT1 and BT2 could be different to the mutation present in the current gene pool. In this case, a gene with reduced penetrance is more likely because these conditions have not been observed in other near-contemporary Upper Palaeolithic burials.

The hypothesis of close familial relationships among the buried dead during the Gravettian was previously formulated by Formicola (1988) for the triple burial of Barma Grande (near Baoussou da Torre Cave) and by Alt et al. (1997) for the triple burial of Dolní Věstonice, based on phenotypic similarities among individuals buried together. The presence of similar congenital disorders shared by two skeletons in Baoussou da Torre Cave adds further support for this hypothesis. However, because these skeletons were found in separate burials and the time span between the two deaths is unknown (although the two burials are very close to one another and in the same archaeological layer), conclusions regarding the degree of relationship between BT1 and BT2 remain speculative.

### Conclusions

Three pathological changes, perhaps due to an underlying genetic aetiology, were discovered in two skeletons from Baoussou da Torre Cave (BT1 and BT2). This discovery suggests that these two adult males may have been genetically related, and strengthens the hypothesis of familial relationships among people buried together, or near to each other, during the Gravettian. It also highlights a potential 25,000-year-old genetic mutation that appears to have been present in prehistoric humans in Italy, but with a phenotype unknown in modern clinical studies. Such discoveries are clearly of considerable significance to our understanding of population biology during the course of human evolution and, potentially, as an aid to understanding the occurrence of these conditions today.

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### References

- Alciati, G., Delfino, V.P., Vacca, E. (Eds.), 2005. Catalogue of Italian Fossil Human Remains from the Palaeolithic to the Mesolithic. Istituto Italiano di Antropologia and Casa Editrice Università La Sapienza, Roma.
- Alemohammad, A.M., Nakamura, K., El-Sheneway, M., Viegas, S.F., 2009. Incidence of carpal boss and osseous coalition: an anatomic study. *J. Hand Surg.* 34, 1–6.
- Alt, K.W., Pichler, S., Vach, W., Klíma, B., Vlček, E., Sedlmeier, J., 1997. Twenty-five thousand-year-old triple burial from Dolní Věstonice: an ice-age family? *Am. J. Phys. Anthropol.* 102, 123–131.
- Artz, T.D., Posch, J.L., 1973. The carpometacarpal boss. *J. Bone Joint Surg. Am.* 55, 747–752.
- Carter, R.M., 1941. Carpal boss: a commonly overlooked deformity of the carpus. *J. Bone Joint Surg. Am.* 23, 935–940.
- Case, D.T., Burnett, S.E., Identification of tarsal coalition and frequency estimates from skeletal samples. *Int. J. Osteoarchaeology*, in press. doi:10.1002/oa.1228
- Chapman, V.M., 2007. The anteater nose sign. *Radiology* 245, 604–605.
- Conway, W.F., Destouet, J.M., Gilula, L.A., Bellinghausen, H.W., Weeks, P.M., 1985. The carpal boss: an overview of radiographic evaluation. *Radiology* 156, 29–31.
- Curtiss, P.H., 1961. The hunchback carpal bone. *J. Bone Joint Surg. Am.* 43, 392–394.
- Fopma, E., Macnicol, M.F., 2002. Tarsal coalition. *Curr. Orthop.* 16, 65–73.
- Formicola, V., 1988. The triplex burial of Barma Grande (Grimaldi, Italy). *Homo* 39, 130–143.
- Formicola, V., 2007. From the Sungir children to the Romito dwarf: aspects of the Upper Paleolithic funerary landscape. *Curr. Anthropol.* 48, 446–453.
- Henry-Gambier, D., 2001. La sépulture des enfants de Grimaldi (Baoussé-Roussé, Italie). *Anthropologie et paléontologie funéraire des populations de la fin du Paléolithique supérieur.* CTHS/RMN, Paris.
- Henry-Gambier, D., 2008. Comportement des populations d'Europe au Gravettien: pratiques funéraires et interprétations. *Paléo* 20, 399–438.
- Leonard, M.A., 1974. The inheritance of tarsal coalition and its relationship to spastic flat foot. *J. Bone Joint Surg. Br.* 56, 520–526.
- Lysack, J.T., Fenton, P.V., 2004. Variations in calcaneonavicular morphology demonstrated with radiography. *Radiology* 230, 493–497.
- Maquirriain, J., Ghisi, J.P., 2006. Acute os styloideum injury in an elite athlete. *Skeletal Radiol.* 35, 394–396.
- Mussi, M., 1986. On the chronology of the burials found in the Grimaldi Caves. *Antropol. Contemp.* 9, 95–104.
- Mussi, M., 2001. Earliest Italy: An Overview of the Italian Paleolithic and Mesolithic. Kluwer Academic/Plenum Publishers, New York.
- Mussi, M., Frayer, D.W., Macchiarelli, R., 1989. Les vivants et les morts. Les sépultures du Paléolithique supérieur en Italie et leur interprétation. In:

- Hershkovitz, I. (Ed.), *People and Culture in Change*. BAR Intl. Series 508, Oxford, pp. 435–458.
- Nakamura, K., Patterson, R.M., Viegas, S.F., 2001. The ligament and skeletal anatomy of the second through fifth carpometacarpal joints and adjacent structures. *J. Hand Surg.* 34, 1016–1029.
- Nalaboff, K.M., Schweitzer, M.E., 2008. MRI of tarsal coalition: frequency, distribution, and innovative signs. *Bull. NYU Hosp. Jt. Dis.* 66, 14–21.
- Oliva, M., 2000. The Brno II Upper Palaeolithic burial. In: Roebroeks, W., Mussi, M., Svoboda, J., Fennema, K. (Eds.), *Hunters of the Golden Age*. Leiden University, Leiden, pp. 143–153.
- Pettitt, P., 2006. The living dead and the dead living: burials, figurines and social performance in the European Mid Upper Palaeolithic. In: Gowland, R., Knüsel, C.J. (Eds.), *Social Archaeology of Funerary Remains*. Oxbow Books, Oxford, pp. 292–308.
- Rivière, E., 1887. *Antiquité de l'homme dans les Alpes-Maritimes*. J.-B. Baillière, Paris.
- Silva, A.M., 2005. Non-osseous calcaneonavicular coalition in the Portuguese prehistoric population: report of two cases. *Int. J. Osteoarchaeology* 15, 449–453.
- Solomon, L.B., Rühli, F.J., Taylor, J., Ferris, L., Pope, R., Henneberg, M., 2003. A dissection and computer tomograph study of tarsal coalitions in 100 cadaver feet. *J. Orthop. Res.* 21, 352–358.
- Verneau, R., 1906. *Les grottes de Grimaldi (Baoussé-Roussé)*. Anthropologie, II-1. Imprimerie de Monaco, Monaco.
- Villotte, S., Henry-Gambier, D., 2010. The rediscovery of two Upper Palaeolithic skeletons from Baouso da Torre cave (Liguria-Italy). *Am. J. Phys. Anthropol.* 141, 3–6.
- Villotte, S., Brůžek, J., Henry-Gambier, D. **Caractéristiques biologiques des sujets adultes gravettiens: révision de l'âge au décès et du sexe.** In: Goutas, N., Guillermin, P., Klaric, L., Pesesse, D. (Eds.), *Identités Gravettiennes. Mém. Soc. Préhist. Française, in press.*
- Wray, J.B., Herndon, C.N., 1972. Hereditary transmission of congenital coalition of the calcaneus to the navicular. *J. Bone Joint Surg. Am.* 45, 365–372.

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