Chapter 12

Hominin Footprints in Caves from Romanian Carpathians

Bogdan P. Onac, Daniel S. Veres, and Chris Stringer

Abstract The Romanian karst hosts numerous caves and shelters that over time provided remarkable archaeological and anthropological vestiges. Altogether they show that humans must have entered caves in Romania at least as early as 170,000 years ago. However, ancient human footprints are very rare in the fossil record of East-Central Europe, with only two known locations in the Apuseni Mountains of western Romania. Vârtop Cave site originally preserved three fossil footprints made about 67,800 years ago by a *Homo neanderthalensis*, whereas Ciur Izbuc Cave was probably home of early *H. sapiens* that left almost 400 footprints (interspersed with spoors of cave bears), which were indirectly dated to be younger than ~36,500 years.

Keywords Karst · Cave · Prehistoric people · Footprints · Romania

Introduction

The major karst areas of Romania occur in the East and South Carpathians, Apuseni Mountains, and Dobrogea (Onac and Goran 2019) (Fig. 12.1), all hosting key archaeological cave sites (for comprehensive reviews, see Boroneanț 2000; Anghelinu and Boroneanț 2019). Over the last 150 years, archaeological and paleontological researches focused on a significant number of shelters and cavities, most of them concentrated in the south-western part of the South Carpathians and

B. P. Onac (✉)

School of Geosciences, University of South Florida, Tampa, FL, USA

“Emil Racoviță” Institute of Speleology, Cluj-Napoca, Romania

e-mail: bonac@usf.edu

D. S. Veres

“Emil Racoviță” Institute of Speleology, Cluj-Napoca, Romania

C. Stringer

Centre for Human Evolution Research, Natural History Museum, London, UK

Fig. 12.1 (a) Romania within Europe; (b) location of Ciur Izbuș and Vârtope caves in Apuseni Mountains karst

Apuseni Mountains that also produced human remains (e.g. Cioclovina, Muierii, Polovragi, Oase). These investigations documented important Middle to Upper Palaeolithic sites, with the latter ones being far more abundant (Mertens 1996; Cârciușmaru 1999; Păunescu 2001). Other archaeological and anthropological findings indicate that the early modern humans had a more constant presence in the Romanian caves (Cârciușmaru 1988; Trinkaus et al. 2003; Olariu et al. 2005; Soficaru et al. 2007; Clottes et al. 2012; Webb et al. 2014; Harvati and Roksandic 2016). Until very recently, the cave-based Middle and Upper Palaeolithic in Romania offered almost exclusively archaeological collections with limited reliable chronological control (Cosac et al. 2018; Anghelinu and Boroneanț 2019). Abri 122 from Vârghiș karst (East Carpathians; Veres et al. 2018) has produced so far the most important Middle Palaeolithic lithic assemblage in the Carpathian region, including evidence of use-wear on fragmented bone tools and cut marks on a bos/bison tibial diaphysis (Cosac et al. 2018). Multiple-method luminescence dating indicates that human use of this site commenced sometime between 141 ± 12 ka and 174 ± 37 ka (Veres et al. 2018). These ages corroborate other evidence of Middle Palaeolithic occurrences in that chronological span within the Dobrogean karst and loess records near the Black Sea (Balescu et al. 2015).

Except for a handful of sites worldwide, human footprints are not that common in the fossil record. Onac et al. (2005) showed that the earliest footprints documenting direct human incursions into a Carpathian cave also come from Middle Palaeolithic (i.e. *Homo neanderthalensis*) and date back to more than 62,000 years ago. The only other ancient footsteps preserved in a Romanian cave were made in soft clay that partly hardened and then remained undisturbed until recently (Rusu et al. 1969; Rîșcuția and Rîșcuția 1970). Their age could be as old as 36,500 years, which heralds them as the oldest direct traces left by anatomically modern humans in a European cave (Webb et al. 2014). The two sites from which these footprints were documented, i.e. Vârtope and Ciur Izbuș caves in western Apuseni Mountains (Fig. 12.1), deserve further attention.

Vârtop Cave (Bihor Mountains)

Forty-five years ago, cavers from Emil Racoviță Speleological Club in Cluj-Napoca, led by the late Iosif Viehmann, organized a winter camp at Casa de Piatră (Stone House), a remote hamlet that counts only a few scattered houses in the heart of the Bihor Mountains. One of the objectives of this camp was a study visit into the Vârtop Glacier Cave (hereafter Vârtop), a short (340 m), but very well-decorated cavity discovered in 1955 and declared a natural monument in 1957 (Bleahu and Viehmann 1963). In the middle section of the cave, just before entering the Dome's Room (Sala Domului), a small, east-trending side passage opens, with its floor covered almost completely by a shallow lake. As the access to this section of the cave was somewhat more difficult prior to this expedition, no one ventured beyond the small chamber hosting the lake. However, in February 1974, Iulia Szekeley and Ioan Bucur passed the lake and climbed a steep flowstone in the north-eastern part of the Lake Room (Sala Lacului). After barely passing between two large stalagmites, they entered a rather small, low-ceilinged chamber. Just behind the stalagmite obstruction, over a flat surface of ca. 1.5 m², they noticed a well-preserved single human footprint (Fig. 12.2a). When I. Viehmann investigated the site, two other less clear prints were noticed, one of a heel and the other made by the toes. A few months later, the cave site was visited by Cantemir Rîșcuția, a well-known Romanian anthropologist who after some preliminary ichnological measurements suggested a possible age of ca. 15,000 years (Viehmann 1975). After numerous other biometric measurements and photographs were taken in situ, the decision was made to cut out the best preserved footprint and safeguard it in the Museum of the Institute of Speleology

Fig. 12.2 (a) Vârtop footprint (*dashed line* represents the CT cross-section shown in b); (b) transversal CT image of the footprint displaying the stalagmite (*stg*), embedded soda-straws (*ss*), and the U-series ages (in thousands of years)

in Cluj-Napoca. Although the decision to remove the print from the cave sparked controversy at the time, a few years later, when the illegal disappearance of the other traces was discovered, the usefulness of the undertaken approach was understood.

Room of the Steps and the Vârtop Footprints

The area of the cave that hosts the footprints consists of a small chamber (Room of the Steps) that continues into a short ascending gallery, with its floor covered with limestone boulders and red-brownish clay. The presence of these materials indicates an older cave entrance at the upper end of this corridor that collapsed more than 15,000 years ago (Onac et al. 2005). The age has been established after dating the base of one of the scattered stalagmites growing over the clayed cave floor by means of U-series technique. The existence of a different cave access point makes total sense, since it is unlikely that the prehistoric human crawled and climbed into the Room of the Steps using the present-day cave entrance.

The footprints were fossilized into a moonmilk deposit that accumulated between the cave wall and an alignment of stalagmites (Fig. 12.2). At the time the human left the prints, the moonmilk blanket covering the floor must have been soft and pliable, but later hardened into a calcareous tufa type deposit. The best preserved footprint is 22 cm in length and rather wide (10.6 cm) and shows a wide gap (1.6 cm) between the great toe of the foot and the rest of the toes (Fig. 12.2a). This is not necessarily a distinctive feature of the foot (i.e. hallux varus), but likely the gap formed when stepping in soft clay, barefoot. This could also be the reason for the overall width of the footprint. These two observations and a comparison with the human footprint from Bâsura Cave (Toirano, Italy), then assigned to a Neanderthal (Blanc and Pales 1960), led Viehmann (1987) to suggest (without any dating information) that the Vârtop Cave footprint is ca. 80,000 years old. However, the antiquity of the human footprints discovered in the Italian cave was revised (based on radiometric dating) to be just 14,000 to 12,000 years old (Molleson et al. 1972; De Lumley et al. 1984), a fact that called for a re-evaluation and a better way to estimate the age of the Vârtop Man.

Geochronology

As described below, a suite of favourable settings allowed an international group of researcher to successfully date the Vârtop footprint using the U-series method (Onac et al. 2005). The moonmilk deposit accumulated in the Room of the Steps was an ideal surface and material for casting human footprints, especially because it hardened, becoming a compact calc-tufa layer. Computer tomography (CT) imaging suggests the upper 1 cm of this deposit has a low density (grey), followed by a higher density (brighter) indicating less porous calcite, and a more compact layer (1 cm).

The lower part (~4 cm) instead shows a rather low density (dark) material, which would correspond to a porous but homogeneous texture (Fig. 12.2b). Our interpretation of the CT is that the human stepped in the denser and mechanically more competent layer, causing lateral displacement of the softer material below. Since the moonmilk's porous nature is far from ideal for U-series dating, we applied the isochron method to correct for admixed detritus with uniform $^{230}\text{Th}/^{232}\text{Th}$. Based on seven coeval subsamples having different U and Th concentrations and consequently distinct detrital components, an isochron age of 97,000 years (1σ) was obtained for the lower 5 cm of calc-tufa deposit. Statistically speaking, the age is not very robust due to a large uncertainty, but nevertheless implies a rapid accumulation of the moonmilk sometime during MIS 5.

Constraining the footprint age was possible due to the presence of a small stalagmite that grew over the footprint mould right below the big toe (Fig. 12.2) and a piece of soda straw embedded in the calc-tufa layer directly overlying the human print. The latter one was revealed by the CT scan (Fig. 12.2), which also showed the depth to which the footprint was imprinted on moonmilk. The soda straw from this undated layer returned a U-Th age of ~67,800 years. Three ages obtained from the base of the small stalagmite that was growing in the footprint mould cluster around 62,000 years. The last layer of moonmilk that partly filled the footprint was dated to 22,300 years, whereas a calcite fragment from of a soda straw cemented on the surface of the uppermost calc-tufa layer appears to have formed 20,000 years ago and then broke and fell to the floor. To further consolidate the chronology of the entire sequence, the base of a stalagmite which precipitated directly over the reddish clayey floor was dated to 15,400 years. This could be considered the earliest time at which the old entrance collapsed, preventing soil and other sediments from entering the cave.

Based on the calc-tufa stratigraphy and the above chronology, our interpretation of the Vârtop footprint is as follows: some 97,000 years ago, a period with documented speleothem growth near Vârtop Cave (Onac 2001), and other parts of Romania (Onac and Lauritzen 1996), moonmilk accumulated on the floor of the Room of the Steps. A prehistoric human entered Vârtop Cave using a different entrance than today and left her/his footprints impressed in the upper, more competent layer of the moonmilk deposit not earlier than 67,800 years ago, when a soda straw of this age fell off the cave ceiling and was later embedded in a thin (undated) moonlike layer that covers the footprint. In Romania, the period between 78,000 and 67,000 years ago was mild and wet, favouring speleothem precipitation (Onac and Lauritzen 1996; Staubwasser et al. 2018). Similar conditions must have existed ~62,000 years ago when the small stalagmite nested in the middle part of the footprint mould begun its growth. Since the publication of the original paper reporting these footprints (Onac et al. 2005), the newly dated soda straw (67,800 years) indisputably confirms that the Vârtop prints cannot be younger than 67,800 years; thus they clearly belong to a *Homo neanderthalensis*.

Ciur Izbuc Cave (Pădurea Craiului Mountains)

Ciur Izbuc Cave is part of the Toplița-Ciur-Tinoasa karst system located in the south-eastern part of the Pădurea Craiului Mountains on the Runcuri Karst Plateau (Rusu et al. 1970). Although the cave entrance must have been known to locals for centuries, the first documented visit happened in 1962 when T. Rusu, I. Viehmann, and S. Avram surveyed ~150 m out of its total length of 1030 m (Viehmann et al. 1970). During the exploration and mapping of the cave, a team of researchers from the Emil Racoviță Institute of Speleology in Cluj-Napoca (I. Viehmann, T. Rusu, G. Racoviță, and V. Crăciun) discovered in November 11, 1965, about 400 barefooted human footprints (Rusu et al. 1969; Viehmann et al. 1970). These imprints are interspersed with cave bear (*Ursus spelaeus*) footmarks in the clayey floor of the cave's upper level, in what is now known as Sala Pașilor (Footprint Room). Within 3 years from the time of the discovery, ~230 of the best-preserved prints were tagged with numbered metal flags, some of which still at their original position (Fig. 12.3). This process served two purposes, (i) inventory (for systematic observations) and (ii) raising awareness (protection), to those entering the cave. Nevertheless, decades of indiscriminate visitation of the cave led to the disappearance of many of these flags. Since most footprint casts were anyway hard to see in the red-brown clay and others became filled with bat guano, covered by a sub-millimetre-thick calcite dust, or affected by mud cracks, many of them were damaged or even completely destroyed.

Following the discovery of the human footprints in Ciur Izbuc Cave, an article announcing the findings was published by Rusu et al. (1969) in *Ocotirea Naturii* (Nature Conservation), a Romanian popular science magazine. Despite the nontechnical character of the publication, the paper includes very important

Fig. 12.3 (a) Photo of the Footprint Room in Ciur Izbuc Cave showing part of the tagged footprints (Photograph A. Posmoșanu); (b) close-up view of a well-preserved footprint. (Photograph G. Ponta)

scientific information regarding the evolution of the cave, documents the traces left by the cave bears, and for the first time illustrates the human footprints. It was also noticed that there was a lack of any footprints or cave bear bones between the current entrance and the Footprint Room, whose northern end is only 50 m away and 8–10 m below the sinking point in which Tinoasa stream disappears into the cave. Due to this geomorphological setting and because the Footprint Room is too far and difficult to reach using the present day cave entrance, it has been speculated that in the past, humans and cave bears likely used a different access point (Rusu et al. 1969). Relying solely on the presence of some polished cave bear bones (used as tools?) and a human figurine rudimentarily engraved on the root of a cave bear canine tooth, the authors attributed the footmarks to a *Homo sapiens* who lived ~15,000 to ~10,000 years ago.

Three other studies appeared in a book printed on the occasion of Emil Racoviță's (founder of the world's first Speleological Institute in Cluj, Romania) birth centenary. The paper by Rusu et al. (1970) tackles the geomorphology and hydrology of the Toplița-Ciur-Tinoasa karst system but also includes a paragraph on the prehistoric footprints, along with a photograph. Viehmann et al. (1970) present a couple of observations that shed light on the presence of human and cave bear footmarks. Without having any radiocarbon ages, but from the apparent relationship between the human and *Ursus spelaeus* prints, the authors claimed that the human footmarks must be younger than those of Solutrean people (21,000 to 17,000 years). The same study suggested based on the large number of prints that the visits were not occasional and the humans had deliberately entered the cave.

The first standard ichnological analyses were undertaken by Rîșcuția and Rîșcuția (1970), who measured five morphometrical parameters for 188 footprints. By relating the maximum length of the foot (Fl) with the height of individuals (h), using the classic relationship $Fl = 15\% h$, the authors concluded that two adults and a child were the Ciur Izbuc cave trackmakers. They reported a height of 157 cm for the woman and 174.9 cm for the man, but for the child, they only indicated an age range (9 to 11 years old).

A more recent study conducted by Webb et al. (2014) measured the width for the ball and heel and the maximum length of 51 footprints that were still visible on the cave floor. Using the print lengths (range between 157 and 318 mm), the authors estimated the minimum number of individuals and their stature range. Contrary to the previous studies, Webb et al. (2014) suggest a group of six to seven individuals left their footprints in Ciur Izbuc Cave. Considering that the printmakers travelled only ~75 m from the former cave entrance towards the inner part of the Footprint Room, the same study concluded that it would have taken 9 min for an individual (and far less for 6–7 people) to leave behind those 400 footprints originally counted. The estimations regarding the human stature (calculated by either regression or percentage method) overlapped well, both studies reporting heights between 106.4 and 216.1 cm.

The real novelty in the study of Webb et al. (2014) is the approach taken by the authors to estimate the age of the footprints. In the absence of any artefacts or human remains, the direct dating of the tracks was impossible. Nevertheless, considering

that a few human footmarks appear to be overprinted by cave bears, and having radiocarbon dated two bear bones, the study concluded that the Ciur Izbuc people might have ventured in the cave anytime since ~36,500 years ago. Based on this age, the authors suggest that the footprints belong to either early *H. sapiens* or *sapiens/neanderthalensis* hybrids, but without being able to place them in a clear cultural context. It is now known that even if the humans were as old as 36,500 years, they would probably have been too young to be direct hybrids, as they post-dated the last known appearances of Neanderthals in Europe (Higham et al. 2014).

It is not surprising that human footprints have been found within the Romanian Carpathian caves. The area has often been considered a refugial area for humans and ecosystems during stadials (Staubwasser et al. 2018), and the potential dispersal routes into Central Europe intersect those north of the Black Sea along the Carpathian arch and the Danube Valley (e.g. Iovita et al. 2012). As such, south-eastern Europe has long been considered one of the most likely routes for hominin spreads across the continent, including anatomically modern humans, with the Oase Cave fossils amongst the oldest modern human fossils in Europe (Trinkaus et al. 2003). It is thus expected that more intensive research will significantly augment the number of cave archaeological sites, as well as our understanding of migration routes, genetic turnover, and past human population dynamics.

Acknowledgements A. Posmoșanu and G. Ponta are thanked for providing the human footprints photographs from the Sala Pașilor in Ciur Izbuc Cave. Chris Stringer's research is supported by the Calleva Foundation and the Human Origins Research Fund.

References

- Anghelinu, M., & Boroneanț, A. (2019). The archaeology of caves in Romania. In G. M. L. Ponta & B. P. Onac (Eds.), *Cave and karst systems of Romania* (pp. 501–517). Springer: Cham.
- Balescu, S., Tuffreau, A., & Dobrescu, R. (2015). Mamaia Sat (Romania): A late middle Pleistocene Palaeolithic site? *L'Anthropologie*, *LIII*(1–2), 157–166.
- Blanc, A. C., & Pales, L. (1960). Le vestigia umane della Grotta della Basura a Toirano. *Rivista di Studi Liguri*, *26*, 1–90.
- Bleahu, M., & Viehmann, I. (1963). Ghețarul de la Vârtoș. *Ocotirea Naturii*, *7*, 147–152.
- Boroneanț, V. (2000). *Arheologia peșterilor și minelor din România*. București: Institutul de Memorie Culturală (cIMeC).
- Cârciumaru, M. (1988). L'art pariétal préhistorique en Roumanie. *L'Anthropologie*, *92*(1), 239–254.
- Cârciumaru, M. (1999). *Le Paléolithique en Roumanie*. Grenoble: Editions Jérôme Millon.
- Clottes, J., Besesek, M., Gely, B., Keneszi, M., Lascu, V. T., Meyssonier, M., Philippe, M., Plichon, M., Prud'homme, F., Radu, V. A., Rus, T., & Tociu, R. L. (2012). Découverte d'une nouvelle grotte ornée paléolithique en Roumanie, dans le département du Bihor. In J. Clottes (Ed.), *L'Art Pléistocène dans le Monde* (Bulletin de la Société préhistorique de l'Ariège, 65–66) (pp. 513–528).
- Cosac, M., Murătoareanu, G., Veres, D., Niță, L., Schmidt, C., Hambach, U., Alexandru, R., Cuculici, R., Buzea, D. L., Mărgărit, M., Dumitrașcu, V., Vasile, Ș., Petculescu, A., & Dénes,

- I. (2018). Multi-proxy archaeological investigations of a middle Palaeolithic occupation context in eastern Transylvania, Romania. *Quaternary International*, 485, 115–130.
- De Lumley, H., Giacobini, G., Vicino, G., & Yokoyama, Y. (1984). New data concerning the dating and interpretation of human footprints present in the “grotta della Basura” at Toirano (Savona, Northern Italy). Results of an international round table. *Journal of Human Evolution*, 13, 537–540.
- Harvati, K., & Roksandic, M. (2016). The human fossil record from Romania: Early upper Paleolithic European mandibles and Neanderthal admixture. In K. Harvati & M. Roksandic (Eds.), *Paleoanthropology of the Balkans and Anatolia: Human evolution and its context* (pp. 51–68). Dordrecht: Springer.
- Higham, T., Douka, K., Wood, R., Bronk Ramsey, C., Brock, F., et al. (2014). The timing and spatiotemporal patterning of Neanderthal disappearance. *Nature*, 512, 306–309.
- Iovita, R., Fitzsimmons, K. E., Dobos, A., Hambach, U., Hilgers, A., & Zander, A. (2012). Dealul Guran: Evidence for lower Palaeolithic (MIS 11) occupation of the lower Danube loess steppe. *Antiquity*, 86, 973–989.
- Mertens, S. (1996). The middle Paleolithic in Romania. *Current Anthropology*, 37(3), 515–521.
- Molleson, T. I., Oakley, K. P., & Vogel, J. C. (1972). The antiquity of human footprints of Tana della Basura. *Journal of Human Evolution*, 1, 467–471.
- Olariu, A., Skog, G., Hellborg, R., Stenström, K., Faarinen, M., Persson, P., & Alexandrescu, E. (2005). Dating of two Paleolithic human fossil bones from Romania by accelerator mass spectrometry. In A. Olariu, K. Stenström, & R. Hellborg (Eds.), *Applications of high-precision atomic and nuclear methods* (pp. 222–226). Bucharest: Editura Academiei Române.
- Onac, B. P. (2001). Mineralogical studies and uranium-series dating of speleothems from Scărișoara Glacier cave (Bihor Mountains, Romania). *Theoretical and Applied Karstology*, 13–14, 33–38.
- Onac, B. P., & Goran, C. (2019). Karst and caves of Romania: A brief outlook. In G. M. L. Ponta & B. P. Onac (Eds.), *Cave and karst systems of Romania* (pp. 37–40). Cham: Springer.
- Onac, B. P., & Lauritzen, S. E. (1996). The climate of the last 150,000 years recorded in speleothems: Preliminary results from North-Western Romania. *Theoretical and Applied Karstology*, 9, 9–1.
- Onac, B. P., Viehmann, I., Lundberg, J., Lauritzen, S. E., Stringer, C., & Popiță, V. (2005). U-Th ages constraining the Neanderthal footprint at Vârtope cave, Romania. *Quaternary Science Review*, 24(10–11), 1151–1157.
- Păunescu, A. (2001). *Paleoliticul și Mezoliticul din spațiul Transilvan*. Bucharest: Ed AGIR.
- Rișcuța, C., & Rișcuța, I. (1970). Étude anthropologique des empreintes humaines du la grotte “Ciurului-Izbuc”. In T. Orghidan (Ed.), *Livre du centenaire “Émile G. Racovitza”* (pp. 529–533). Editura Academiei RSR: Bucharest.
- Rusu, T., Viehmann, I., Racoviță, G., & Crăciun, V. (1969). Primele urme de pași ale omului preistoric din peșterile României (First footprints of prehistoric humans from Romanian caves). *Ocotirea Naturii*, 13, 191–200.
- Rusu, T., Racoviță, G., & Crăciun, V. (1970). Le système karstique Toplița - Ciur - Tinoasa (Les Monts Pădurea Craiului). In T. Orghidan (Ed.), *Livre du centenaire “Émile G. Racovitza”* (pp. 627–650). Editura Academiei RSR: Bucharest.
- Soficaru, A., Dobos, A., & Trinkaus, E. (2007). Early modern humans from the Peștera Muierii, Baia de Fier, Romania. *PNAS*, 104(103), 17196–17201.
- Staubwasser, M., Drăgușin, V., Onac, B. P., Assanov, S., Ersek, V., Hoffmann, D. L., & Veres, D. (2018). Climate change impact on the transition of Neanderthals to modern humans in Europe. *PNAS*, 115(37), 9116–9121. <https://doi.org/10.1073/pnas.1808647115>.
- Trinkaus, E., Moldovan, O., Milota, S., Bilgär, A., Sarcină, L., Athreya, S., Bailey, S. E., Rodrigo, R., Gherase, M., Higham, T., Ramsey, C. B., & Van Der Plicht, J. (2003). An early modern human from the Peștera cu Oase, Romania. *PNAS*, 100(20), 11231–11236.
- Veres, D., Cosac, M., Schmidt, C., Murătoareanu, G., Hambach, U., Hubay, K., Wulf, S., & Karátson, D. (2018). New chronological constraints for Middle Palaeolithic (MIS 6/5-3) cave

- sequences in Eastern Transylvania, Romania. *Quaternary International*, 485, 103–114. <https://doi.org/10.1016/j.quaint.2017.07.015>.
- Viehmänn, I. (1975). Urme de viață de acum 15000 de ani (Traces of life from 15000 years ago). *Radio Tele Școală*, 33–34.
- Viehmänn, I. (1987). Prehistoric footprints in Romania's cave. *Theoretical and Applied Karstology*, 3, 229–234.
- Viehmänn, I., Racoviță, G., & Rîșcuța, C. (1970). Découvertes tracéologiques concernant la présence de l'homme et de l'ours de caverne dans la grotte Ciurului-Izbuc des Monts Padurea Craiului. In T. Orghidan (Ed.), *Livre du centenaire "Émile G. Racovitza"* (pp. 521–527). Editura Academiei RSR: Bucharest.
- Webb, D., Robu, M., Moldovan, O., Constantin, S., Tomuş, B., & Neag, I. (2014). Ancient human footprints in Ciur Izbuc cave, Romania. *Amercian Journal of Physical Anthropology*, 155, 128–135.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.