

AperTO - Archivio Istituzionale Open Access dell'Università di Torino

**New human fossil from the latest Pleistocene levels of Grotta Romanelli (Apulia, southern Italy)**

**This is a pre print version of the following article:**

*Original Citation:*

*Availability:*

This version is available <http://hdl.handle.net/2318/1832348> since 2024-04-06T08:01:57Z

*Published version:*

DOI:10.1007/s12520-021-01491-1

*Terms of use:*

Open Access

Anyone can freely access the full text of works made available as "Open Access". Works made available under a Creative Commons license can be used according to the terms and conditions of said license. Use of all other works requires consent of the right holder (author or publisher) if not exempted from copyright protection by the applicable law.

(Article begins on next page)

# Metadata of the article that will be visualized in OnlineFirst

ArticleTitle	New human fossil from the latest Pleistocene levels of Grotta Romanelli (Apulia, southern Italy)	
Article Sub-Title		
Article CopyRight	The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature (This will be the copyright line in the final PDF)	
Journal Name	Archaeological and Anthropological Sciences	
Corresponding Author	FamilyName	<b>Iannucci</b>
	Particle	
	Given Name	<b>Alessio</b>
	Suffix	
	Division	Dipartimento di Scienze della Terra, Sapienza
	Organization	Università di Roma
	Address	Roma, 00185, Italia
	Phone	
	Fax	
	Email	alessio.iannucci@uniroma1.it
	URL	
	ORCID	<a href="http://orcid.org/0000-0002-4392-5690">http://orcid.org/0000-0002-4392-5690</a>
Author	FamilyName	<b>Mecozzi</b>
	Particle	
	Given Name	<b>Beniamino</b>
	Suffix	
	Division	Dipartimento di Scienze della Terra, Sapienza
	Organization	Università di Roma
	Address	Roma, 00185, Italia
	Phone	
	Fax	
	Email	
	URL	
	ORCID	<a href="http://orcid.org/0000-0002-7097-3217">http://orcid.org/0000-0002-7097-3217</a>
Author	FamilyName	<b>Buzi</b>
	Particle	
	Given Name	<b>Costantino</b>
	Suffix	
	Division	DFG Center for Advanced Studies “Words, Bones, Genes, Tools”
	Organization	Eberhard Karls Universität Tübingen
	Address	72070, Tübingen, Germany
	Phone	
	Fax	
	Email	
	URL	
	ORCID	<a href="http://orcid.org/0000-0001-8951-2990">http://orcid.org/0000-0001-8951-2990</a>
Author	FamilyName	<b>Micarelli</b>
	Particle	
	Given Name	<b>Ileana</b>
	Suffix	
	Division	Dipartimento di Biologia Ambientale, Sapienza
	Organization	Università di Roma

Address 00185, Rome, Italy  
Phone  
Fax  
Email  
URL  
ORCID <http://orcid.org/0000-0001-7498-5218>

---

Author  
FamilyName **Bona**  
Particle  
Given Name **Fabio**  
Suffix  
Division  
Organization Museo Civico dei Fossili di Besano  
Address Via Prestini 5, 21050, Besano, Italy  
Phone  
Fax  
Email  
URL  
ORCID <http://orcid.org/0000-0003-4994-7003>

---

Author  
FamilyName **Forti**  
Particle  
Given Name **Luca**  
Suffix  
Division Dipartimento Di Scienze Della Terra “Ardito Desio”  
Organization Università Degli Studi di Milano  
Address 20133, Milan, Italy  
Division  
Organization Consiglio Nazionale delle Ricerche Di Italia (CNR), Istituto di Geoscienze e Georisorse  
Address 56124, Pisa, Italy  
Phone  
Fax  
Email  
URL  
ORCID <http://orcid.org/0000-0002-5662-7756>

---

Author  
FamilyName **Lembo**  
Particle  
Given Name **Giuseppe**  
Suffix  
Division  
Organization Ministero dell’Istruzione  
Address 44121, Ferrara, Italy  
Phone  
Fax  
Email  
URL  
ORCID <http://orcid.org/0000-0001-9367-6509>

---

Author  
FamilyName **Manzi**  
Particle  
Given Name **Giorgio**  
Suffix  
Division Dipartimento di Biologia Ambientale, Sapienza  
Organization Università di Roma  
Address 00185, Rome, Italy  
Phone

Fax  
Email  
URL  
ORCID <http://orcid.org/0000-0002-8611-1371>

---

Author            FamilyName        **Mazzini**  
                  Particle  
                  Given Name        **Ilaria**  
                  Suffix  
                  Division            Consiglio Nazionale delle Ricerche di Italia (CNR)  
                  Organization        Istituto di Geologia Ambientale and Geoingegneria  
                  Address            Monterotondo, 00015, Rome, Italy  
                  Phone  
                  Fax  
                  Email  
                  URL  
                  ORCID              <http://orcid.org/0000-0003-2164-7826>

---

Author            FamilyName        **Muttillo**  
                  Particle  
                  Given Name        **Brunella**  
                  Suffix  
                  Division            Dipartimento degli Studi Umanistici  
                  Organization        Università di Ferrara  
                  Address            44121, Ferrara, Italy  
                  Phone  
                  Fax  
                  Email  
                  URL  
                  ORCID              <http://orcid.org/0000-0001-8039-5767>

---

Author            FamilyName        **Pieruccini**  
                  Particle  
                  Given Name        **Pierluigi**  
                  Suffix  
                  Division            Dipartimento di Scienze della Terra  
                  Organization        Università di Torino  
                  Address            10125, Torino, Italy  
                  Phone  
                  Fax  
                  Email  
                  URL  
                  ORCID              <http://orcid.org/0000-0002-8994-2867>

---

Author            FamilyName        **Ranaldo**  
                  Particle  
                  Given Name        **Filomena**  
                  Suffix  
                  Division  
                  Organization        Museo della Preistoria di Nardò  
                  Address            73048, Lecce, Italy  
                  Phone  
                  Fax  
                  Email  
                  URL  
                  ORCID              <http://orcid.org/0000-0001-9885-5717>

---

Author            FamilyName        **Sigari**

Particle  
Given Name **Dario**  
Suffix  
Division Dipartimento degli Studi Umanistici  
Organization Università di Ferrara  
Address 44121, Ferrara, Italy  
Division Geosciences Center  
Organization University of Coimbra  
Address Coimbra, 3030-790, Portugal  
Phone  
Fax  
Email  
URL  
ORCID <http://orcid.org/0000-0002-7427-0877>

---

Author  
FamilyName **Sardella**  
Particle  
Given Name **Raffaele**  
Suffix  
Division Dipartimento di Scienze della Terra, Sapienza  
Organization Università di Roma  
Address Roma, 00185, Italia  
Phone  
Fax  
Email  
URL  
ORCID <http://orcid.org/0000-0002-9752-6281>

---

Schedule  
Received 4 May 2021  
Revised  
Accepted 12 Dec 2021

---

Abstract  
Grotta Romanelli can be counted among the most interesting sites for the late Upper Palaeolithic of the Mediterranean area, since returned a consistent record of lithic artefacts, faunal remains, mobiliary and parietal art, and human fossils which represent the least-known materials from the context. The resumption of the investigations in 2015, after 40 years of inactivity in the cave, provided relevant results. During the 2019 campaign, a distal phalanx of the hand was recovered in the so-called *terre brune* levels, providing for the first time a clear stratigraphic and chronological reference for the human fossils record of Grotta Romanelli. In addition to morphological description and age estimation, the new finding is here analyzed using 3D Micro-CT scans. The new human fossil confirms the exceptional richness of the paleoanthropological record of Grotta Romanelli, opening new avenues of investigation and posing crucial questions on the use of the cave and cultural practices at the Late Pleistocene-Holocene boundary.

---

Keywords (separated by '-') *Homo sapiens* - Distal phalanx of the hand - Morphology - Upper Palaeolithic - Final Epigravettian

---

Footnote Information  
The online version contains supplementary material available at <https://doi.org/10.1007/s12520-021-01491-1>.

---



## 2 New human fossil from the latest Pleistocene levels of Grotta 3 Romanelli (Apulia, southern Italy)

4 Beniamino Mecozzi<sup>1</sup> · Costantino Buzi<sup>2</sup> · Alessio Iannucci<sup>1</sup> · Ileana Micarelli<sup>3</sup> · Fabio Bona<sup>4</sup> · Luca Forti<sup>5,6</sup> ·  
5 Giuseppe Lembo<sup>7</sup> · Giorgio Manzi<sup>3</sup> · Ilaria Mazzini<sup>8</sup> · Brunella Muttillio<sup>9</sup> · Pierluigi Pieruccini<sup>10</sup> ·  
6 Filomena Ranaldo<sup>11</sup> · Dario Sigari<sup>9,12</sup> · Raffaele Sardella<sup>1</sup>

7 Received: 4 May 2021 / Accepted: 12 December 2021

8 © The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2021

### AQ1 Abstract

10 Grotta Romanelli can be counted among the most interesting sites for the late Upper Palaeolithic of the Mediterranean area,  
11 since returned a consistent record of lithic artefacts, faunal remains, mobiliary and parietal art, and human fossils which  
12 represent the least-known materials from the context. The resumption of the investigations in 2015, after 40 years of inactivity  
13 in the cave, provided relevant results. During the 2019 campaign, a distal phalanx of the hand was recovered in the so-called  
14 *terre brune* levels, providing for the first time a clear stratigraphic and chronological reference for the human fossils record  
15 of Grotta Romanelli. In addition to morphological description and age estimation, the new finding is here analyzed using  
16 3D Micro-CT scans. The new human fossil confirms the exceptional richness of the paleoanthropological record of Grotta  
17 Romanelli, opening new avenues of investigation and posing crucial questions on the use of the cave and cultural practices  
18 at the Late Pleistocene-Holocene boundary.

AQ2 **Keywords** *Homo sapiens* · Distal phalanx of the hand · Morphology · Upper Palaeolithic · Final Epigravettian

### 20 Introduction

21 One of the richest human records in the Italian Peninsula  
22 comes from Grotta Romanelli (GR) (Sardella et al. 2018,  
23 2019; Fig. 1), in the Apulia region (SM 1). This cave has  
24 been excavated since the beginning of 1900 and the paleoan-  
25 thropological record includes three burials, cranial remains,  
26 mandibles, isolated teeth, and postcranial elements (SM 2  
27 and 2.1). After 40 years from the latest campaign, in 2015,

new fieldwork and excavations started in the site, thanks to 28  
a project supported by Sapienza University of Rome. During 29  
the new excavations, a human bone was found in the upper 30  
part of the sedimentary succession, generally known as *terre 31*  
*brune*. This new human finding, a distal phalanx of the hand, 32  
has been studied through the use of Micro-CT imaging and 33  
is here described together with its stratigraphic context and 34  
a chronological assessment (SM 2.2 and 2.3). 35

A1 ✉ Alessio Iannucci  
A2 alessio.iannucci@uniroma1.it

A3 <sup>1</sup> Dipartimento di Scienze della Terra, Sapienza, Università di  
A4 Roma, Roma 00185, Italia

A5 <sup>2</sup> DFG Center for Advanced Studies “Words, Bones,  
A6 Genes, Tools”, Eberhard Karls Universität Tübingen,  
A7 72070 Tübingen, Germany

A8 <sup>3</sup> Dipartimento di Biologia Ambientale, Sapienza, Università  
A9 di Roma, 00185 Rome, Italy

A10 <sup>4</sup> Museo Civico dei Fossili di Besano, Via Prestini 5,  
A11 21050 Besano, Italy

A12 <sup>5</sup> Dipartimento Di Scienze Della Terra “Ardito Desio”,  
A13 Università Degli Studi di Milano, 20133 Milan, Italy

<sup>6</sup> Consiglio Nazionale delle Ricerche Di Italia (CNR), Istituto  
di Geoscienze e Georisorse, 56124 Pisa, Italy A14  
A15

<sup>7</sup> Ministero dell’Istruzione, 44121 Ferrara, Italy A16

<sup>8</sup> Consiglio Nazionale delle Ricerche di Italia (CNR), Istituto  
di Geologia Ambientale and Geoingegneria, Monterotondo,  
00015 Rome, Italy A17  
A18  
A19

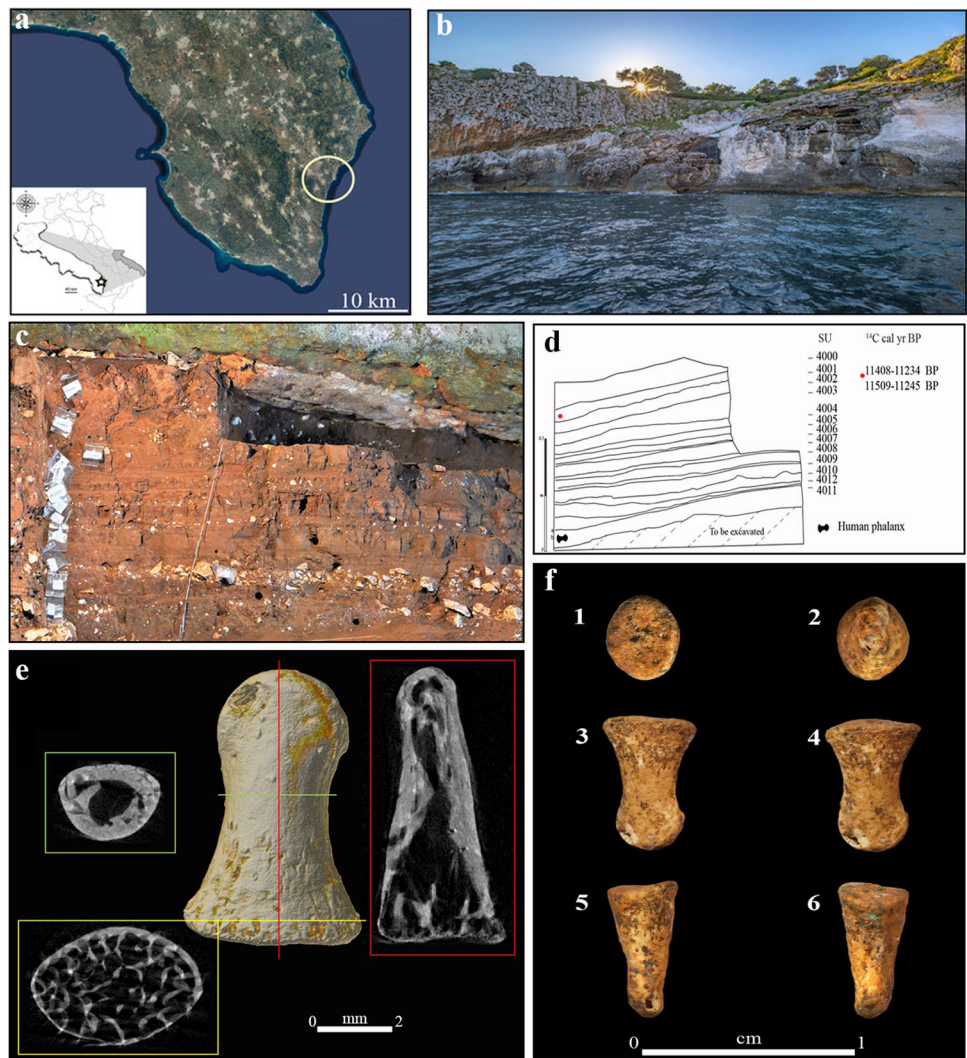
<sup>9</sup> Dipartimento degli Studi Umanistici, Università di Ferrara,  
44121 Ferrara, Italy A20  
A21

<sup>10</sup> Dipartimento di Scienze della Terra, Università di Torino,  
10125 Torino, Italy A22  
A23

<sup>11</sup> Museo della Preistoria di Nardò, 73048 Lecce, Italy A24

<sup>12</sup> Geosciences Center, University of Coimbra,  
Coimbra 3030-790, Portugal A25  
A26

**Fig. 1** Geographic position of Grotta Romanelli (a); photo of the Romanelli bay (b, modified from Forti et al. 2020); sedimentary succession of SS3 (c) and its stratigraphic log (d). Superior view of the digital model of the human phalanx RR1127 (center), reconstructed from microCT-scan. In different colors are reported two coronal sections, one near de distal end (upper left, green) and the other at the proximal end (lower left, yellow). In red is reported a mid-sagittal section (right) (e). RR1127 from Grotta Romanelli (f) in proximal (f1), distal (f2), anterior (f3), dorsal (f4), lateral (f5), and medial (f6) views



36 **The new human remain from Grotta**  
 37 **Romanelli**

38 The distal phalanx of the hand, labeled with the catalog  
 39 number RR1127, was found during the 2019 fieldwork  
 40 activities and it is temporarily housed in the PaleoFac-  
 41 tory Laboratory, Department of Earth Sciences, Sapienza,  
 42 University of Rome.

43 RR1127 (Fig. 1) is a small tubular extremity bone from  
 44 a human individual. The specimen is almost complete,  
 45 missing a portion of the distal portion (1 × 1.5 mm). The  
 46 maximum length of the fragment, from the double proximal  
 47 facet up to opposite tip, is 7.8 mm (Table 1).

48 The phalanx is flattened on the palmar surface and  
 49 rounded dorsally, showing a D-shaped appearance in the  
 50 cross-section of the shaft. This morphology character-  
 51 izes it as a hand phalanx. Furthermore, its tapering shape

indicates that the phalanx is a distal one, although lacking 52  
 a hypertrophied ungual tuberosity. 53

The process of fusion between distal epiphyses of phalan- 54  
 ges and the shafts starts around 13.5 years old in females and 55  
 16 years old in males (Schaefer et al. 2009). On the proximal 56  
 facet, signs of bony activity that may suggest the start or the 57

**Table 1** Measurements of RR1127 from Grotta Romanelli

Measurements	mm
Maximum length (ML)	7.8
Midshaft breadth (MB)	2.8
Midshaft height (MH)	2
Proximal breadth (PB)	4.5
Distal breadth (DB)	3.3
Distal height (DH)	2
Proximal height (PH)	3.5

continuing of the processes of epiphyseal fusion are not visible. In Fig. 1 (yellow box), where it is reported the coronal section of the proximal end, it is evident the starting of that process, called billowing (White et al. 2011). This evidence, very common on the epiphyses of sub-adults, is characterized by an undulated surface. Even if the billowing is not visible on the proximal articular surface of the specimen (Fig. 1), the beginning of this process is well detachable from the inner view.

Given the juvenile age of the individual, it is not possible to distinguish to which finger it belongs. As well, any degenerative process of the joint is not noticeable. In addition, the phalanx does not show any concavity or marked bony characteristics related to stress. This evidence allows classifying the individual as a sub-adult. The possible young age is further corroborated by the lack of a well-developed ungual tuberosity.

In literature, most of the analyzed findings of fossil phalanges are from adult individuals (for a complete review of the specimens, see Lorenzo et al. 2015). A comparison with modern cases of human sub-adults (Gaskin et al. 2011) suggests that the individual belongs to the group of children (3–12 years old, following age subdivision in Buikstra and Ubelaker 1994).

## Discussion and conclusion

The juvenile distal phalanx of the hand here described is the first human remain from GR, precisely contextualized *in-situ*, that is chronologically attributed to the final Late Pleistocene (for a complete review of the human fossil record from GR, see Supplementary Materials 2.1). In fact, the stratigraphic provenance and chronology of the human fossils collected in the first half of 1900 during the excavations by Gian Alberto Blanc (Blanc 1920, 1928) are still poorly constrained. Other human materials recovered by Paolo Emilio Stasi in the early years of 1900 (Stasi and Regalia 1904) are shrouded by even more uncertainty.

Therefore, the newly discovered human phalanx RR1127 confirms that human frequentation occurred in the cave in the latest Pleistocene levels, between 13,886–13,589 and 11,319–11,188 cal. years BP. However, SS3 succession, which enclosed the human finding, is characterized by several erosional surfaces, like that recognized at the base of SU 4011 and sedimentary structures (i.e., SU 4011a), that suggest the presence of runoff processes within the cave (SM 4). Taphonomic and stratigraphical analyses show the impact of water flows in the deposition of fossils within the sedimentary succession in the cave, especially during the formation of the *terre brune* deposit (SM 2.3 and 4). This may explain why the RR1127 was found isolated and disarticulated in the inner chamber of GR.

From a social perspective (SM 5), RR1127 suggests that the access to the cave was probably not limited upon an age-based distinction of the members of the human group and fixes new research questions for the future: (i) Was GR used as a burial ground? (ii) Did the use of the cave change over time, i.e., from a living area to a burial ground or *vice versa*? (iii) What was the role of young individuals in the Upper Paleolithic societies, since the consistent number of juvenile individuals in late Upper Paleolithic burials? (iv) Is there any specific area of GR where people were laid down or buried? (v) Is there any specific association between the human remains and the parietal art in GR?

The discovery of a human bone during the new excavation campaigns confirms the richness of the paleoanthropological heritage of GR and reveals that is paramount to conduct further research in this renowned site, where much has yet to be discovered. New human findings from GR can add crucial elements in the contextualization of the human occupation of the cave and its use. The detailed and thorough contextualization of new findings (i.e., mineralogical, isotopic and paleobotanical analyses, study of vertebrate remains, lithic artefacts, and mobiliary art) can enrich the knowledge on the European-western Asian Late Pleistocene framework. In the future, historical collections from GR should be revised to better define their morphological and biometric variability, their stratigraphic provenance (if possible), the exact number of the remains for each level (as defined by Blanc 1920), the ration of adult and juvenile individuals, and, in the case of burials, the demography.

Last, the RR1127 human phalanx shows how even a small finding may determine a new push in the research by opening new questions and provide important information in the understanding of an overlooked site.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s12520-021-01491-1>.

**Acknowledgements** The authors are thankful to the Soprintendenza Archeologia, Belle Arti e Paesaggio delle province di Brindisi, Lecce e Taranto (Maria Piccarreta, Laura Masiello and Serena Strafella) for authorizing the research and field activities (2015–2017 and 2018–2020, resp. R. Sardella). We are grateful to Castro municipality, the Capitanerie di Porto di Castro e di Otranto and Parco Naturale Regionale Costa Otranto S.M. di Leuca—Bosco di Tricase. We thank Medica Assunta Orlando (Museo Civico di Paleontologia e Paleontologia, Maglie), Francesca Alhaique and Luca Bondioli (Museo delle Civiltà, ex. Museo Nazionale Preistorico ed Etnografico L. Pigorini, Roma), Dario Massafra (Museo della Preistoria, Nardò), Luciano Bruni, and Stefano Grimaldi (Istituto Italiano di Paleontologia Umana, ISIPU) for their assistance in locating the archaeological and palaeontological material from Grotta Romanelli and the opportunity to study it. We also thank Rossella Bedini e Raffaella Pecci (Centro Nazionale di Tecnologie Innovative in Sanità Pubblica—Istituto Superiore di Sanità) for the digital acquisition of the human phalanx. Many colleagues helped during the 2015 fieldwork: Luca Bellucci, Andrea Billi, Mauro Brilli, Jacopo Conti, Giovanni Gaglianone, Francesca Giustini, Dawid



163 Adam Iurino, and Flavia Strani. We want to thank Nini Ciccarese,  
 164 Toto De Santis, Don Piero Frisullo, Luigi Fersini, Antonio Capraro,  
 165 and Michele Rizzo for their continuous and precious logistic support.  
 166 We also wish to thank all members of the Romanelli team and Gruppo  
 167 Speleologico Salentino for their useful suggestions and help.

168 **Funding** This work was supported by Grandi Scavi 2016 (ref.  
 169 SA116154CD9592F3), Grandi Scavi 2017 (ref. SA11715C81468801),  
 170 Grandi Scavi 2018 (ref. SA1181642D3B3C58), Grandi Scavi  
 171 2019 (ref. SA11916B513E7C4B), and Grandi Scavi 2020 (ref.  
 172 SA120172B2C05E68) of Sapienza, University of Rome, resp. Raf-  
 173 faele Sardella.

174 **Data availability** Not applicable.

175 **Code availability (software application or custom code)** Not applicable.

176 **Declarations**

**AQ4** **Competing interests** The authors declare no competing interests.

178 **References**

179 Blanc GA (1920) Grotta Romanelli I. Stratigrafia dei depositi e natura  
 180 e origine di essi. Archivio per L'antropologia e La Etnologia  
 181 50:1–39  
 182 Buikstra JE, Ubelaker DH (1994) Standard for data collection from  
 183 human skeletal remains. Arkansas Archaeological Survey  
 184 Research Series, 40, Fayetteville  
 185 Forti L, Mazzini I, Mecozzi B, Sigari D, Sardella R (2020) Grotta  
 186 Romanelli (Castro, Lecce) un sito chiave del Quaternario

mediterraneo. *Geologicamente* 2:18–27. <https://doi.org/10.3301/GM.2020.02> 187  
 188  
 Gaskin CM, Kahn MMSL, Bertozzi JC, Bunch PM (2011) Skeletal 189  
 development of the hand and wrist: a radiographic atlas and digital 190  
 bone age companion. Oxford University Press, Oxford 191  
 Lorenzo C, Pablos A, Carretero JM, Huguet R, Valverdú J, Martínón- 192  
 Torres M, Arsuaga LL, Eudald Carbonell E, de Castro JMB 193  
 (2015) Early Pleistocene human hand phalanx from the Sima del 194  
 Elefante (TE) cave site in Sierra de Atapuerca (Spain). *J Human 195*  
*Evol* 78:114–121 196  
 Sardella R, Mazzini I, Giustini F, Mecozzi B, Brilli M, Iurino DA, 197  
 Lembo G, Muttillio B, Massussi M, Sigari D, Tucci S, Voltaggio 198  
 M (2018) Grotta Romanelli (Southern Italy, Apulia): legacies and 199  
 issues in excavating a key site for the Pleistocene of the Mediter- 200  
 ranean. *Riv Ital Paleontolog Stratigr* 124(2):247–264. <https://doi.org/10.13130/2039-4942/9983> 201  
 202  
 Sardella R, Iurino DA, Mecozzi B, Sigari D, Bona F, Bellucci L, Col- 203  
 torti M, Conti J, Lembo G, Muttillio B, Mazzini I (2019) Grotta 204  
 Romanelli (Lecce, Southern Italy) Between past and future: new 205  
 studies and perspectives for an archaeo-geosite symbol of the pal- 206  
 aeolithic in Europe. *Geoheritage* 11:1413–1432 207  
 Schaefer M, Black SM, Schaefer MC, Scheuer L (2009) Juvenile osteo- 208  
 eology. Academic Press, San Diego 209  
 Stasi PE, Regalia E (1904) Grotta Romanelli stazione con faune inter- 210  
 glaciali calde e di steppa. Nota preventiva. Società Italiana di 211  
 Antropologia 1:17–81 212  
 White TD, Black MT, Folkens PA (2011) Human osteology. Academic 213  
 press, Burlington 214

**Publisher's note** Springer Nature remains neutral with regard to 215  
 jurisdictional claims in published maps and institutional affiliations. 216

217

Journal:	<b>12520</b>
Article:	<b>1491</b>

## Author Query Form

**Please ensure you fill out your response to the queries raised below and return this form along with your corrections**

Dear Author

During the process of typesetting your article, the following queries have arisen. Please check your typeset proof carefully against the queries listed below and mark the necessary changes either directly on the proof/online grid or in the 'Author's response' area provided below

Query	Details Required	Author's Response
<a href="#">AQ1</a>	Please check if the affiliations are captured and presented correctly.	
<a href="#">AQ2</a>	Please check if the keywords are captured and presented correctly.	
<a href="#">AQ3</a>	Blanc 1928 was mentioned in the manuscript; however, this was not included in the reference list.	
<a href="#">AQ4</a>	Please check captured supplementary materials if correct.	