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Tracking in Caves: Experience based reading of Pleistocene human footprints in French caves

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Some of the painted caves in southern France preserve human footprints from the Ice Age of 17,000 years ago. Research has so far dealt with them sparsely and through a morphometric approach only. In 2013 three indigenous hunters/trackers from the Kalahari had an opportunity to read several spoor accumulations in four caves on the basis of their indigenous knowledge. As a result of this morpho-classificatory approach to track reading they produced new hypotheses on prehistoric cave visitors. Most spectacular is the narrative which the trackers generated from the footprints not far from the clay bison at Tuc d'Audoubert. Further research is planned to inspect more tracks and look into the epistemological status of the indigenous tracking method.

Human hand- and footprints are the most personal, non-substance-based remains left from our Pleistocene ancestors. Under ideal conditions a short period of time in the life of a single person may be recorded in a plastic surface by such an imprint. No other findings are so clearly linked to a short individual moment.

Prehistoric foot- and handprints are known from different continents and periods (Lockley *et al.* 2008; Pasda 2013). Among them the most spectacular are the footprints from Laetoli, Koobi Fora, Willandra (Leakey & Harris 1987; Raichlen *et al.* 2008; Webb *et al.* 2006) and those recently discovered at Happisburgh (Ashton *et al.* 2014). No less fascinating are footprints left by Pleistocene humans in decorated caves in southwestern France (Duday & García 1985; Pales 1976; Vallois 1931). The extraordinary status of such fragile remains stands in stark contrast to the paucity of scientific attention: during the last 100 years, only Vallois, Pales and Duday have seriously studied some of the known footprints. This imbalance is perhaps owed to the relative cultural ignorance of such remains and of the potential means to interpret them. As an alternative to the experience-based reading of tracks as hunter-gatherers practise it, western science

has resorted to morphometric and statistical analyses as the only applied methods (e.g. Ashton *et al.* 2014; Bennett & Morse 2014; Kinahan 2013; Pales 1976; Webb *et al.* 2006). The hypotheses resulting from these methods remain extremely limited and vague: uncertainties exist in the determination of the exact number of individuals, their age and sex, and very little behavioural evidence is produced. Furthermore the story behind the imprints is normally far from factual: in some cases ritual dancing, with scant rationale, was put forth as ultimate explanation (Table 1) (Bégouën 1928; Lemozi 1929).

Methods

In order to stimulate research on human footprints, three professional trackers from the Ju/'hoan San from Tsumkwe (Namibia)—once known as 'Bushmen'—Ciqae, Thao and Kxunta, were directly confronted with the original footprints in four French caves (Boytshev 2013): Niaux, Fontanet and Tuc d'Audoubert (all Ariège) and Pech-Merle (Lot) (Figs. 1 & 2). For perhaps the first time, indigenous knowledge was integrated into archaeological data-gathering without the detour of ethnographic analogy or as mere

Table 1. Methodological base: morphometric versus morpho-classificatory approach. *Refers largely to animal spoor, but most can be transferred to human spoor as well; studies by Stander *et al.* (1997) and Wong *et al.* (2011) refer only to animal spoor.

	Morphometric approach (Western science)	Morpho-classificatory approach (San trackers)*
Epistemological method	Induction	Abduction (Liebenberg 1990) hypothetico-deductive method
Knowledge from different sources	Anatomy; statistics; prehistory; ethnography	Anatomy; zoological details on behaviour, seasonal changes, reproduction, diet and feeding habits – concerning the prey as well as ‘contextual’ animals; biosphere; geosphere; pedology; climate; memory of recent weather conditions; knowledge of place; absolute orientation
Acquisition of relevant knowledge	Reception of empirical studies on adult male persons from South and Central Africa, Madagascar, South Asia, South Pacific Islands and Middle Europe (Vallois 1931; Pales 1976)	Lifelong learning and practice of skills, using it in constant discourse with others
Detection depth	Species; size; speed of movement; sometimes sex (Pales 1976)	Species; individual; age; sex; way and speed of movement; behaviour; body posture; weight; handicap; age of spoor
Contextual frame	Controlled, rigid	Flexible
Preconditions for interpretation	Controlled substrate matrix, requires optimum conditions (Vallois 1931; Duda & García 1983)	Flexible, works also under adverse conditions
Data source	Complete foot	Partial footprint suffices
Body posture of subject	Requires controlled upright posture and steady movement for analysis	Irrelevant, since any body posture can be read from the spoor
Body height	Foot length $\times 6.67 =$ body height (foot length = 15 per cent of body height) (Vallois 1931; Pales 1976)	No statement except implications from age indication
Precondition for height estimates	Compliance with empirical studies (see above)	–
Age estimates	Rough categorization: child – adolescent – adult	Narrowly approximated age in years
Sex indication	Only in exceptional cases	Definite
General reliability	No test studies	95 per cent (Stander <i>et al.</i> 1997)
		74 per cent (Wong <i>et al.</i> 2011)

confirmation of previous results (Webb *et al.* 2006; Webb 2007).

Calling on indigenous knowledge (IK) of tracking is not a matter of romanticism and it is not aimed at obtaining an exotic view of tracks from another world-view. Rather, we seek alternative interpretation of data on the same empirical basis that is available to everyone (Liebenberg 1990; Lockley 1999) (Table 1). Indigenous knowledge of tracks is not based on different rationality, logic or causalities, as may be the case with traditional ecological knowledge (TEK), at least in part (Berkes 2008, 8). Taking series of measurements (e.g. Ashton *et al.* 2014; Bennett & Morse 2014; Kinahan 2013; Pales 1976; Webb 2007) is an unsatisfactory substitute and cannot produce understanding, in the way that reading does (Chamberlin 2002). Expert tracking aims to produce, on the basis of in-depth knowledge of the entire ecosystem acquired by thorough experience (Blurton Jones & Konner 1976; Liebenberg 1990), a narrative of something that is irrevocably past.

The capabilities of hunter-gatherers in reading tracks are legendary throughout various types of literature (e.g. Biesele & Barclay 2001; Liebenberg 1990; Marshall Thomas 1988) and have been proven under western scientific test conditions (Stander *et al.* 1997; Wong *et al.* 2011); but despite the presence of prehistoric tracks on all continents (Lockley *et al.* 2008; Pasda 2013) only very little, rather anecdotal, use has been made of it as an approach in archaeological contexts (Franklin & Habgood 2009; Webb *et al.* 2006).

If the method of tracking is analysed epistemologically, it is often linked to the concept of abduction (after C.S. Peirce: *cf.* Liebenberg 1990) and, upon thorough study of the character of tracking, authors have no doubt of its status analogous to science or as its forerunner (Blurton Jones & Konner 1976; Chamberlin 2002; Liebenberg 1990). Ciqae, Kxunta and Thao assert that decisions of trackers who hunt together and their interpretation of spoor are based on intense communication and consensus (see Biesele & Barclay

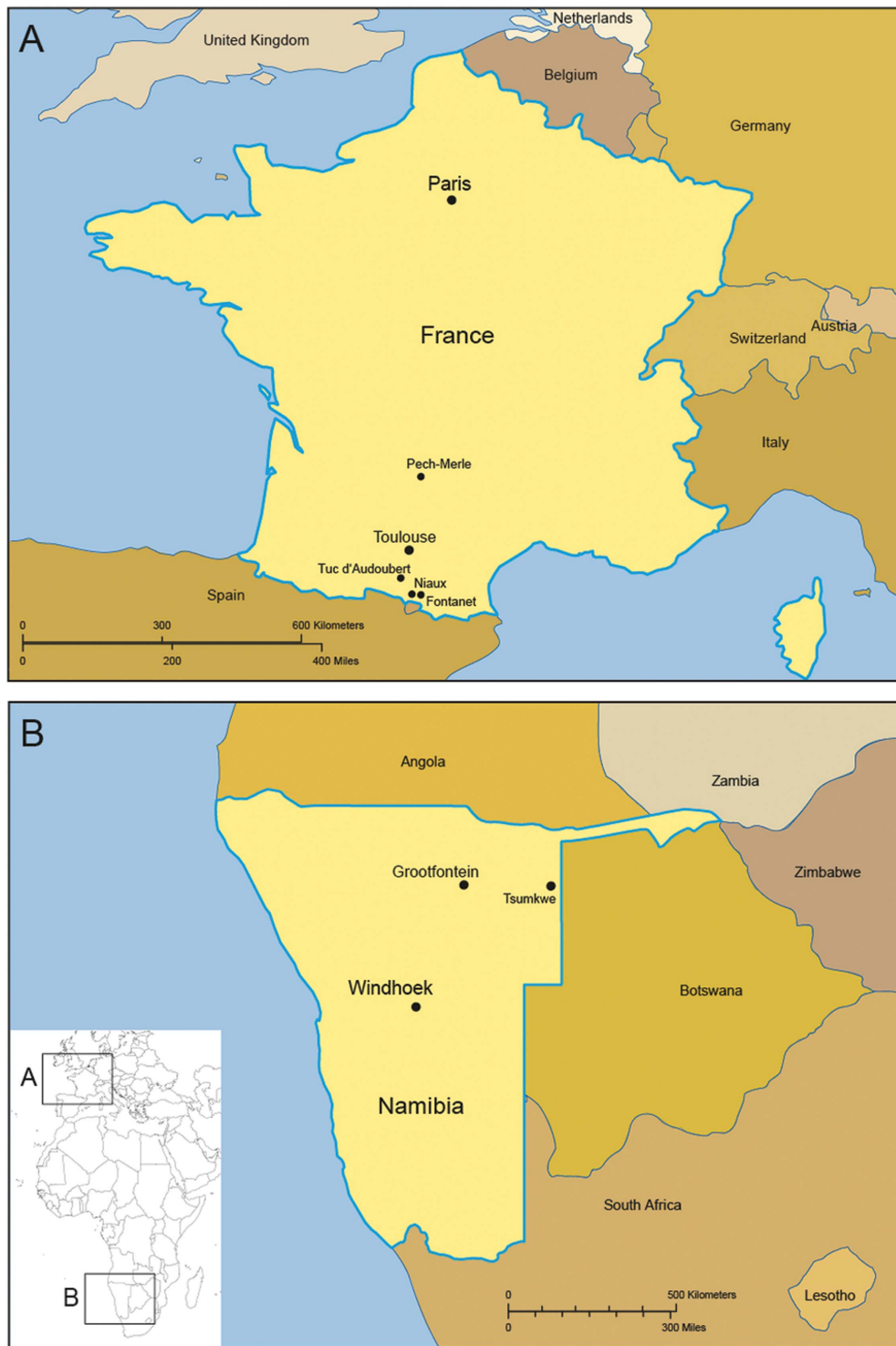


Figure 1. (Colour online) The location of Tsumkwe (below) and selected sample of sites with human footprints in France (above).



Figure 2. (Colour online) Reading human footprints. (A) Kxunta and Thao in Niaux; (B) Tuc d'Audoubert with Ciquae. (Photographs: Tracking in Caves and Association Louis Bégouën.)

2001; Blurton Jones & Konner 1976; Liebenberg 1990, for corroboration). Moreover, in hunter-gatherer societies skills in tracking are not knowledge exclusive to adult male hunters and they are not restricted to animal tracks, but also include human spoor (cf. Biesele & Barclay 2001, 79; Marshall Thomas 1988, 26).

The experiment we describe aimed to test the feasibility of such an integration of two knowledge systems and the benefit for archaeological science. It was not, however, intended to test the reliability of indigenous tracking skills (cf. Stander *et al.* 1997; Wong *et al.* 2011).

While species can be identified by characteristic features, there also exist individual variations within a species. These variations make it possible for an experienced tracker to determine the sex as well as an approximate estimation of the animal's age, size and mass. A tracker may also be able to identify a specific individual animal by its spoor. (Liebenberg 1990, 122–3)

In fact, the interpretations of human footprints by Ciquae, Thao and Kxunta are as precise as those noted

by Liebenberg. This prompts questions as to which aspects of the footprint are significant for such detailed information, but so far detailed answers concerning human footprints have not been forthcoming. Liebenberg compiles different aspects which serve as a base for the determination of age and sex: size, depth and way of movement, body structure and association with other footprints. Ciquae, Thao and Kxunta corroborate that a male foot looks stronger and wider than a female foot—indicating that, of course, intuitive assessment of proportions is the foundation of sex determination. According to Liebenberg (1990), wear, foot tension and again size are significant for age determination, which paraphrases the criteria mentioned and judged by the trackers. Furthermore, Liebenberg noted that the exact shape of every individual is unique and therefore it is possible to identify individual animals and also humans. This, too, is confirmed by Ciquae, Thao and Kxunta, who maintain that in particular the shape of the toes and also the way in which a foot is set on the ground help them to identify their family, neighbours and friends by their footprints.

This compilation shows that presently a rather general list of distinctive criteria can be proposed, but the epistemological procedure cannot be determined in the way that Liebenberg has done for the entire tracking process (Liebenberg 1990, 29–30). According to him, there are two principal approaches in following a spoor; one is inductive-deductive, which he labels systematic tracking. The other is a hypothetico-deductive (or abductive) one, termed speculative tracking. Further research is necessary to determine the epistemological characteristics of the methodology applied by Ciquae, Thao and Kxunta to each single imprint. In order to collect first data on this topic the entire determination process in each cave was recorded as audio protocols. Their transcription will serve as an important resource in future.

Even if the concrete method of San tracking is still unknown and is a study in progress, the precise and plausible results are worth presenting to a wider public.

Sites with Late Pleistocene human footprints and selected sample

Late Pleistocene human footprints in caves are known mainly in France. The first documented discoveries date back to the work of Émile Carteilhac and Henri Breuil at Niaux and Bédouilhac (Pales 1976; Vallois 1931). These spoors were destroyed after discovery, but they were the first evidence accepted as spoor of Pleistocene people. Further discoveries

followed at the beginning of the twentieth century at Tuc d'Audoubert, Pech-Merle and Montespan (Bégouën *et al.* 2009; Trombe & Dubuc 1947; Vallois 1928; 1931). In 1948 Denis Cathala shed light on the 'Galerie des Pas' at Aldène with hundreds of human footprints (Pales & Vialou 1984). At the beginning of the 1970s the caves of Réseau Clastres and Fontanet were discovered and later Chauvet and Cussac, in 1994 and 2000 respectively, all containing important footprints (Clottes 2001; Clottes & Simonnet 1972; Delteil *et al.* 1972; Jaubert *et al.* 2012). Outside France, late Pleistocene footprints are known in Europe from the caves of Toirano (Italy) and Ojo Guareña (Spain) (Pales 1976) and in Australia in the dry Willandra Lakes deposit (Webb 2007; Webb *et al.* 2006). All in all, about a dozen caves with late Pleistocene footprints are known.

From this list of a dozen sites, four were chosen for Ciqae, Kxunta and Thao's encounter with the original footprints. Because of the experimental character of the project, practicability was the leading criterion for the choice of caves. Ciqae, Kxunta and Thao examined the full set of 38 footprints in the 'Diverticule des Empreintes' at Niaux, as well as all 12 footprints in the 'Galerie des Disques' at Pech-Merle. Furthermore, a selection of several hundred footprints were explored in three areas in the deeper part of Fontanet and in the 'Salle des Talons' at Tuc d'Audoubert.

Results

The cave system of Niaux extends for more than two kilometres on different levels (Clottes 1995). In 1949, de Contenson here discovered several human footprints around 600 m inside the prehistoric entrance to the cave (after Pales 1976) (Fig. 3). On a small intact surface of about 6 sq.m he counted 38 imprints moulded in the clay. Further footprints are known in other parts of Niaux, but they were either destroyed or the preserved ones are interpreted as modern remains (Clottes 1984). Historic graffiti on the walls date back to the seventeenth century and evince continuous frequentation of the cave by modern visitors. Even the footprints discovered by de Contenson are not securely dated to prehistoric times. Due to chronological disparity the archaeological remains at Niaux do not represent a closed archaeological trait.

Ciqae, Kxunta and Thao read the 38 footprints as the imprints of a 12-year-old girl who left an unequal number of right and left footprints. The imprints themselves were executed in a controlled manner, slow and clean, and do not result from dynamic movement. We are left with an unresolved riddle: the trackers report that the footprints reflect an upright

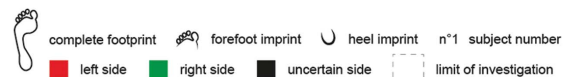
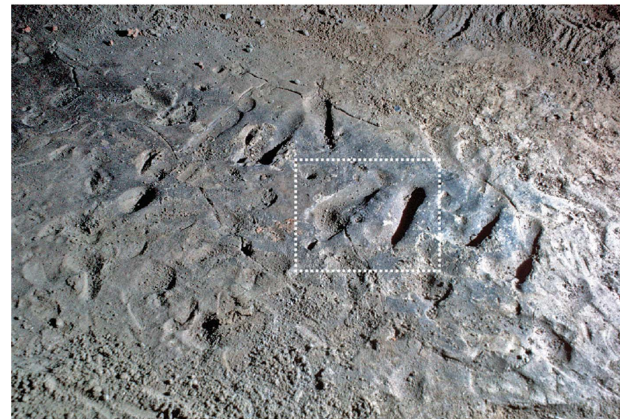
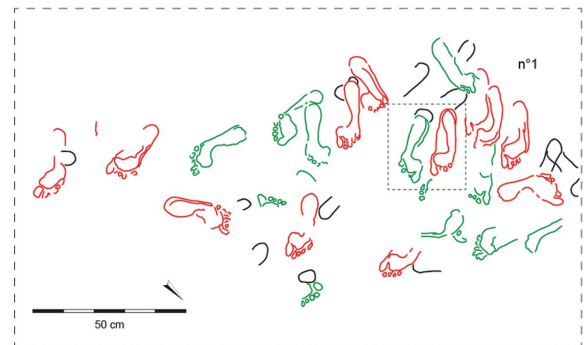
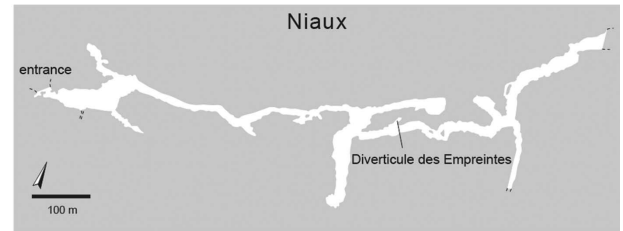


Figure 3. (Colour online) Niaux: investigated area in the 'Diverticule des Empreintes'. The slightly dotted rectangle marks a central pair of footprints for orientation. Subject: no. 1, female (12). (Drawing after Pales 1976; photograph: Heinrich Wendel.)

position of the girl while the present low ceiling of 0.95 m clearance would make this posture possible only for small children.

Basic details of this interpretation fit with the observations published by Pales. He concludes that the footprints are distributed 'anarchistically' and were executed intentionally (Pales 1976, 92–3). But for Pales the footprints indicate two or three children, between

nine and twelve years of age. The seemingly chaotic distribution of footprints was also mentioned by de Contenson in his first report, where he made a narrative interpretation: he saw in the ‘Diverticule des Empreintes’ a ritual dance in the frame of an initiation (after Pales 1976, 23).

In 1922 Lemozi discovered not only the dotted horses and the ‘Frise Noire’ at Pech-Merle; he also recognized a small surface of around nine square metres with some human footprints in the ‘Galerie des Disques’ (Lemozi 1929) some 100 m from the collapsed late Pleistocene entrance (Fig. 4). The number of human footprints identified by previous researchers ranges from only four (Vallois 1931) up to 12 (Duday & García 1983). By discovering six hitherto unknown footprints, Ciqae, Kxunta and Thao increased the number to 18. In these prints they see five individuals, from age nine to more than 50 years. Two men, two women and one boy crossed this area at a normal and fast pace. While the young boy changed his direction of movement to the left, the 30-year-old woman (no. 5) was carrying an additional load.

The interpretations of the trackers go far beyond those published: both Lemozi and Vallois saw only two individuals (Lemozi 1929; Vallois 1931). While Lemozi assumes a woman walking with an adolescent (her child), Vallois presumes an adult and a child without further precise basis. The last analysis, conducted by Duday and his team, reduced the number of individuals to one single person (Duday & García 1983). They see a large child, an adolescent or a small adult in these footprints.

An exceptional discovery was made by Wahl and his team in 1972 (Delteil *et al.* 1972): they discovered a 300 m long gallery in the huge cave system of Fontanet with a large number of human footprints (Fig. 5). From around 150 m beyond the collapsed original entrance up to the end of the ‘Galerie Wahl’ wide stretches of the cave floor are covered with clay in which every movement of the prehistoric visitors has been recorded. The first enthusiasm of this discovery is belied by the poor output in publications and therefore only sketchy information has been disseminated. A large number of footprints from children and adults—among them a young child of about six years of age—is mentioned by Clottes (1975). Furthermore, Pales interpreted a single footprint as having been made by a foot wearing a soft and flexible moccasin-like covering (*piéd chaussé*) (Clottes 1975)—claiming that it is no less than the only such known worldwide (Fig. 6).

Ciqae, Kxunta and Thao investigated two different areas in the back part of the cave. On the bigger one they detected 13 individuals—six men, two women,

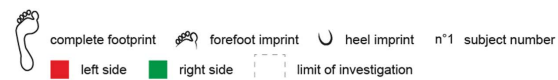
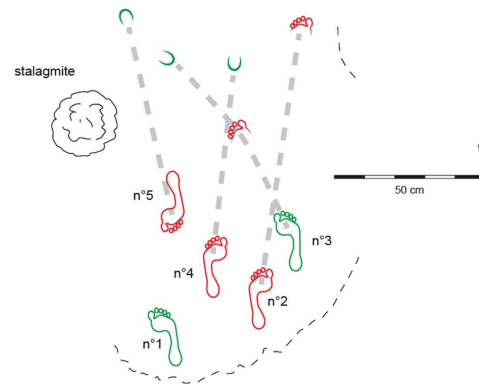
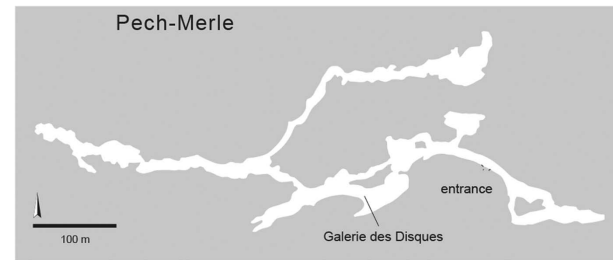


Figure 4. (Colour online) Pech-Merle: investigated area in the ‘Galerie des Disques’. Subjects: no. 1, male (34–35); no. 2, female (25); no. 3, male (9–10); no. 4, male (>50); no. 5, female (30). (Drawing after Duday & García 1983; photograph: Heinrich Wendel.)

one boy, three girls and one unspecified male—with ages ranging from three to 60 years. The individuals were walking mostly in a normal way. However, there are some more specific observations: the 30-year-old woman had slipped (no. 5), the 45-year-old man was going fast (no. 6) and the unspecified male was kneeling (no. 10). Furthermore Ciqae, Kxunta and Thao

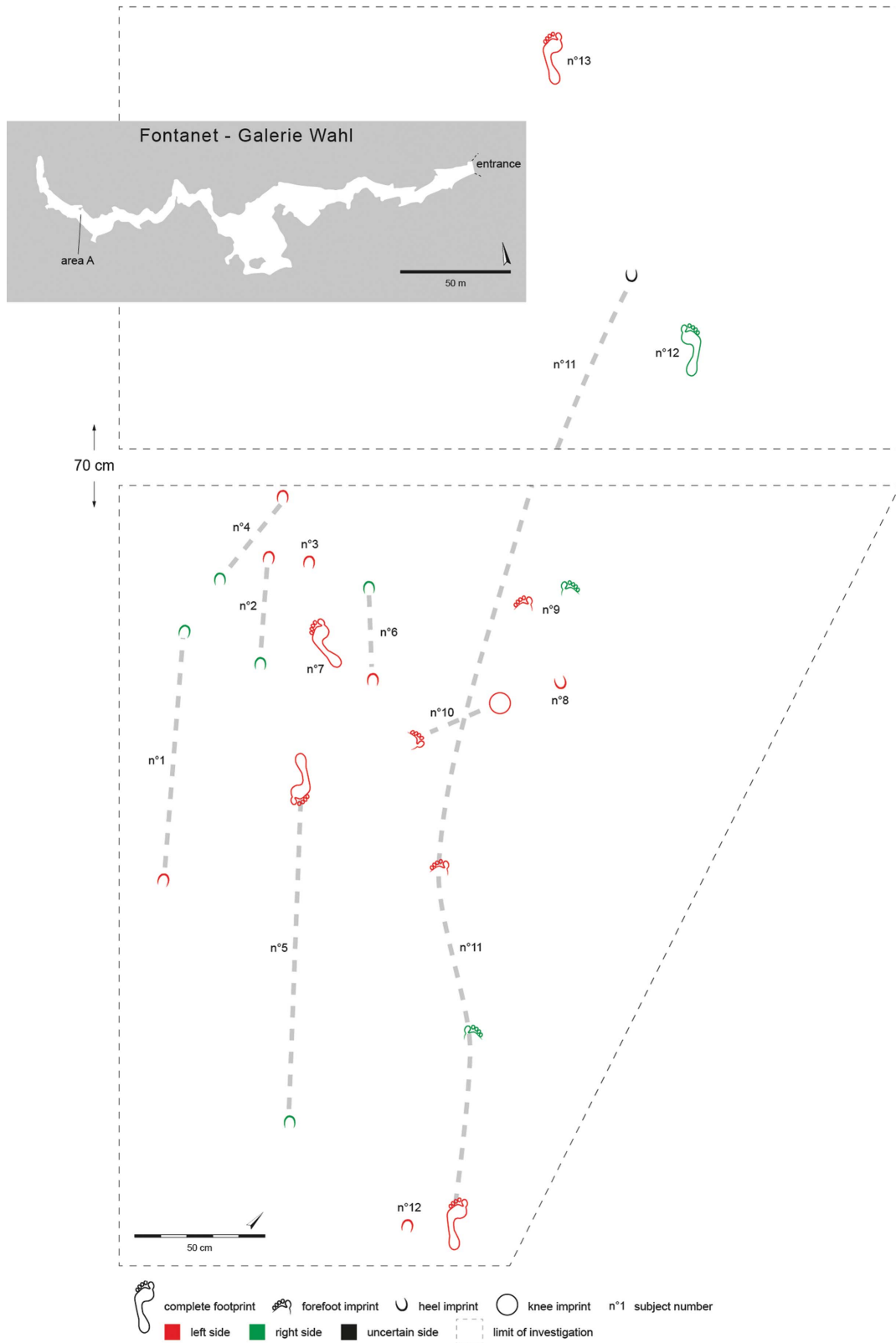


Figure 5. (Colour online) Fontanet, area A: investigated area in the 'Galerie Wahl'. Subjects: no. 1, female (28); no. 2, male (10); no. 3, female (12); no. 4, female (3); no. 5, female (30); no. 6, male (45); no. 7, male (17); no. 8, male (60); no. 9, female (14); no. 10, male (uncertain age); no. 11, male (45), no. 12, male (22); no. 13; male (19).

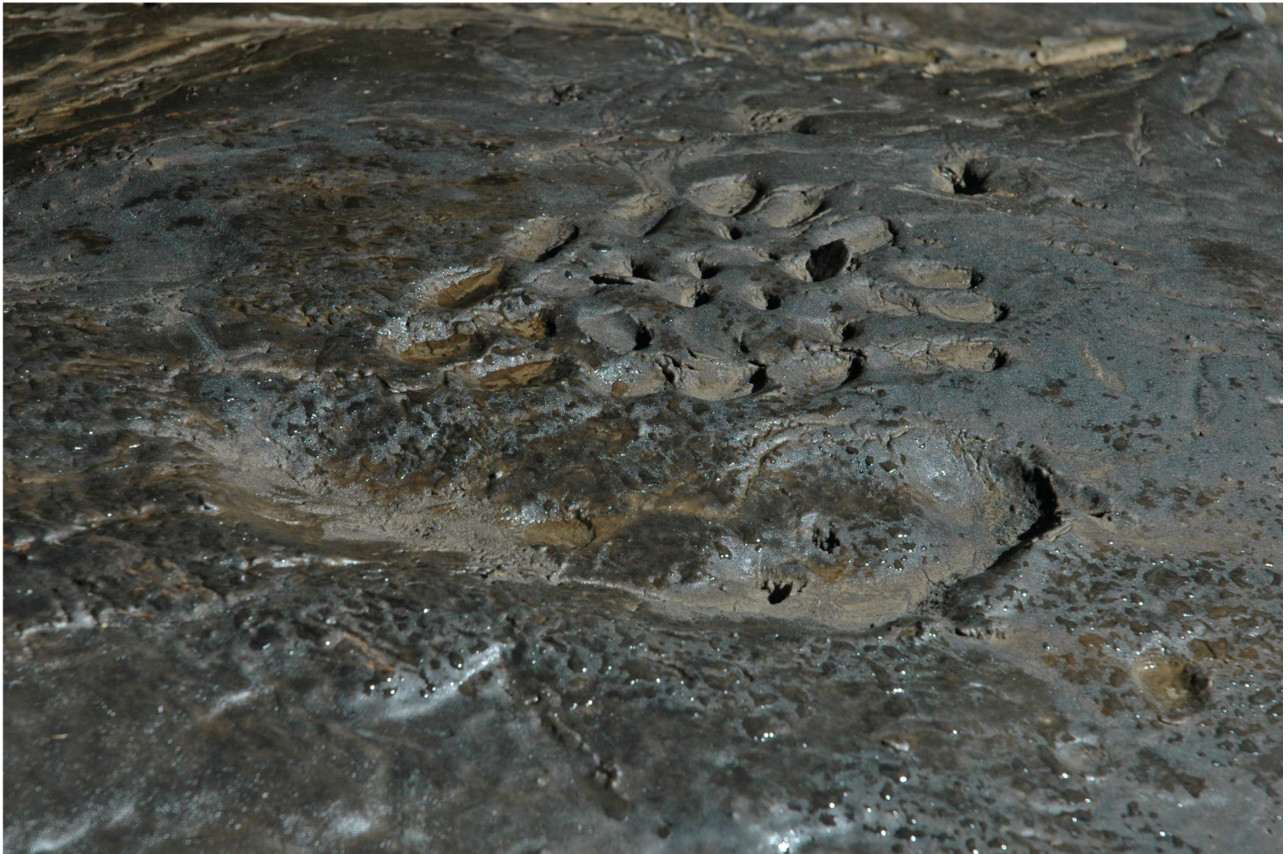


Figure 6. (Colour online) Fontanet: right human shoeless footprint (no. 14) known as ‘pied chaussé’. (Photograph: Vincent Guinot.)

grouped the 28-year-old woman (no. 1) together with the three children (nos. 2, 3 and 4), meaning that they walked together.

On the second area they identified four male individuals between 16 and 50 years old, walking in a normal way (Fig. 7). Their reading of the footprint from a 48-year-old man (no. 14) is remarkable, because they do not confirm the former interpretation of a foot wearing a soft covering. According to Ciqae, Kxunta and Thao the footprint was made barefoot, slightly showing the entire row of toes.

Since the discovery of the Tuc d’Audoubert cave in 1912, researchers have puzzled over the accumulation of heel prints in the ‘Salle des Talons’ nearly 650 m deep inside the cave (Fig. 8). It was in October 1912 that Max and Louis Bégouën, with the help of François Camel, opened a naturally grown closure of siliceous sinter and shed light on the intact upper gallery of the cave with its hundreds of footprints and the spectacular two clay bison at the end. The imprints in the ‘Salle des Talons’ and the two clay bison probably belong together because clay from the adjacent room was used to mould the bison (Bégouën *et al.* 2009).

The hall itself has a surface of nearly 48 sq.m and a partly low roof between 1.2 and 1.5 m clearance. As maintained by Ciqae, Kxunta and Thao, two individuals, a 38-year-old man and a 14-year-old boy, crossed the room diagonally to reach a small clay pit at the southeastern edge (Fig. 9). They went there twice to carry clay, probably for modelling the bison sculptures in the adjacent ‘Galerie des Bisons d’Argile’. This interpretation is based on the observation that the footprints towards the clay pit are only slightly sunk in the ground, while on the way back they are up to 5 cm deep. It is obvious that the two individuals carried additional weight on their way back from the clay pit. Our calculations concerning extracted clay (Fig. 9) suggest that each person carried a maximum 45 kg of clay divided between their two passages. Their way of walking seems puzzling: almost exclusively heels with a mean step width of 25 cm are impressed in the clay. Additionally the trackers found some interesting new imprints: three complete footprints and seven imprints of knees. The imprints of the knees can be differentiated between right and left knee, and in one single case a left footprint is associated with

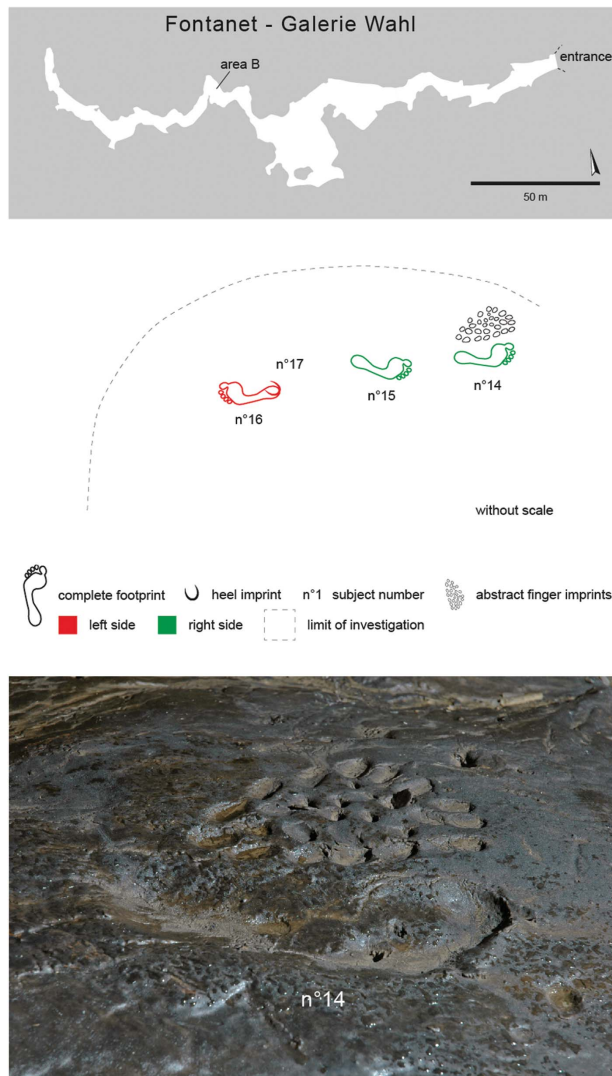


Figure 7. (Colour online) Fontanet, area B: investigated area in the 'Galerie Wahl'. Subjects: no. 14, male (48) 'pied chaussé'; no. 15, male (25); no. 16, male (16); no. 17, male (50). (Photograph: Vincent Guinot.)

the imprint of a right knee. Some of the knee imprints also correlate with meandering lines drawn with fingers in the clay surface, thus evoking a plausible body posture for these activities. Previously, without the knowledge of the knee prints, the production of the meandering lines was an unresolved riddle.

The interpretations of Ciqae, Kxunta and Thao partly conform to the existing ones. Bégouën saw several sequences of heel imprints crossing the room diagonally and facing toward the clay pit (Bégouën 1928). According to him, five or six pathways are recorded, which he interprets as the scenario of a ritual dance of young individuals in the frame of an initiation. Vallois is much more cautious in his in-

terpretation: he saw young individuals walking on their heels deliberately and not forced by local circumstances, such as low ceiling or texture of floor (Vallois 1931). Bégouën's recent publication on Tuc d'Audoubert summarizes the former interpretations and supplements them with some summary statements: 183 imprints from five individuals were counted and it is an open question as to why no complete footprint is present in the 'Salle des Talons' (Bégouën *et al.* 2009).

Discussion

Fundamental to the present investigation is the insufficient knowledge of academically trained scientists in dealing with tracks. Their morpho-metric approach, depending on counting and measuring rather than reading tracks, is unable to translate the data into a narrative about a moment of action by individuals. The alternative, morpho-classificatory approach of track reading as part of IK is a complex application of knowledge from different sources, acquired through a long process of learning and experiencing (Liebenberg 1990; IPACC - Indigenous Peoples of Africa Coordinating Committee 2007). In this method an imprint is a sign which the tracker reads by evoking, before his or her inner eye, the maker of the spoor in a certain posture and activity. Present investigations were instigated in order to find out whether IK can contribute to established knowledge about late Pleistocene visitors to some of the painted caves. Once established, morpho-metric and morpho-classificatory approaches as complementary methods may stimulate each other and produce more reliable results.

In all four caves visited, the old interpretations of human tracks are now flanked by alternative readings which necessitate several revisions (Table 2). Most spectacular may be the identification of toe imprints in the track that was, before, presented in the literature as the only print of a shod foot (Clottes 1975). If pointed out by an expert, the impressions of the toes are recognizable even to an untrained observer, so that the hypothesis of a moccasin cannot really be upheld. For not one of the tracks that had formerly been interpreted as 'ritual dance' or similar ceremonial behaviour was there any corroboration by the trackers. All footprints appear to have been generated by ordinary stride with a few exceptions of a faster pace, thus leaving no space for hypotheses regarding extraordinary behaviour. In none of the caves investigated was there any proven or even potential connection between spoor and the parietal art of the caves. In three cases the hitherto assumed number of active

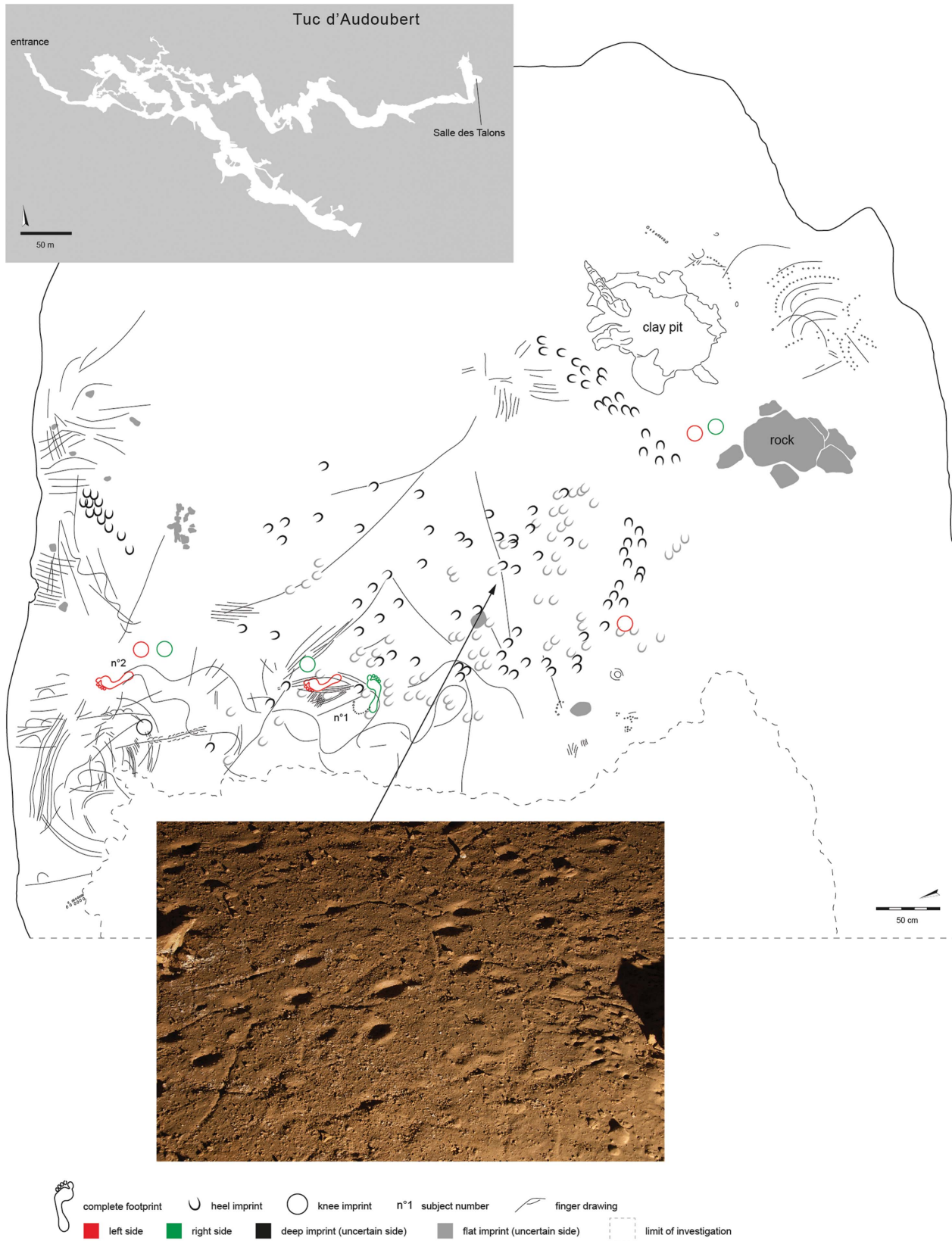


Figure 8. (Colour online) Tuc d'Audoubert: investigated area in the 'Salle des Talons'. Subjects: no. 1, male (38); no. 2, male (14). (Drawing after Bégouën et al. 2009; photograph: Association Louis Bégouën.)

Table 2. Comparison of results: number of subjects. *Plus unspecified large number in Fontanet.

Factual information	'State of the art' according to literature	Tracking in Caves 2013
adult	3–4*	19 ≥14 yrs
child	5–6*	5 <14 yrs
male	–	16
female	1	8
age	young child–adult	3–60 yrs
total	8–10*	24

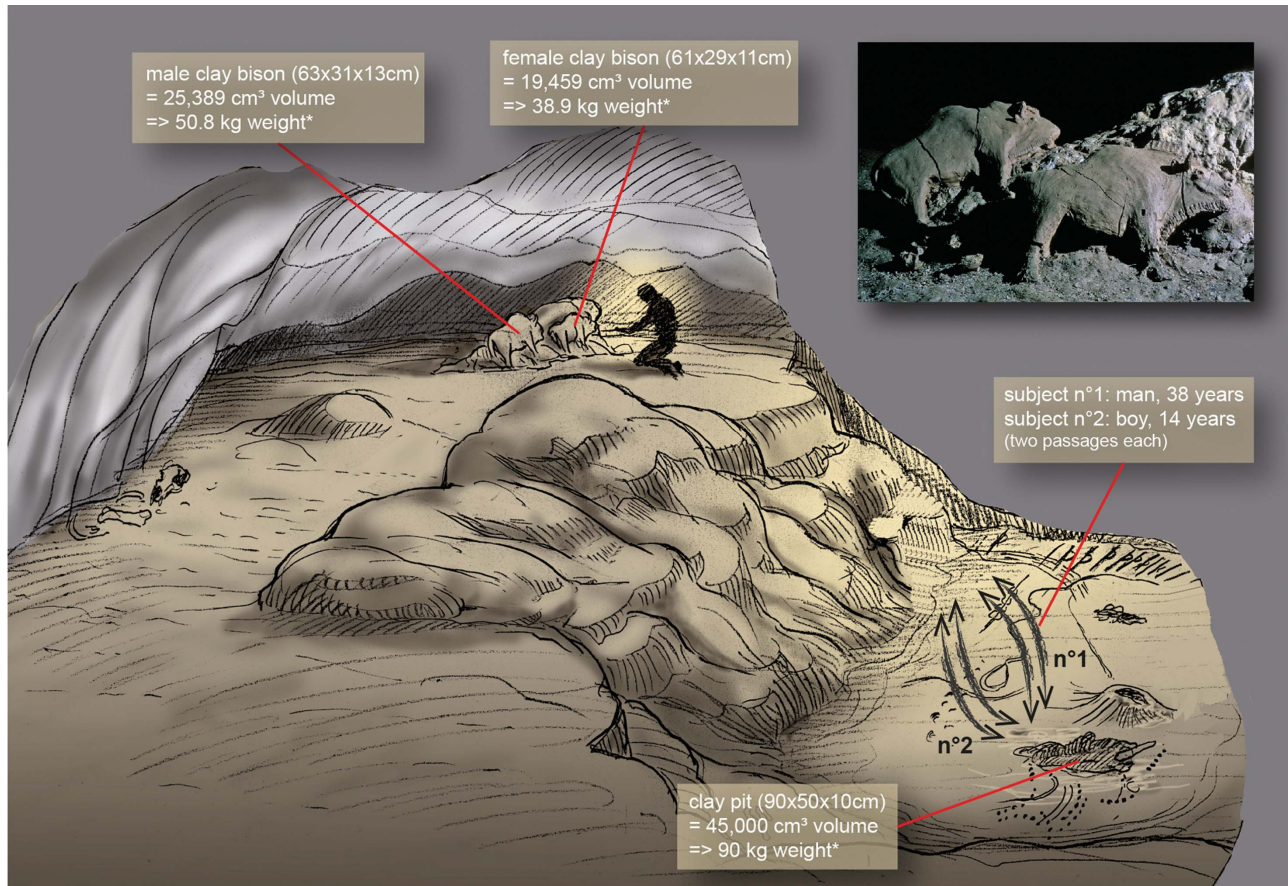


Figure 9. (Colour online) Tuc d'Audoubert: reconstruction of the modelling process of the clay bison by reference to new experience-based reading of the footprints. *Data calculated at 2 kg/1litre of clay as the maximum weight for damp clay. (Document and photograph: Association Louis Bégouën.)

people was either increased (Pech-Merle) or reduced (Niaux, Tuc d'Audoubert).

Notable progress for prehistoric research comes from clues identified at Tuc d'Audoubert, indicating that the man and adolescent boy who consistently walked on their heels were collecting clay for the sculptured bison laid down only 15 m away from the clay pit. As demonstrated above (see Fig. 9), the quantities of clay taken from the pit and those used for the bison match convincingly. The loads carried by the two people in two extraction trips respectively also represent trustworthy scales. Thus it is highly plausi-

ble to link the heel tracks to the production of the bison sculptures. According to the knowledge of the trackers, walking on heels can guarantee anonymity, since a knowledgeable person can recognize someone with whom he or she is acquainted from the full footprint. Remaining anonymous in an action that is linked to some evidently powerful symbolism, i.e. sculpturing bison, may be sufficient motivation for practising a cumbersome way of walking.

A major result of the tracking in caves is the identification of 28 individuals from their footprints (Fig. 10). Some are represented by a single print,

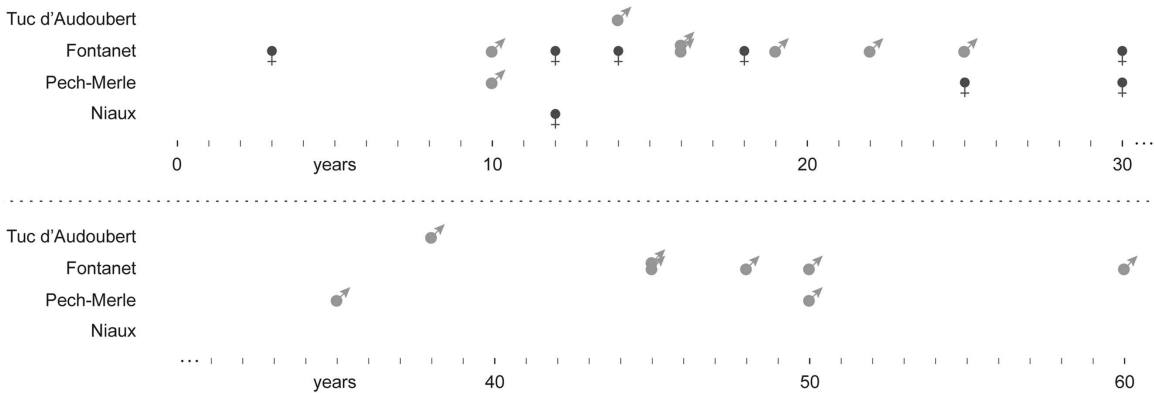


Figure 10. Summary of the concrete results of experience-based reading of late Pleistocene footprints.

others by a sequence of several footprints. Since most footprints under investigation here are probably of Magdalenian date (Bégouën *et al.* 2009; Clottes 1995; Lorblanchet 2010; Vialou 1986), these individuals can be used for some tentative statements as to the demography of cave visitors. There can be no doubt that this statistical base is extremely biased and scattered but the only other source for demographic hypotheses, namely burials from the same period (Orschiedt 2013), is no less biased and lacks consistency to perhaps an even greater extent. Comparing the ‘demographic data’ from the available sources shows the progress which IK can provide for prehistoric research. From these data it becomes obvious that the popular assumption that the painted caves were especially visited by children or adolescents in the context of initiations is not tenable, since their ‘population’ does not seem to be larger in the caves than in an ordinary hunter-gatherer society. Also the youngest child identified during research, being three years old, would not hint at a typical initiation. The only clear demographic imbalance that derives from the new statistics on the tracks concerns the lack of women of more than 30 years of age, while there are eight men ranging from 35 to 60 years. This is almost certainly due to the non-representative sample and may be levelled out if further tracks can be investigated (such as those abounding at Tuc d’Audoubert, Fontanet and Aldène).

The research by indigenous trackers in the painted caves has added much precision to the identification of those individuals who left their footprints some 17,000 years ago. These results provide a new frame of reference for future analyses of the tracks, taking into account the need for further testing and widening of these preliminary findings. Time restriction and research setting of this project allowed no more than an initial collection of impressions. In a more systematic study of tracks, focusing on the rich sites listed above, linguistic research will

be paramount for analysis and understanding of the methodological base of the IK. Presently all factual information presented here is derived from summaries which the interpreter Tsamkxao Ciqae provided after long discussions which the three trackers had among themselves. Word-by-word transcriptions of the audio protocols recorded during these discussions are currently being produced by the Ju/’hoan Transcription Group in Tsumkwe and await epistemological analysis.

Human tracks constitute a source that is comparatively obvious and unambiguous, though replete with information. They are equally accessible to various kinds of knowledge system and therefore may be an ideal prototype for the integration of IK into archaeological sciences, not as an exotic add-on but as a serious interdisciplinary liaison method.

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References

- Ashton, N., S.G. Lewis, I. de Groot, *et al.*, 2014. Hominin footprints from early Pleistocene deposits at Hap-pisburgh, UK. *PLOS ONE*, 9(2). DOI: 10.1371/journal.pone.0088329.
- Bégouën, H., 1928. Les empreintes de pieds préhistoriques. *Congrès International d'Anthropologie et d'Archéologie Préhistorique*, III. Amsterdam, 323-8.
- Bégouën, R., C. Fritz, G. Tosello, J. Clottes, A. Pastoors & F. Faist, 2009. *Le sanctuaire secret des bisons: Il y a 14 000 ans dans la caverne du Tuc d'Audoubert* . . . Paris: Somogy.
- Bennett, M.R. & S.A. Morse, 2014. *Human Footprints: Fossilised Locomotion?* Cham: Springer International Publishing.
- Berkes, F., 2008. *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. New York (NY): Routledge.
- Biesele, M. & S. Barclay, 2001. Ju/'hoan women's tracking knowledge and its contribution to their husbands' hunting success. *African Study Monographs* (Suppl. 26), 67-84.
- Blurton Jones, N. & M.J. Konner, 1976. !Kung knowledge of animal behavior: or: the proper study of mankind is animals, in *Kalahari Hunter-Gatherers*, eds. R.B. Lee & I. DeVore. Cambridge (MA): Harvard University Press, 325-48.
- Boychev, H., 2013. Modern trackers decipher ancient footsteps. *Science* (341), 326.
- Chamberlin, J.E., 2002. Hunting, tracking and reading, in *Literacy, narrative and culture*, eds. J. Brockmeier, M. Wang & D.R. Olson. Richmond: Curzon, 67-85.
- Clottes, J., 1975. Circonscription de Midi-Pyrénées. *Gallia Préhistoire* 18(2), 613-50.
- Clottes, J., 1984. Grotte de Niaux, in *L'art des cavernes: Atlas des grottes ornées paléolithiques françaises*, ed. Ministère de la Culture. Paris: Imprimerie nationale, 416-23.
- Clottes, J., 1995. *Les Cavernes de Niaux: Art Préhistorique en Ariège*. Paris: Seuil.
- Clottes, J., ed., 2001. *La Grotte Chauvet: L'Art des Origines*. Paris: Seuil.
- Clottes, J. & R. Simonnet, 1972. Le réseau René Clottes de la Caverne de Niaux (Ariège). *Bulletin de la Société Préhistorique Française* 69, 293-323.
- Delteil, J., P. Durbas & L. Wahl, 1972. Présentation de la galerie ornée de Fontanet (Ornolac-Ussat-les-Bains, Ariège). *Bulletin de la Société Préhistorique de l'Ariège* 27, 11-20.
- Duday, H. & M.A. García, 1983. Les empreintes de l'Homme préhistorique. La grotte du Pech-Merle à Cabrerets (Lot): une relecture significative des traces de pieds humains. *Bulletin de la Société Préhistorique Française* 80, 208-15.
- Duday, H. & M.A. García, 1985. L'homme et la caverne. *Histoire et Archéologie* (90), 35-9.
- Franklin, N.R. & P.J. Habgood, 2009. Finger markings and the Willandra Lakes footprint site, South-Eastern Australia. *Rock Art Research* 26(2), 199-203.
- IPACC [Indigenous Peoples of Africa Coordinating Committee], 2007. *Southern African Regional Workshop on the Formalisation of the Traditional Knowledge of Tracking: 25-29 September 2006*. Klein Dobe n'lore camp, N/ /oq!'àè-Nyae Nyae Conservancy, Tsumkwe East, Namibia. Claremont.
- Jaubert, J., N. Aujoulat, P. Courtaud, *et al.*, 2012. Le projet collectif de recherche 'Grotte de Cussac' (Dordogne, France): étude d'une cavité ornée à vestiges humains du Gravettien. *Bulletin de la Société Préhistorique de l'Ariège* 65-66, 325-42.
- Kinahan, J., 2013. The use of skeletal and complementary evidence to estimate human stature and identify the presence of women in the recent archaeological record of

- the Namib desert. *South African Archaeological Bulletin* 68(197), 72–8.
- Leakey, M.D. & J.M. Harris (eds.), 1987. *Laetoli: A Pliocene Site in Northern Tanzania*. Oxford: Clarendon.
- Lemozi, A., 1929. *La grotte-temple du Pech-Merle: Un nouveau sanctuaire préhistorique*. Paris: Picard.
- Liebenberg, L.W., 1990. *The Art of Tracking: The Origin of Science*. Cape Town: David Philip.
- Lockley, M., 1999. *The Eternal Trail: A Tracker Looks at Evolution*. Reading (MA): Perseus Books.
- Lockley, M., G. Roberts & J. Yul Kim, 2008. In the footprints of our ancestors: an overview of the hominid track record. *Ichnos* 15, 106–25.
- Lorblanchet, M., 2010. *Art pariétal: Grottes ornées du Quercy*. Rodez: Éditions du Rouergue.
- Marshall Thomas, E., 1988. *The Harmless People*. Cape Town: David Philip.
- Orschiedt, J., 2013. Bodies, bits and pieces: burials from the Magdalenian and the Late Palaeolithic, in *Pleistocene Foragers: Their Culture and Environment: Festschrift in honour of Gerd-Christian Weniger for his Sixtieth Birthday*, eds. A. Pastoors & B. Auffermann. Mettmann: Neanderthal Museum, 117–32.
- Pales, L., 1976. *Les empreintes de pieds humains dans les cavernes: Les empreintes du réseau nord de la caverne de Niaux (Ariège)*. Paris: Masson.
- Pales, L. & D. Vialou, 1984. Grotte de l'Aldène, in *L'Art des Cavernes: Atlas des Grottes Ornées Paléolithiques Françaises*, ed. Ministère de la Culture. Paris: Imprimerie nationale, 340–42.
- Pasda, C., 2013. Zu Fuss – Spurenfossilien des eiszeitlichen Menschen, in *Pleistocene Foragers: Their Culture and Environment: Festschrift in honour of Gerd-Christian Weniger for his Sixtieth Birthday*, eds. A. Pastoors & B. Auffermann. Mettmann: Neanderthal Museum, 51–70.
- Raichlen, D.A., H. Pontzer & M.D. Sockol, 2008. The Laetoli footprints and early hominin locomotor kinematics. *Journal of Human Evolution* 54, 112–17.
- Stander, P., // . Ghau, D. Tsisaba, // . #Oma & / . /Ui, 1997. Tracking and the interpretation of spoor: a scientifically sound method in ecology. *Journal of Zoology* 242, 329–41.
- Trombe, F. & G. Dubuc, 1947. *Le Centre Préhistorique de Ganties-Montespan (Haute-Garonne)*. Paris: Masson.
- Vallois, H.V., 1928. Etude des empreintes des pieds humains du Tuc d'Audoubert, de Cabrerets et de Ganties. *Congrès International d'Anthropologie et d'Archéologie Préhistorique*, III. Amsterdam, 328–35.
- Vallois, H.V., 1931. Les empreintes de pieds humains des grottes préhistoriques du Midi de la France. *Palaeobiologica* 4, 79–98.
- Vialou, D., 1986. *L'Art des Grottes en Ariège Magdalénienne*. Paris: CNRS.
- Webb, S., 2007. Further research of the Willandra Lake fossil footprint site, southeastern Australia. *Journal of Human Evolution* 52, 711–15.
- Webb, S., M.L. Cupper & R. Robins, 2006. Pleistocene human footprints from the Willandra Lakes, southeastern Australia. *Journal of Human Evolution* 50(4), 405–13.
- Wong, P.B.Y., P. de Van Coeverden Groot, C. Fekken, et al., 2011. Interpretation of polar bear (*Ursus maritimus*) tracks by Inuit hunters: inter-rater reliability and inferences concerning accuracy. *The Canadian Field-Naturalist* 125, 140–53.

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Tilman Lenssen-Erz is senior researcher at the Institute of Prehistoric Archaeology (African Archaeology) at the University of Cologne, with interests in the analysis and interpretation of rock art. He conducted the publication series about the Brandberg rock art, including the 2001 volume *Gemeinschaft—Gleichheit—Mobilität. Felsbilder im Brandberg, Namibia, und ihre Bedeutung. Grundlagen einer textuellen Felsbildarchäologie*. Köln: Heinrich-Barth-Institut (Africa Praehistorica, 13).

Tsamkxao Ciqae, Ui Kxunta and Thui Thao are specialized trackers from the Ju/'hoan San of Tsumkwe (Namibia). They were taught by their elders to recognize animal and human tracks, and to use their knowledge of animal behaviour and the environment to hunt and gather to feed their families. Currently all are working in ecotourism and photographic safari businesses in Namibia.

Robert Bégouën, as conservator of the Louis Bégouën Association manages all necessary aspects of the property, conservation and study of the Volp Caves (Tuc d'Audoubert, Les Trois-Frères and Enlène). He has conducted research and published widely on cave art and mobile art.

Megan Biesele, since 1970, has been undertaking anthropological research with the Ju/'hoan San of Botswana and Namibia, teaching and publishing on topics from their religion and folklore to their political history since Namibian independence. As co-founder and director of the Kalahari Peoples Fund, she raises awareness of indigenous causes in southern Africa.

Jean Clottes was, until 1999, Scientific Advisor at the French Ministry of Culture for prehistoric rock art. He is the editor of the *International Newsletter on Rock Art*, and is particularly interested in all aspects of rock art, including its meaning and age, as well as its interpretation for the public. He is known especially for his work at the Grottes Cosquer and Chauvet.