Walking along the oldest human fossil pathway (Roccamonfina volcano, Central Italy)?

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ABSTRACT

Here we report the remarkable superposition of a pre-historic trackway (349-350 ± 3 Ka) with one used in more recent historical times, potentially forming one of the oldest path or trackways currently known. A Plinian eruption of the Roccamonfina Volcano resulted in a succession of pyroclastic flows. A combination of syn-sedimentary erosion and depositional morphology resulted in a bench contouring the depositional slope. Prior to rapid lithification of the flow early human ancestors used the bench as a route-way. At least two individuals diverted from this route-way to make the famous Trackways A and B of the Devil's Trails which have been described previously. The bench and associated animal tracks were covered by subsequent pyroclastic ash falls before being exhumed in historical times by a combination of natural erosion and quarrying. The bench was re-used as a route-way at this time and some of the tracks modified by human action to improve surface conditions and perhaps drainage. The P1-Trackway is the result and its detailed morphology is described here. Not only does it provide remarkable evidence of the convergence of route-ways through time along key geomorphological features in the landscape but the palimpsest of tracks provides a useful case study for archaeologists and ichnologists interpreting complex and superimposed

surface traces.

KEYWORDS

Roccamonfina Volcano, Devil's Trails, Ciampate del diavolo, human footprints, ichnology

1.Introduction

Human tracks record a range of archaeological evidence (Bennett and Morse, 2014; Panarello, 2016), including: (1) evidence of presence; (2) biometrics such as stature for the track-making populations; (3) ecological associations where the tracks are associated with animal tracks; (4) biomechanical inferences where track depth is equated in some way to plantar pressure; and (5) behavioural characteristics of the track-maker or associated population. Behavioural characteristics are of particular importance and have been subject to a number of recent papers. For example, inferences have been made about group hunting behaviour for tracks at Ileret in northern Kenya (Roach et al., 2016; Hatala et al., 2016). Similar children tracks associated with domesticated animals have been described as revealing a potentially 'playful' disposition and clearly show children tending domesticated flocks (Bennett et al., 2014). Particularly interesting in the context of behaviour are the remarkable tracks at Roccamonfina (Italy) which are deposited uniquely on a steeply inclined surface and indicate rapid downslope movement of at least two individuals. The Roccamonfina tracks were the oldest human tracks outside Africa prior to the discovery of those at Happisburgh (Ashton et al., 2013). The Roccamonfina tracks have been dated by $^{40}Ar/^{39}Ar$ to 349-350 ± 3 Ka (Scaillet et al., 2008; Santello, 2010) and are preserved on an eroded pyroclastic flow shortly after its deposition. The well-known part of the site contains two trackways (Trackways A and B) which zig-zag down a steep slope and have been widely described (Mietto et al., 2003; Avanzini et al., 2008; Fig. 1). Less well known is the trackway from which these two tracks start which is located on a terrace or bench which contours parallel to the slope. This trackway is known as the P1-Trackway and is normally hidden by the metal walkway which acts as a viewing platform (Fig. 2). This trackway is also important because it has been modified post-lithification through the use of the bench/terrace as route-way by villagers over a number of years. Modifications provide a challenge to the interpretations of the tracks, but also add information pertinent to the recognition of intact, true tracks from those modified subsequently by human action. As such it contains important and useful information for the interpretation of tracks more widely. Further it shows the extended use over millennia of as a pathway, or route-way, located on a prominent geomorphological feature and as such potentially forms one of the oldest known route-ways.

2. Geological Setting

P1-Trackway lies within the "Devil's Trails" ("Ciampate del diavolo") paleontological site and is located on the north-eastern side of the Roccamonfina volcano (Fig. 1). It is situated on the top of the same BLT (*Brown Leucitic Tuff*) zeolitized layer which preserves the well-known Roccamonfina Middle-Pleistocene human fossil footprints known as “Devil’s Trails” or “Ciampate del Diavolo” (Mietto et al., 2003; Avanzini et al., 2008; Fig. 2). The BLT formation is the result of series of explosive eruptions (Plinian to Sub-Plinian types) that took place during the second volcanic eruptive phase of the Roccamonfina volcano and that deposited series of pyroclastic flows. The stratigraphy of the BLT reflects the evolution of pyroclastic currents originated by collapses of eruptive columns. Geochemical and petrographical characteristics of the BLT Roccamonfina volcanic rocks are commonly subdivided into two geochemical series: high K (HK) and low K (K) defined the HK series to encompass ne- and lc-normative leucite-bearing lavas, and the K series to include Qz-normative olivine basalts, trachybasalts, and biotite augite latites. The extensive analyses made on the whole rocks samples of the pyroclastic flow units testify that BLT rocks mainly belong to HK series (Luhr and Giannetti, 1987).The lithification by zeolitization of the formation occurred very shortly after deposition. The stratigraphic position of P1-Pathway is on the top of the stratigraphic layer called LS7 (Fig. 1b). LS7 stratigraphic unit is covered and sealed by another pyroclastic one, which is called LS8. Between LS7 and LS8 a discontinuity layer ranging from 2 to 11 cm in thickness is clearly visible. This discontinuity layer is subdivided into two further subsets called α and β. The lower unit (α) resting directly on the top of LS7 is composed of tiny crystals of K-feldspars, Augite and Biotite and of small lithic and juvenile fragments sizing less than 10 mm. β-unit (orange-grey coloured) (Fig. 1c) rests on the top of α-unit and behind the bottom of LS8. It ranges from 1 to 10 cm in thickness and is mainly composed of tiny ash-fragments (1-3 mm thick) and of crystals of Augite, Sanidine, Ti-Biotite and minor Zeolites. The described stratigraphical succession is clearly visible everywhere.

3. Methods

All significant depressions on the bench/terrace which contains P1-Trackway were georeferenced with a Garmin Etrex© 10 (accuracy of ±3 m). Then they were all photographed and photogrammetrical models made using AgisoftPhotoScanProTM (ver. 0.9.0 build 1586) and KitwareParaViewTM (ver. 3.98.1.64). (Cameras used: Canon EOS 450D, Canon© EOS 550D, Canon© EOS 60D, Canon©*PowerShot* G9 cameras and Canon© EF-S 18-200mm and Sigma© 12-24mm II DG HSM lenses). Each segment was scaled on the

94 basis of a 10 cm long metallic bar. The parameters of each figured model are shown in Table 1, which is
95 filled according to the method suggested by Lockley et al. (2015).
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Table 1.
Parameters of the photogrammetric models

Figured model	Figure	Number of images	Camera Model	Image Resolution	Focal Length	Error	Resolution
Segment P1_01	3	25	Canon EOS 450D	4272 x 2848	18-20 mm	0.564506 pix	0.00230989 m/pix
Segment P1_02	3	26	Canon EOS 450D	4272 x 2848	18-20 mm	0.591884 pix	0.00234768 m/pix
Segment P1_03	3	29	Canon EOS 450D	4272 x 2848	18-20 mm	0.797966 pix	0.00250807 m/pix
Segment P1_04	3, 4, 5	59	Canon EOS 450D	4272 x 2848	18-20 mm	0.859301 pix	0.00220695 m/pix
Segment P1_05	3, 4, 5	23	Canon EOS 450D	4272 x 2848	18-20 mm	0.593573 pix	0.00225153 m/pix
Segment P1_06	3, 6, 7	46	Canon PowerShot G9	4000 x 3000	7,4-9,036 mm	0.60885 pix	0.00158813 m/pix
Segment P1_07	3	73	Canon PowerShot G9	4000 x 3000	7,4 mm	0.697667 pix	0.00139306 m/pix
Segment P1_08	3	59	Canon PowerShot G9	4000 x 3000	7,4 mm	0.73908 pix	0.00203004 m/pix
Segment P1_09	3, 8	42	Canon PowerShot G9	4000 x 3000	7,4 mm	0.72933 pix	0.00178023 m/pix
Segment P1_10	3, 9	77	Canon PowerShot G9	4000 x 3000	7,4-9,855 mm	0.827783 pix	0.0020629 m/pix
Segment P1_11	3	54	Canon PowerShot G9	4000 x 3000	7,4 mm	0.73323 pix	0.00248915 m/pix
Segment P1_12	3	45	Canon PowerShot G9	4000 x 3000	7,4-8,205 mm	0.589531 pix	0.00215708 m/pix
Segment P1_13	3	79	Canon PowerShot G9	4000 x 3000	7,4 mm	0.741622 pix	0.00189519 m/pix
Segment P1_14	3	67	Canon PowerShot G9	4000 x 3000	7,4 mm	0.718196 pix	0.00208611 m/pix
Segment P1_15	3, 10	82	Canon PowerShot G9	4000 x 3000	7,4 mm	0.727266 pix	0.00223685 m/pix
Segment P1_16	3	34	Canon PowerShot G9	4000 x 3000	7,4 mm	0.693991 pix	0.00208994 m/pix
Segment P1_17	3	42	Canon PowerShot G9	4000 x 3000	7,4 mm	0.701934 pix	0.00179714 m/pix
Segment P1_18	3	52	Canon PowerShot G9	4000 x 3000	7,4 mm	0.625804 pix	0.00184557 m/pix
Segment P1_19	3, 11, 12	77	Canon PowerShot G9	4000 x 3000	7,4 mm	0.684919 pix	0.00198457 m/pix
Segment P1_20	3	57	Canon PowerShot G9	4000 x 3000	7,4-8,205 mm	0.729331 pix	0.00281392 m/pix
Segment P1_21	3	27	Canon EOS 60D	5184 x 3456	18-20 mm	0.919064 pix	0.00260873 m/pix
Segment P1_22	3	9	Canon EOS 60D	5184 x 3456	18 mm	0.780295 pix	0.00125485 m/pix
Segment P1_23	3	67	Canon PowerShot G9	4000 x 3000	7,4 mm	0.654285 pix	0.00272875 m/pix
Segment P1_24	3	98	Canon PowerShot G9	4000 x 3000	7,4 mm	0.663599 pix	0.00223249 m/pix
Segment P1_25	3	163	Canon PowerShot G9	4000 x 3000	7,4 mm	0.649191 pix	0.0022528 m/pix
P1_15_Det4a-b	10	12	Canon EOS 550D	5184 x 3456	18-50 mm	1.02933 pix	0.000615674 m/pix
P1_19_Det.1	11	12	Canon PowerShot G9	4000 x 3000	7,4 mm	0.583588 pix	0.000440926 m/pix
P1_19_Det.2-3	12	45	Canon EOS	5184 x	18-50	0.792757	0.000651455

	550D	3456	mm	pix	m/pix

4. Description of the P1-Trackway

The trackway has been subdivided, from West to East, into 25 segments (Fig. 3) for ease of description. Each segment was identified with the help of numbering on the support stanchion for the metallic footbridge which was put in place in 2007 (Panarello, 2009). As a whole the trackway is 53.19 m long and ranges in width from 1.40 m to 3.21 m (start: N41°19.954'-E14°01.466', ends: N41°19.962'-E14°01.496'). The altitude ranges from 292±3 m a.s.l. at the start (west) to 283±3 m a.s.l. in the east. We recognise several superimposed levels of human traces on this surface. The lowest surface contains the human footprints linked to those already described for Trackways A and B (Mietto et al., 2003; Avanzini et al., 2008; Scaillet et al., 2008; Santello, 2010). Superimposed on these traces is evidence for the subsequently, post-lithification, smoothing of the tracks by the passage of both human and animals in additions to active carving/quarrying of the surface in historical times. A detailed description of the traces present in each section of the trackway is provided in Table 2.

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Section(s)	Description	Figures
P1_01 to P1_03	Poorly preserved and characterized by invasive alterations of the original ground due to both natural and anthropic actions. Lots of metal-tool marks are visible. However, in the same area, some notable elements are also visible: 1) a pronounced hump whose top is at higher quota than that of the bottom of LS8 (this enable us to consider it as an actual and survived displacement-rim created by prehistoric trampling of the originally soft and wet ground); 2) three winding troughs or grooves that sometimes interweave themselves so marking three possible directions of walking. These troughs all proceed in some subsequent segments of path.	Fig. 3
P1_04	Although significantly altered by both anthropic and natural action, a succession of three interesting depressions on the ground survives. This succession of hollows is about 90 cm long and consists of cavities (P1_04_a; P1_4_b, P1_04_c) which are dimensionally compatible with other actual human footprints preserved in the same site (Mietto et al. 2003 and Avanzini et al., 2008). Their length, in fact, ranges from 19 to 22 cm and their width ranges from 7 to 9 cm.	Figs. 3, 4
P1_05	Preserves a deep central trough flanked by wavy ridges and a succession of at least three depressions on the ground (P1_05_a, P1_05_b, P1_05_c) which is both morphologically and dimensionally compatible with aligned human footprints: the best preserved and reliably measurable of them (P1_05a) is, in fact, 25cm long and 10 cm wide. Moreover, although altered by weathering, by modern trampling and by metallic tools, the three footprints preserve their general morphology and their medial concavity, which is always oriented to the line of progression. It is worth noting that P1_5a preserves also a slight hump in its medial side which can be well interpreted as a displacement-rim.	Figs. 3, 4, 5
P1_06	Structurally different from the previous segment and preserves at least one interesting depression on the ground (P1_06_a), which is both morphologically and dimensionally compatible with the other actual fossil footprints preserved in the same site. Actually, although partially altered, the depression P1_6_a is still reliably measurable and is 27 cm long and about 11.8 cm wide. It can be interpreted as a footprint left by right foot and seems to be oriented westward, i.e. in the opposite walking direction with the respect to other already recorded footprints. Furthermore, the footprint P1_6_a is preserved in an area in which a superimposition of human footprints randomly oriented seems to be visible.	Figs 3, 6
P1_07	Human footprint (P1_07_a) is preserved. Just like all the other described hollows, the structure of P1_07_a is altered by metallic tools but it still preserves clearly visible the heel-strike zone, the longitudinal medial arch and the ball area. These details enable us to consider it as a partially altered human footprint created by the pressure of a a right foot: it is 24.8 cm long and 9.9 cm wide.	Figs. 3, 7
P1_08 to P1_13	No ichnological evidence. However, in this area the three original troughs are made to converge in an unique and wider groove by recent anthropic cuts. A great amount of signs left by small picks and by hoes are clearly visible everywhere, but they are more evident on the upstream side. Cutting of the tuff-ground starts in the segment P1_09 and follows up to the segment P1_13, where it stops. It is, here, very evident the point in which the carvers left their purpose to merge the three original troughs into one wider groove In the area of the segment P1_13 some other depressions very similar to animal tracks are visible on the ground. Finally, within the segment P1_10 a wide area with extensive and evident mud-cracks is preserved This is important because gives us evidence that the top of LS7 is really the prehistoric trampled surface.	Figs. 3, 8
P1_14	The upstream part of this section is quite completely undamaged. In its central part it preserves the continuation of the narrow through which started in the preceding section. Within its width (about 20 cm) at least two kidney-shaped hollows are visible. They are about 26 cm long and have their concavities alternately facing the medial side. They appear to be compatible with poor preserved human fossil footprints but no anatomical detail is preserved to support this possibility. Some other hollows with an apparent displacement rim are preserved in the same section. They could be animal footprints but they are until under study.	Fig. 3
P1_15	One the most important segments of P1-Pathway. On its ground, hence, we can observe a significant element which enables us to confirm that P1-Pathway is really a prehistoric fossil pathway: the starting point of the *Trackway A* of "Devil's Trails" (Mietto et al., 2003 and Avanzini et al., 2008). In this point, actually, the ancient trackmaker left his walking along the muddy ledge of the slope and decided to move downwards. Here, some aligned depressions, geometrically compatible with a human gait-pattern, are clearly visible and, although deeply altered by recent cut, they cannot be misinterpreted. They are, hence, in the unique position from which the "Trackway A" can branch off. On the ground of the same segment P1_15 some animal footprints are also visible. They seem to be referred to some small ungulate	Figs. 3, 9, 10
P1-16 to P1_18	No relevant details are evident, except for one winding groove.	Fig. 3
P1_19	The most important element of P1-Pathway is preserved in this segment in the form of a left human footprint (P1_19a) whose recent alteration was not completed. On its general structure, it is very evident a regular cut along the lateral margin of the footprint and it is also evident the starting point of the cut in the heel-zone of the medial side. In the same zone a small square cut 4 cm wide is also visible. The proximal and the distal part of the same footprint, although both altered by cuts, still preserve enough details to enable us to unmistakably consider P1_19_Det.1 as an actual human fossil footprint since it preserves the heel-strike zone, the ball area and the medial longitudinal arch. The footprint P1_19a is 21 cm long and 10.5 cm wide. These dimensions are perfectly compatible with those of the other human footprints	Figs. 3, 11

	found in the same site and, specifically, with those of the footprints of the "*Trackway B*" of "Devil's Trails" (Mietto et al., 2003 and Avanzini et al., 2008). This trackway has its starting-point a little further, in the segment P1_23. It's worth noting that in the same area extensive mud-cracks are preserved.	
P1_18 to P1_24	Other perfectly preserved mud-cracks are located along the upstream margin from segment. They are associated to many possible animal footprints, which are still under study.	Figs. 3, 4, 11, 12

Table 2: Detailed description of both natural tracks/traces and subsequently modification in historical times

5. Discussion

The best-preserved part of P1-Trackway is located between segment P1_13 and segment P1_19 (Table 2). There are a number of marks left by quarrying and by pack animals superimposed on the original pre-historic tracks. The site was used for the extraction of blocks for building purposes in historic times. Other significant damage to the original ground surface were made by frequently footfall especially during the 17th and 18th centuries, when the pathway was regularly used by people living in the near village of Foresta to reach a water well located in this area and to bring cereals to the watermill located at the stream of water called "Fosso Rionale" (Panarello, 2005). Three original troughs between segments P1_10 and P1_13 show signs of quarrying presumably aimed at merging the tracks into one wider depression. This process was never completed and an interrupted rock cut is visible in segment P1_13, together with numerous signs left by small picks on the upstream sidewall of the trough. The type of pick used for the carving suggests that the first intervention may have taken during Middle times (Cagnana, 2000). The last alteration of P1-Trackway probably took place between 1807-1833 (De Angelis, 2009) when a series of floods destroyed, or at least significantly altered, the network of local trails and shortcuts. This may have made it necessary to widen the walkable space of P1-Trackway. In addition we suggest that the floods may have unearthed the surface of the P1_19, on which the most important pre-historic tracks are preserved (i.e they were buried until this point). Such evidence, here called P1_19_Det. 1, is a partially altered left-foot human footprint (Fig. 11).

The cut marks at P1_19_Det. 1 allows one to understand how, and potentially with what tools, the prehistoric footprints were altered in historical times. The lateral margin of the footprint was almost completely removed by a longitudinal cut and the proximal medial wall was modified by another clear cut produced by a small pick 40 mm wide. The proximal and the distal part of the footprint were also affected by cuts, but they were not altered enough to completely erase the anatomical details of the foot (heel-strike, ball, plantar arch, medial concavity). As a result, P1_19_Det.1 is an actual human fossil footprint which was partially enlarged to house the boots of human workers and the shoes of pack animals in order to make safer their walking along a dangerous and slippery path. Quite understandably, carvers did not create new cavities, but preferred to alter existing ones. Despite these alterations, the general pattern of P1-Pathway

142 was not significantly changed, quite clearly preserving inside its space the meandering direction and the
143 right/left series of the original footprint hollows.
144 Other human fossil footprints are preserved within the segments P1_04, P1_05, P1_06 and P1_07
145 (Fig. 4; Fig. 5; Fig. 6, Fig. 7). They are fully compatible with the general dimensional range of human foot and
146 footprints (Avanzini et al., 2008; Meredith, 1944; Tuttle, 1987; Tuttle et al., 1990; Garcia, 2005; Bennett et al.,
147 2009; Kim et al., 2009; Schmincke et al., 2010; Bates, 1950), and specifically with the dimensional range of
148 the actual human fossil footprints existing in the same site (Mietto et al., 2003; Avanzini et al., 2008). All
149 surveyed depressions located in the space of P1-Trackway, whether altered or not, are in fact aligned,
150 despite some breaks, in alternate right/left positions and are dimensionally compatible with human footprints.
151 Furthermore, *"Trackway A"* and the *"Trackway B"* of "Devil's Trails" (Mietto et al., 2003; Avanzini et al., 2008)
152 branch off precisely from there.
153 It is worth noting that the depressions of P1-Trackway cannot be confused with more recent
154 depressions made by cutting the tuff: prehistoric alterations of the original ground are all aligned along the
155 most external border of the path, where recent human and animal frequentation has become very dangerous
156 especially during the rainfalls, when the ground surface is particularly slippery. Furthermore, some cavities
157 inside segments P1_05 and P1_09 still preserve a slight displacement rim and a bean-shaped aspect always
158 turning their concavity to the medial line of progression. It is worth nothing that although the main direction of
159 P1-Pathway is from West to East, at least two segments (P1_05 and P1_06; Fig. 5; Fig. 6) preserve some
160 footprints oriented in the reverse walking direction. This can only mean that prehistoric trackmakers walked
161 in both the directions.
162
163 **6. Conclusions**
164 The surface terrace/bench on which P1-Trackway runs contains a complex palimpsest of traces dating from
165 both pre- and post-lithification, as such it provides an important resource for those interpreting track sites that
166 have been used and modified over extended periods. After the cooling of the pyroclastic flow, and during the
167 last phase of geological alteration process dating to 349-350 ± 3 Ka (Scaillet et al., 2008; Santello, 2010),
168 unshod humans and animals walked along this mud-rich ash surface leaving their footprints. Both the more
169 famous track-makers responsible for Trackways A and B, took this route before heading steeply down slope.
170 The tracks were subsequently covered by a light and fine-grained tephra (Fig. 1b), which allowed them to dry
171 and preserved them from the later pyroclastic flows (LS8), which shows a lower degree of lithification
172 (Santello, 2010). The original surfaces were exhumed by erosion.

Intriguingly this pre-historic route way became re-used in historical times, particularly as the bench contours the steep slope providing a natural pathway (Bates, 1950). Cutting of the margin of overlying LS8 tuff by quarrymen and farmers enhanced this natural terrace improving its functional use (Panarello, 2008). The features of P1-Pathway seem to match very well also the characteristics described by Timothy Earle (Earle, 2009) to distinguish paths from trails and roads, since P1-Pathway had some logistic functions, local spatial extent and was probably walked every day. Some other prehistoric pathways are known at Must Farm (Eastern England; Knight, 2009), in the Chaco Valley (New Mexico; Kantner, 1996, 2004; Duff et al., 2012), in the Arenal volcano area (Costa Rica; Mckee et al., 1994; Sheets, 2009), in the "Colorado Plateau" (USA) (Ives, 1942), near the prehistoric village of Hohokam of Snaketown (Arizona; Motsinger, 1988), in the Rano Raraku quarry area (Easter Island; Lipo and Hunt, 2005), in the Palpa area (southern Perù; Lambers and Sauerbier, 2006; Eisenbeiss et al., 2007), and elsewhere (Snead et al., 2009). Their age though cannot be compared with that of P1-Pathway: in fact, other fossil pathways which can be dated to an age older than 349-350 ± 3 Ka (Scaillet et al., 2008; Santello, 2010) are not known anywhere in the world. P1-Trackway must be hence considered the oldest human pathway known up to now in the world.

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Figure captions

Fig. 1. "Ciampate del Diavolo" ("Devil's Trails") paleontological site (Roccamonfina volcano area, central Italy); a: Location; b: Geological stratigraphy; c: Detail stratigraphy of the contact between LS7 and LS8; d: Model surface of the whole bench with Trackways A and B and their relationship to P1-Trackway.

Fig. 2. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site; a: General view; b: Detail image of the steel walk way structures; c: Detail photo of the last segment of Trackway A; d: Detail photo of the terminal part of Trackway B.

Fig. 3. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site: overhead view of P1-Trackway with locations and the numbering of the metal supports of the walkway.

Fig. 4. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site; Detail image of the contact point between segments P1_04 and P1_05 (external margin); a: overhead photo; b: depth map; c: contour map (1 mm contour intervals).

Fig. 5. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site, segment P1_05; a: Western view of segment P1_05 (1 bar = 10 cm); b: detail photo of the footprint P1_05a; c: contour map (1 mm contour intervals) of the footprint P1_05_a; d: depth map of the succession P1_04_d, P1_05_a, P1_05_b, P1_05_c (view from the North).

Fig. 6. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site, segment P1_06 (1 bar = 10 cm); a: Western view of the segment P1_06; b: detail photo of footprint P1_06_a; c: contour map (1 mm contour intervals) of the footprint P1_06_a; d: depth map of the succession of depressions on the ground including P1_06_a (view from the North).

Fig. 7. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site, segment P1_07; a: Western view of segment P1_07 (1 bar = 10 cm); b: detail photo of the possible footprint P1_07_a; c: contour map (1 mm contour intervals) of the footprint; d: depth map of the succession of depressions on the ground including P1_07_a (view from the North).

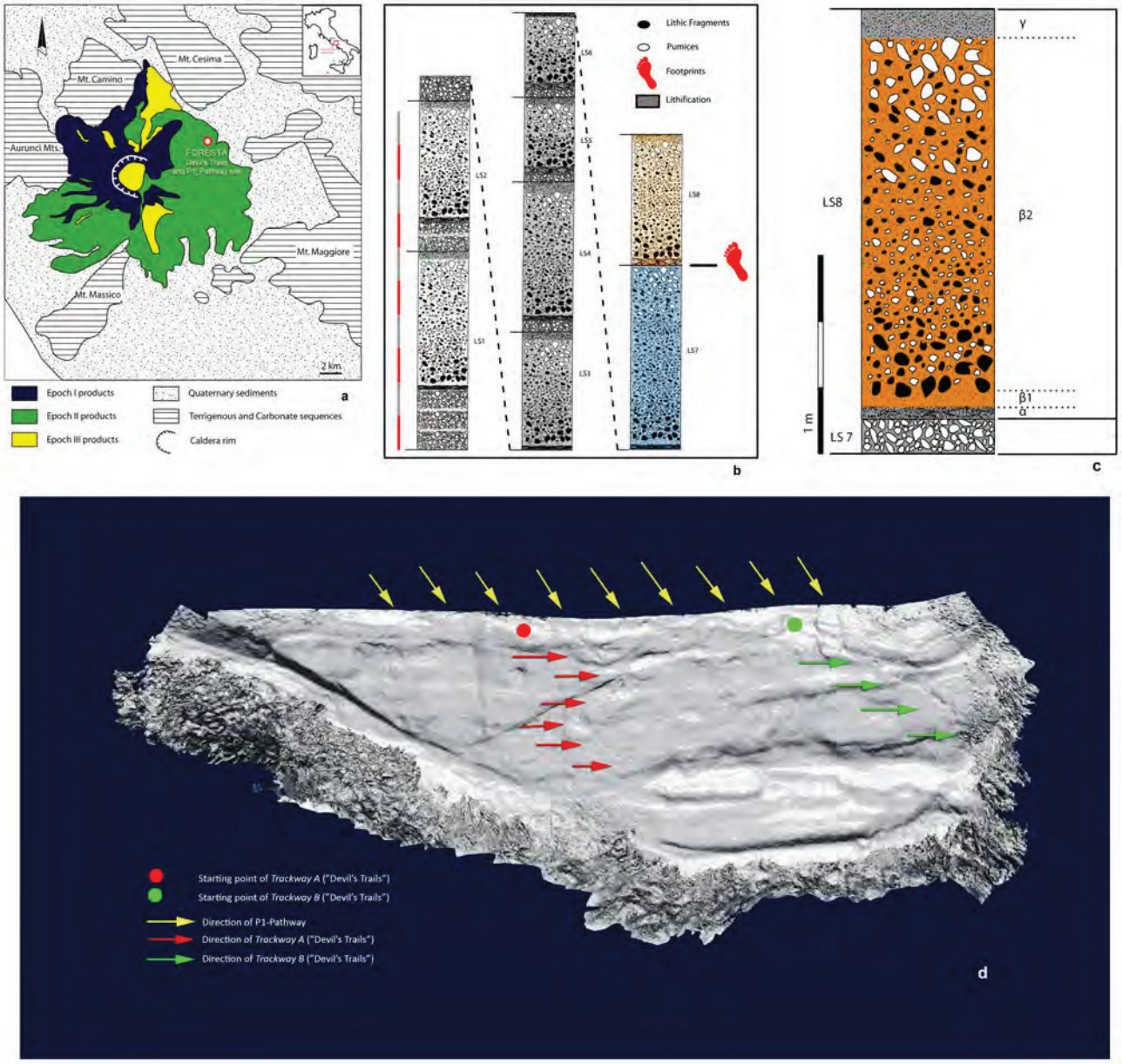
Fig. 8. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site; A western view of the segments P1_09 and P1_13 (rendered images from 3D photogrammetric model; 1 bar = 10 cm).

Fig. 9. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site; a: Segment P1_10, detail photo of a small zone (circled in red) in which prehistoric mud-crack are preserved; b, c: A western view of the segment P1_15 (3D photogrammetric model rendered image and depth map, respectively) with the starting point (pointed out by the red arrow) of the "Trackway A" of the "Devil's Trails" (1 bar = 10 cm) .

Fig. 10. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site, segment P1_15, detail image (overhead view from the North) of some animal tracks; a: photo; b: model surface; c: depth map; d: contour map (0,5 mm contour intervals).

Fig. 11.*Roccamonfina* volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site, segment P1_19, detail image (overhead view from the South-West) of the footprints P1_19_Det.1; a: photo; b: model surface; c: depth map; d: contour map (0,5 mm contour intervals).

Fig. 12. Roccamonfina volcano, Foresta (Tora e Piccilli), "Devil's Trails" paleontological site, segment P1_19, detail image (overhead view from the South) of the small ground area on which prehistoric mud-crack and animal footprints are preserved. In the same area it is also visible the deep mark left by a metal pick of modern age; a: photo; b: depth map; c: contour map (0,5 mm contour intervals).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Starting point of Trackway A ("Devil's Trails")
Starting point of Trackway B ("Devil's Trails")
Direction of P1-Pathway
Direction of Trackway A ("Devil's Trails")
Direction of Trackway B ("Devil's Trails")
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P1 Trackway
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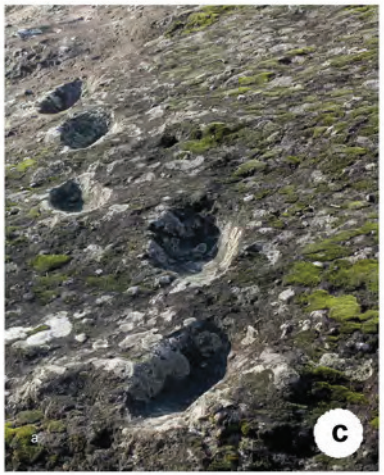
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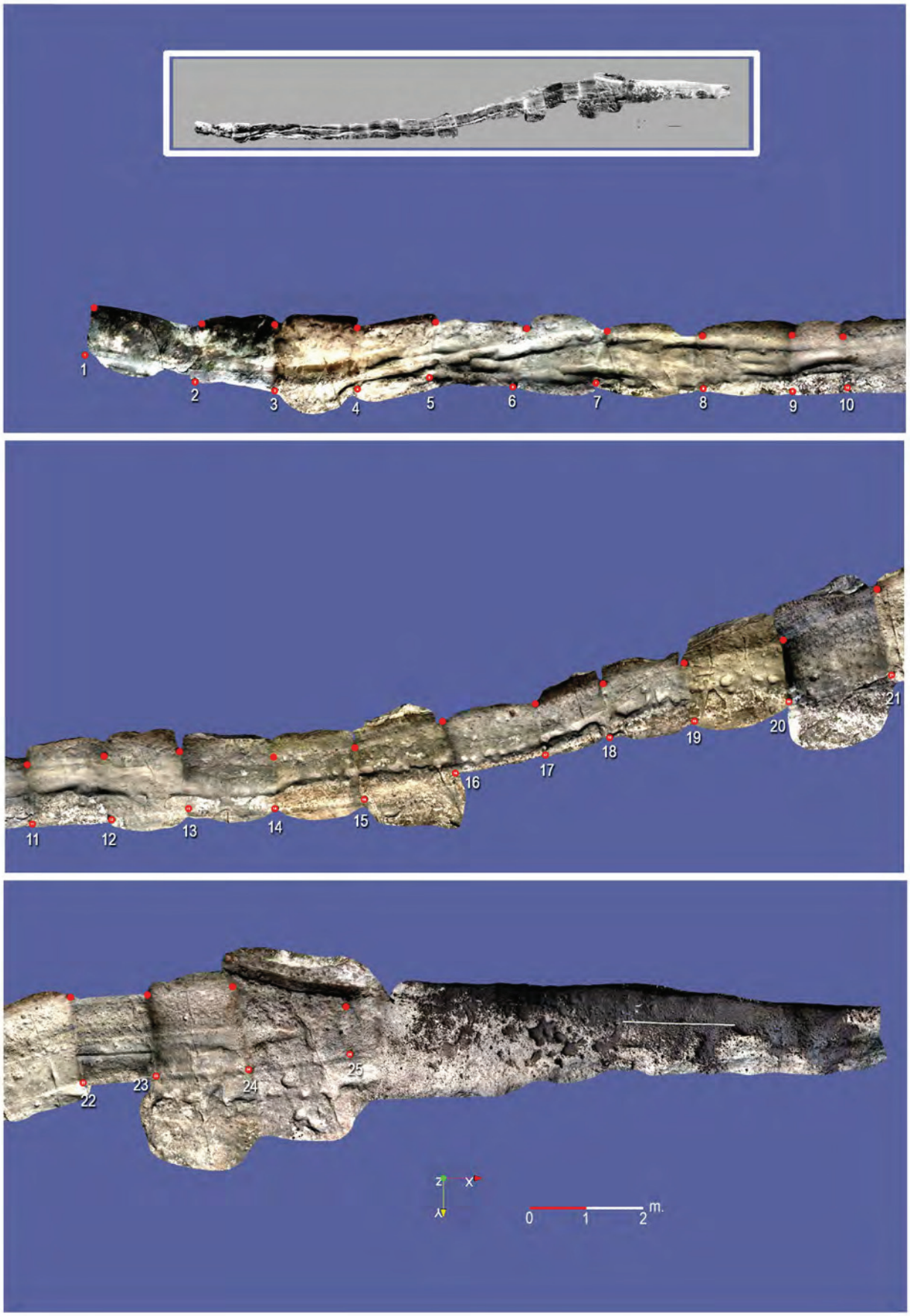
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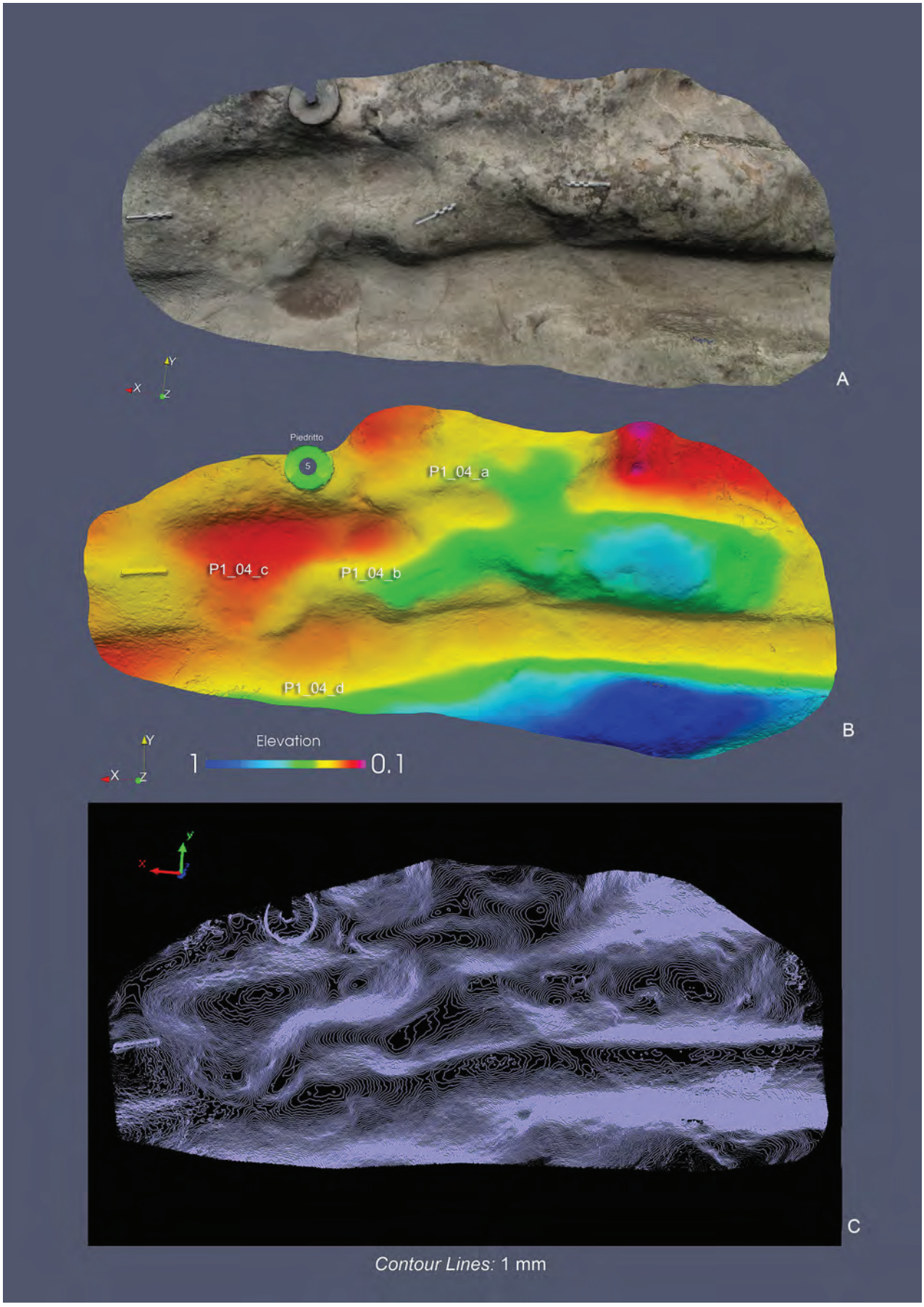

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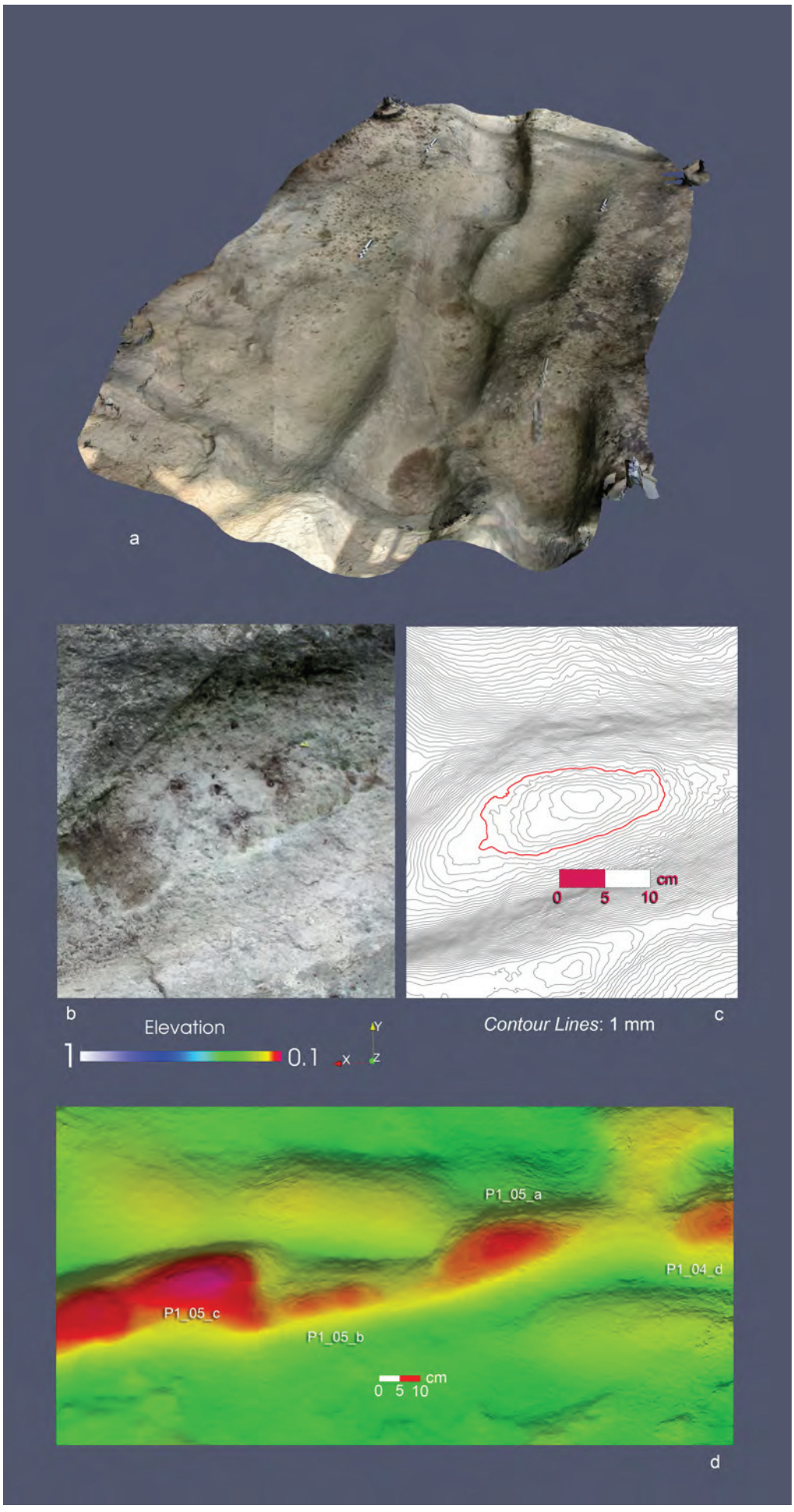
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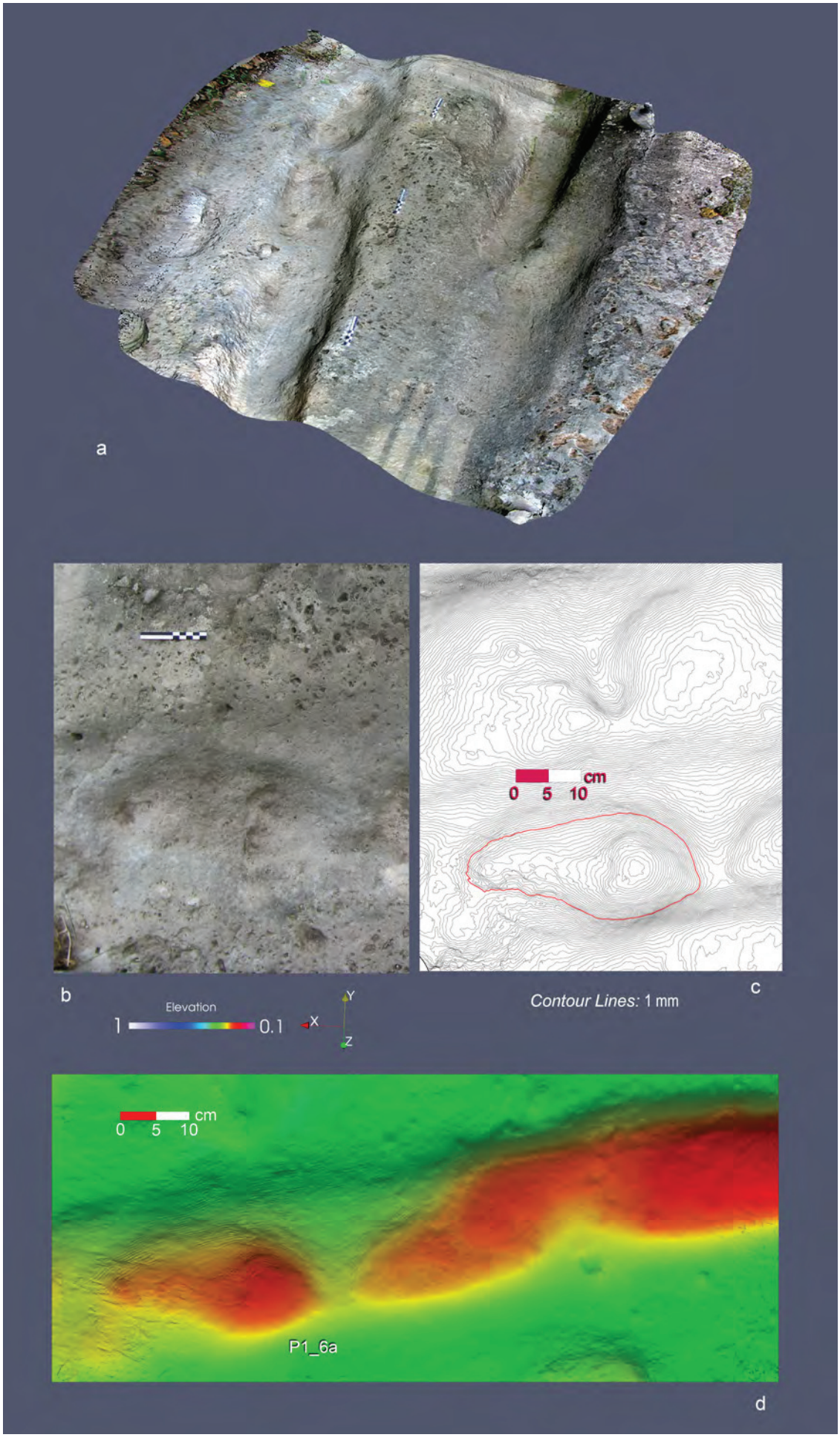
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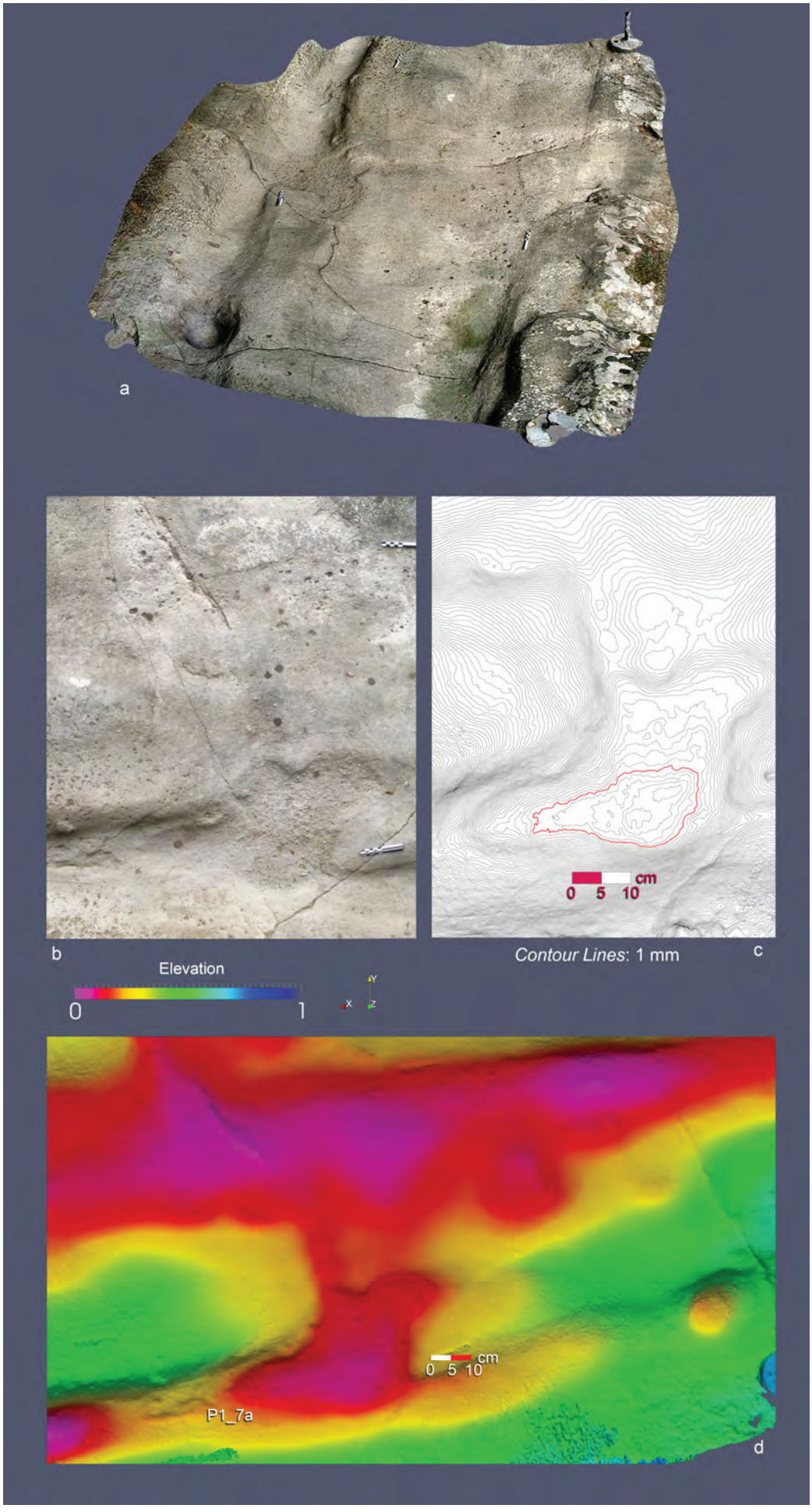
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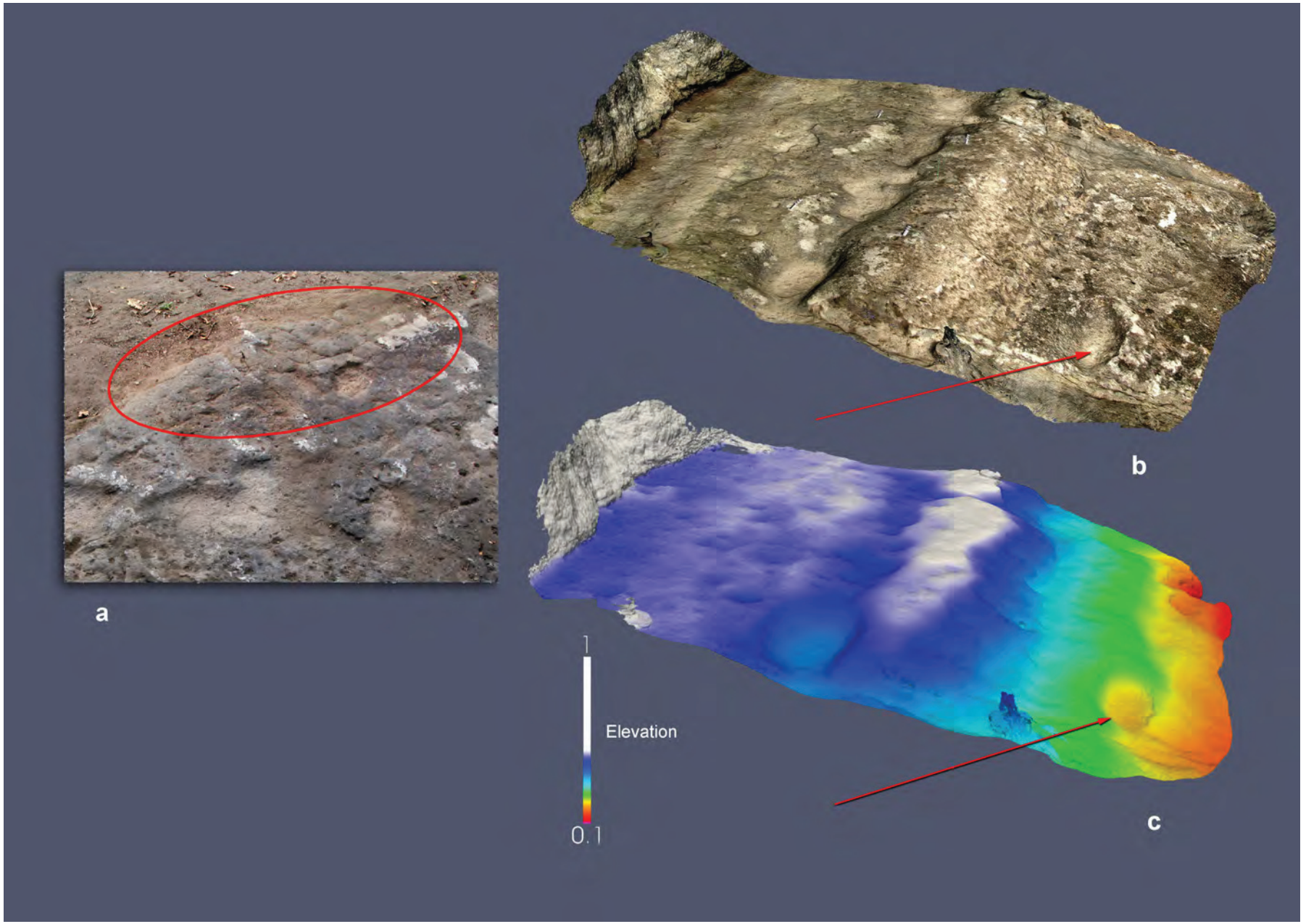
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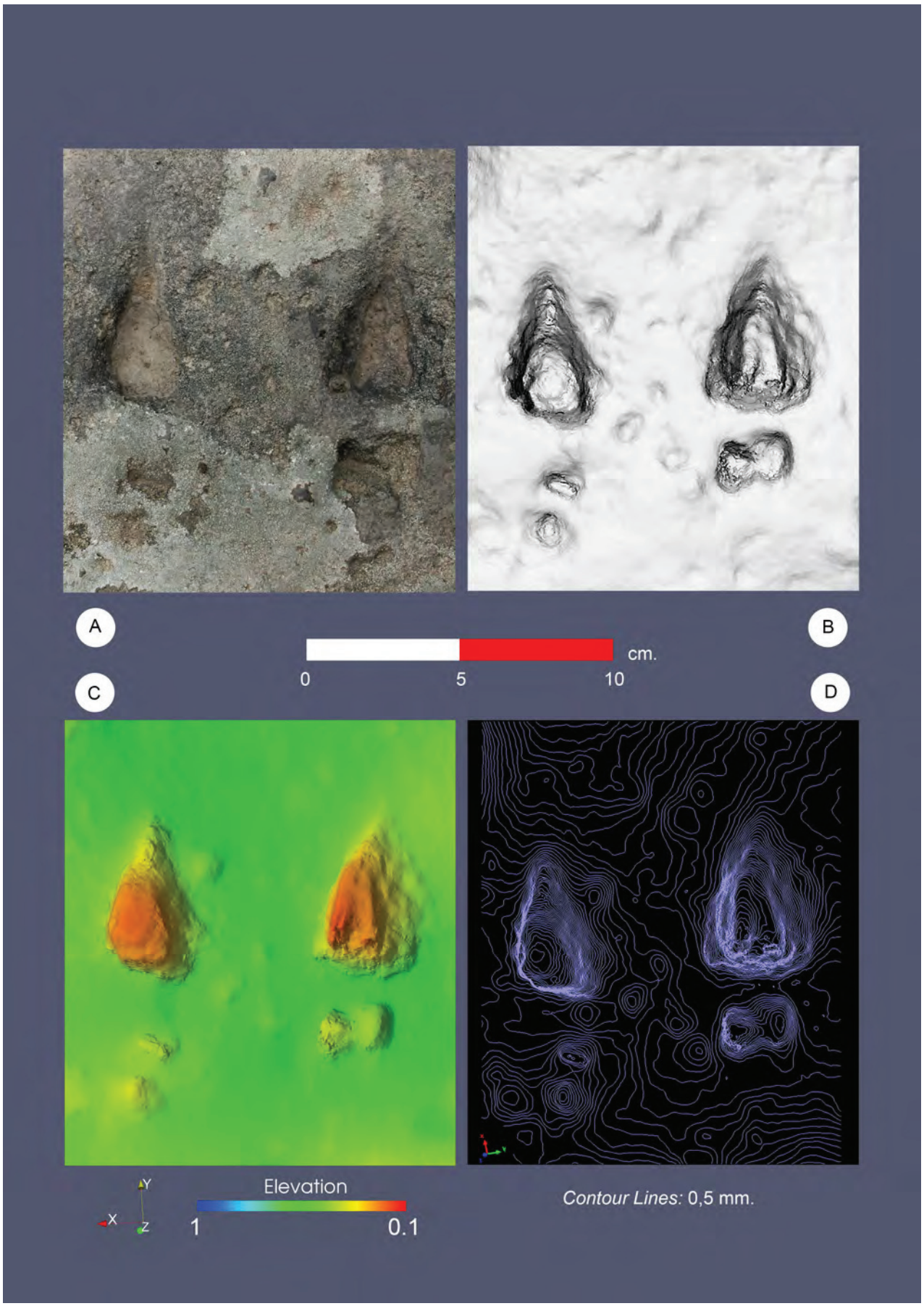
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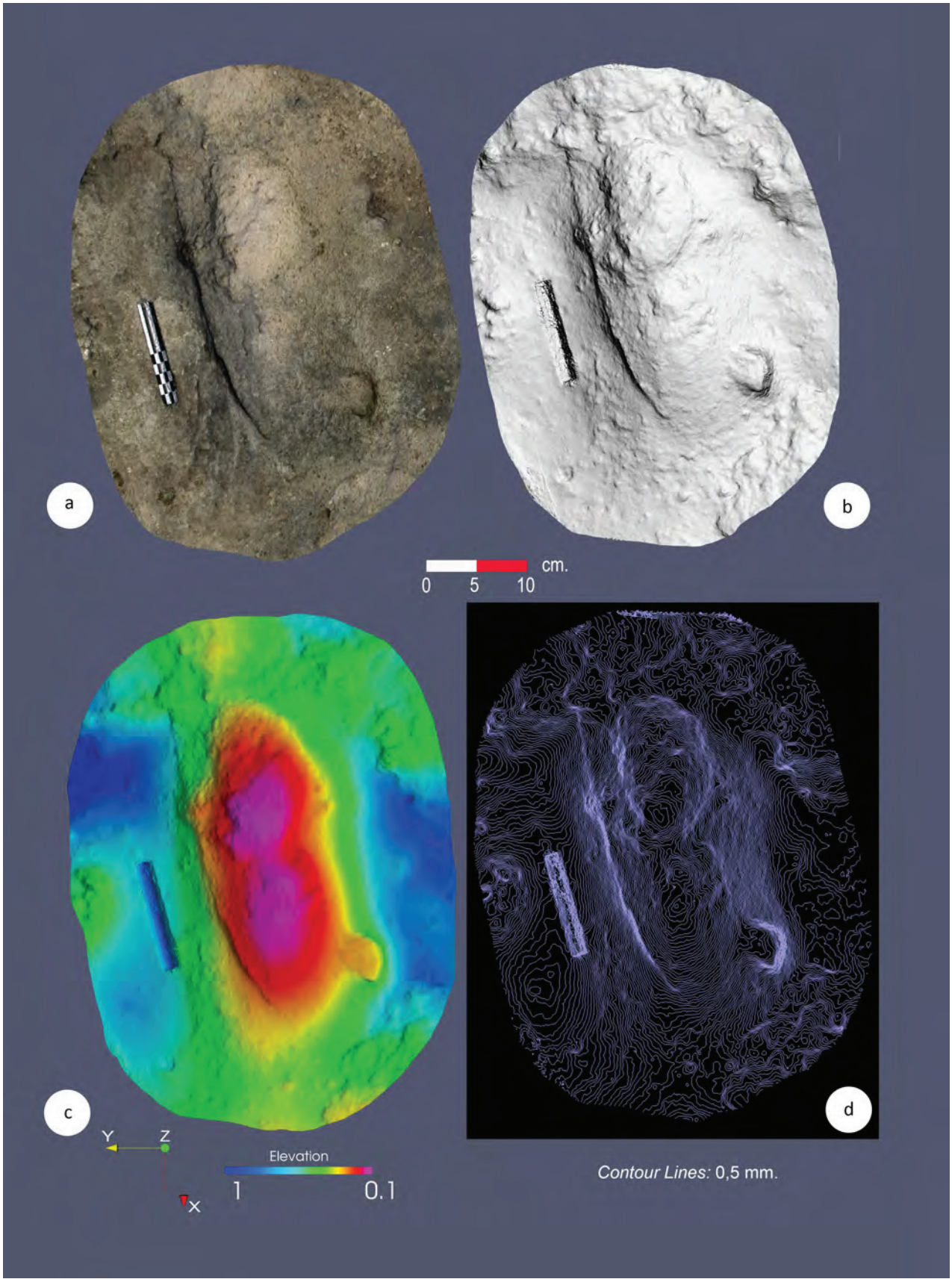
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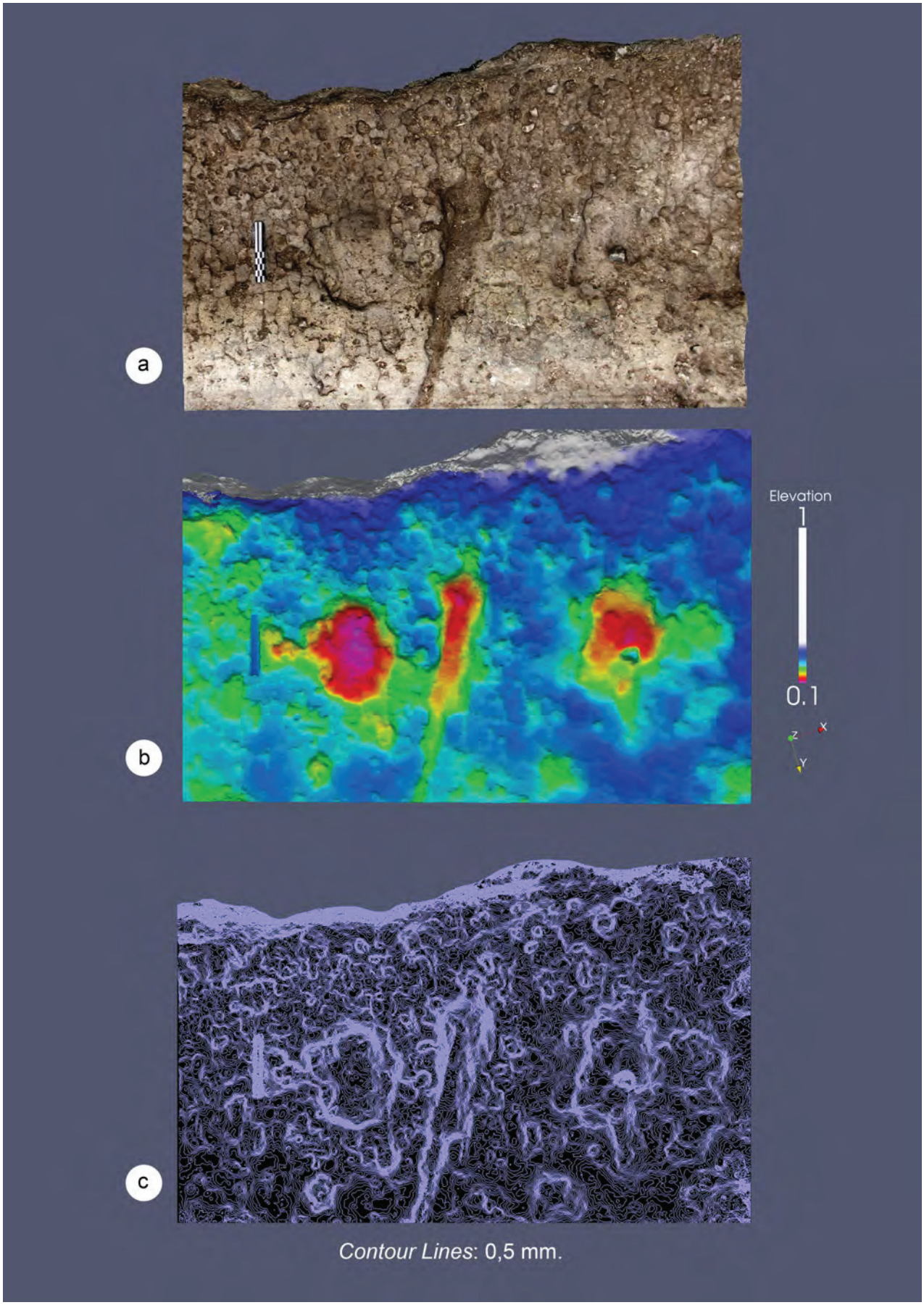
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Highlights

- New findings within Roccamonfina paleontological site.
- Report on what is probably the oldest human fossil path or trackway ever found.
- Multiple occupation/use of topographic benches and terraces.
- Archaeology and 3D modelling to demonstrate actuality of ichnological evidence.