

ICNO-ARCHEOLOGY OF A HUMAN PALAEO-LITHIC ECOSYSTEM: THE HUMAN AND ANIMAL FOOTPRINTS IN THE GROTTA DELLA BASURA (TOIRANO, NORTHERN ITALY)

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Abstract: The footprints of human and animal trackmakers, which around 12,000 years B.P. attended the Cave of Bàsura (Toirano, Liguria, Northern Italy), were studied through morpho-classificatory and morphometric approaches. First results indicate at least three different human producers, two youths and the third of tender age, bears and wolves (or dogs). Analysis of the data demonstrate the power of 3D, of landmark based morphometrics and the utility to use the methods of forensic anthropology in the determination of human footprints. The analysis of the number of trackmakers using the PCA analysis on 'multi-trampling' surfaces could represent a model in the study of cave sites.

Key words: Ichnology, cave, upper Palaeolithic, human footprints, bear footprints

1. INTRODUCTION

The Cave of Bàsura (Grotta della Bàsura), opening at 186 m above sea level (a.s.l.) at the foot of Mount Carmo in Loano (Toirano, Savona), is known by the 1890, when Nicolò Morelli highlighted the occurrence of some evidence dating back to the Neolithic and late Roman period in the outermost portion of the cave. In 1950, the inner rooms of the cave were discovered. Soon after, the outstanding evidence of human frequentation, in addition to remains of *Ursus spelaeus*, were brought into the limelight of the Italian palaeontological and palaeoanthropological research by Virginia Chiappella (1952, 1955). In 2014, the "Soprintendenza Archeologia Belle Arti e Paesaggio per la Città Metropolitana di Genova e le province di Imperia, La Spezia e Savona - Genova", promoted and initiated a new multidisciplinary project on the cave. The project is aimed at better understanding and integration of many different data, also consisting of tracks and traces attributable to bears and canids tracks, as well as other traces of different human activities (e.g. footprints, carbons, digital tracks, lumps of clay adhering to the walls).

2. MATERIAL AND METHODS

The substrate of the cavity preserves in many sectors numerous traces with different degree of conserva-

tion. Most of them are concreted, differently others are imprinted on a still plastic substrate. Recent radiometric datings (2017) confirm the attendance of the cavity in the Upper Paleolithic at 14420 BP c.a.

In the innermost room (i.e. Sala dei Misteri) where the study was concluded (Citton et al., 2017) 54 track and traces were detected among which 35 human footprints and 6 bear footprints (Fig.1).

Numerous other traces are preserved in other portions of the cave and are currently under investigation using new cutting-edge methodology such as high resolution 3D modelling and morphometric analyses. The material under examination comprises a substantial number of human footprints referable to individuals of different gender and age classes, footprint referable to bears (very likely *Ursus arctos*) and footprints left by canids (wolves or dogs).

The main sectors of the cave were digitally acquired via laser scanner Leica Scanstation C10. The scans were performed at 360° (acquisition grid of the point cloud of 2x2 cm probe 7 m and of 0.5x0.5 cm probe 7 m). The recording shows a final alignment error of 2 mm. Schematic reliefs were derived from the model where the positions of each single studied footprints are showed.

All tracks recognized were analyzed in the field using a classical morphological approach. Each track was photographed and designed on site. The dimensional and morphological parameters collected in the field were



Fig. 1 - Human footprints, bear footprints and human traces preserved in the 'Sala dei Misteri' in the Grotta della Basura SM1, SM6, SM15 human footprints; SM12 adult bear footprint; SM41 immature bear footprint; SM44 human finger traces.

double-checked, using photos and photogrammetric models. The measurements of human footprints are based on both the landmark proposed by Robbins (1985), and on studies following the forensics medicine methods. For all the studied footprints, a photogrammetric model was obtained using photos taken with a 24 Megapixel Canon EOS 750D (18 mm focal length). The software used to build the models in this paper is Agisoft PhotoScan Pro, (www.agisoft.com), among the most user-friendly programs for photogrammetry' (Mallison and Wings, 2014). The accuracy of the obtained models is up to 1 mm for close-range photography (Fig. 2).

The 13 best-preserved human and animal (canids) footprints, were subject to a Principal Component Analysis (PCA). For the analysis, the software PAST 3.10 was used (Hammer et al., 2001). For the correspon-

dence of the log-transform to an isometric null hypothesis and to fit linear models the raw data were log-transformed (see Chinnery, 2004; Cheng et al., 2009; Romano and Citton, 2015, 2016).

3. RESULTS

To date, a first ichnological analysis focused on about thirty footprints of human producers, attending the innermost areas of the cave (Sala dei Misteri), was carried out. By adopting a morpho-classificatory and morphometric approach applied to the best-preserved footprints, an estimation of the minimum number of track-makers, as well as their age and height, was reached. The recognition of three well-separated morphotypes indicates a child under 5 years of age and two youth of

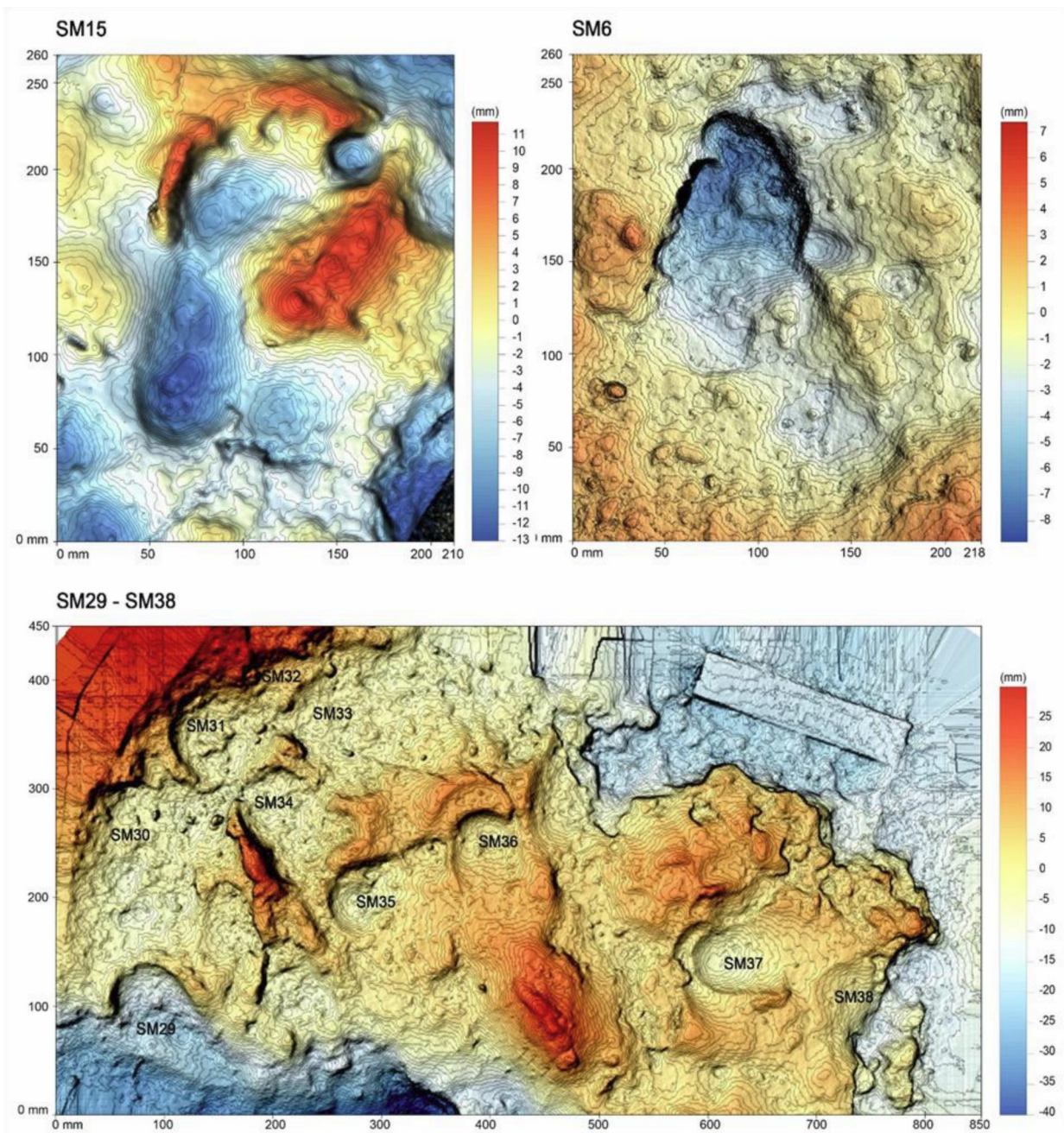


Fig. 2 - Three-dimensional, false coloured photogrammetric models of selected tracks from 'Sala dei Misteri in the Grotta della Basura. SM15) medium sized human footprint with well-developed concave plantar arch (Morphotype 3); SM6) medium sized human footprint impressed in thin moist clay (Morphotype 3); SM29-SM38) heel prints.

6-7 and 11-12 years of age, respectively, as track producers (Fig. 3).

The ongoing analysis of human footprints, preserved in other areas of the cave, confirms the presence of the subjects identified in the Sala dei Misteri to which other individuals should be added after the new multidisciplinary analysis still in progress.

The relationships between animal and human attendance of the hypogeal environment are currently being

defined, even if from a preliminary analysis it seems that the human traces are successive to those of bear and antecedent or contemporary to those left by canids.

4. DISCUSSION AND CONCLUSION

The work in progress in the Grotta della Basura confirms the great archaeological and palaeontological interest of this cavity within the European Upper Paleo-

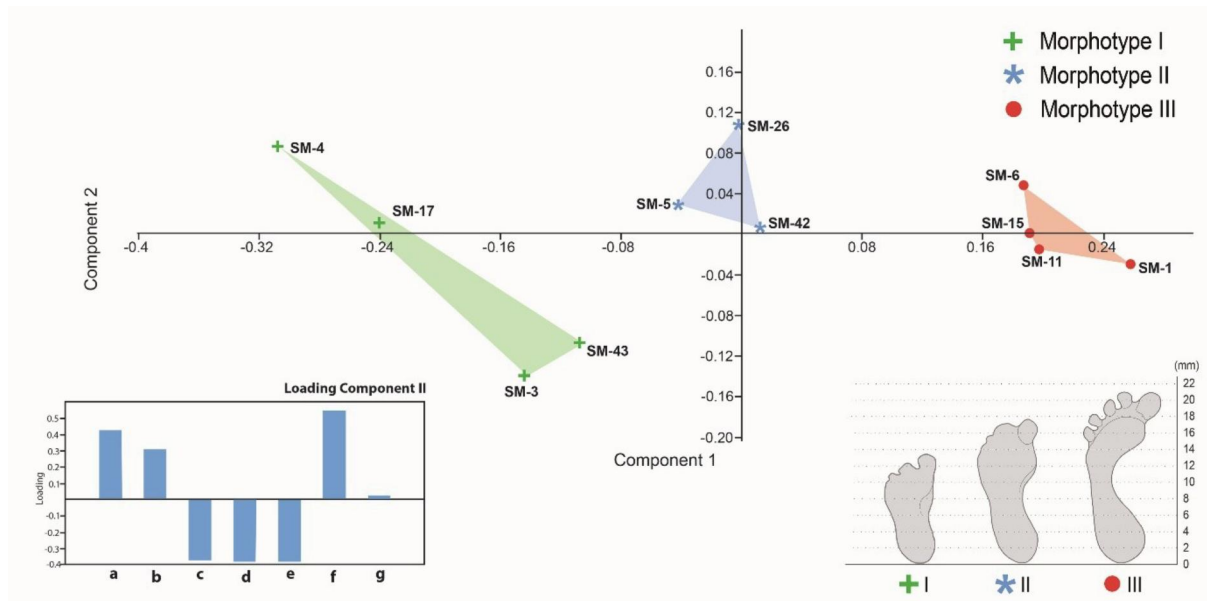


Fig. 3 - Principal Component Analysis based on the best-preserved footprints from 'Sala dei Misteri'. Scatter plot of principal components PC1-PC2 and loadings. In the inset the main morphotypes, to which footprints from 'Sala dei Misteri' have been referred, are shown: a child under 5 years of age (morphotype I) and two youths of 6-7 and 11-12 years of age (Morphotypes II and III respectively).

lithic panorama. The strongly conservative environment has led to the preservation, on the same level, of a complex ichnological framework whose spatial and temporal relationships will be clarified by ongoing research.

As already reported from different European caves, the currently obtained results enable to confirm that children, despite their apparent elusiveness in prehistoric archaeological contexts, were ubiquitous in daily life of the Pleistocene populations, constituting a significant demographic component of Upper Paleolithic communities (see Citton et al., 2017). The review of the complex ichnological record of the Grotta della Bàsura is currently underway and oriented at recognizing any relationships between the different producers that attended the cave, in order to gain a more complete frame of this ancient ecosystem.

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