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Reassessing Roman military activity through an interdisciplinary approach: Myth and archaeology in Laboreiro Mountain (Northwestern Iberia)

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A R T I C L E I N F O

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A B S T R A C T

The present work aims at the archaeological characterisation and historical contextualisation of two large enclosures recently located through remote sensing in the Laboreiro Mountain on the border between Portugal and Galicia: Lomba do Mouro and Chaira da Maza. Ancient written sources, remote sensing, archaeological survey, and absolute dating will be combined in order to shed new light on these enclosures.

Given the specificity of the archaeological structures and contexts under study, the need to use complementary absolute dating methods will be discussed, including luminescence and radiocarbon dating. The results in the case of the Lomba do Mouro enclosure point to it possibly being a Roman military camp of late-Republican chronology.

1. Introduction

Roman military camps were temporary constructions built by the Roman army to protect themselves while away from a permanent base for campaigning - marching and besieging enemy positions-, or for conducting other military operations, such as building larger, more permanent fortifications, or practising camp-building (Jones, 2009, 2012). These camps vary in size, shape, and purpose, but typically they tended to be rectangular, with rounded corners, and were defended by an external ditch and an earthen or turf rampart or stone wall (Maxwell, 1989; Reddé, 2008). Despite the increase of archaeological data and the growing scientific interest in this topic, functions are to be assumed rather than based on tangible evidence. Aspects related to the spatial distribution, dating, morphology, size, function, and purpose of these sites are largely unknown. Roman camps were of temporary use and indeed are a challenging archaeological case study especially due to the scarce materiality associated (Peralta Labrador, 2002). Temporary occupations such as those tend to leave fragile and subtle traces on the surface, and the geomorphological and geological conditions add to this constraint, justifying the limited archaeological evidence that is usually found on site (Camino Mayor and Martín Hernández, 2015; Costa-García et al., 2020; Fonte et al., 2022; Menéndez Granda and Sánchez Hidalgo, 2018). Thus, the defensive system that enclosed these sites also constitutes the main structural evidence of their presence, but the ditches, ramparts and walls have been since infilled and flattened. Moreover, the scarcity of material culture, acidic soils and post-depositional

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taphonomic processes make it difficult to define the construction, occupation, and post-abandonment of Roman camps. The challenges in their identification and study therefore require innovative and multidisciplinary approaches.

Until recently, the only archaeological data related to the Roman military presence in northern Portugal and Galicia was limited to the permanent forts of A Cidadela (Sobrado dos Monxes, A Coruña) (Caamaño Gesto and Fernández Rodríguez, 2002; Sánchez-Pardo et al., 2020) and *Aquis Querquernis* (Bande, Ourense) (Rodríguez Colmenero and Ferrer Sierra, 2006; Puente et al., 2018) (Fig. 1). However, these sites were built from the late 1st century AD onwards, so they postdate the Roman conquest of Northwest Iberia, already completed in the late 1st century BC. The use of remote sensing techniques has allowed the identification of several temporary Roman camps (Menéndez Blanco et al., 2020; Costa-García et al., 2019; Fonte et al., 2022). Two large enclosures of over 20 ha were recently identified in the Laboreiro Mountains, on the border between Portugal and Galicia and integrated into the Gerês-Xurés Transboundary Biosphere Reserve: Lomba do Mouro (Castro Laboreiro, Melgaço and Verea, Ourense) and Chaira da Maza (Lobeira, Ourense) (Costa-García et al., 2019: 32-34) (Fig. 1). The Laboreiro mountain range is a natural upland route located between the rivers Lima - to the south- and the Minho -to the north-, and saw early human presence, most notably with one of the largest Megalithic necropolises of Northwest Iberia located here (Baptista, 1997; Eguileta Franco, 1999; Jorge et al., 1997; Sousa, 2013; Berganzo-Besga et al., 2021). The location, morphology, and size of the new enclosures indicate that they may represent Late Republican Roman military camps which could be related to the first Roman army expeditions into this area mentioned by ancient written sources around the 2nd and 1st centuries BC. To verify this interpretation an interdisciplinary approach was applied, combining literary sources with archaeological fieldwork, absolute dating, and remote sensing. A particular attention was dedicated to the Lomba do Mouro enclosure, where an archaeological survey took place in the Summer of 2020.

2. The sites under study: The discovery with remote sensing techniques

Both enclosures were identified from the airborne LiDAR (Light Detection and Ranging) data provided by Spanish National Geographic Institute (IGN) through the PNOA (National Plan for Aerial Orthophotography) project (https://pnoa.ign.es/). It includes data from two temporal coverages (from 2009 and 2016 for this area). The point clouds were processed to extract a 1-meter digital terrain model (DTM) from the points automatically classified as ground. From the DTM, different visualization techniques were applied to enhance the contrast of archaeological microtopographies, like local relief model (Hesse, 2010), positive openness (Doneus, 2013), visualization for archaeological topography (VAT) (Kokalj and Somrak, 2019) and sky-view factor (Zakšek et al., 2011). For this, we used a combination of different software, in particular LAStools (https://rapidlasso.com/lastools/), Relief Visualization Toolbox (RVT) (Kokalj and Somrak, 2019; Zakšek et al., 2011) and planlauf/TERRAIN (https://planlaufterrain.com/). In addition, a drone-derived photogrammetric survey of the Lomba do Mouro enclosure was also completed. Based on its data, a high-resolution orthophoto and digital surface model (DSM) were generated. Several oblique aerial photos were also obtained for illustration.

From the remote sensing data, positive features representing stone walls built with local granite stone are clearly identifiable at both sites (Figs. 2 and 3). At Lomba do Mouro these present a loosely quadrangular layout with rounded corners, adapting its shape to the local topography (Costa-García et al., 2019: 33). An exterior concentric wall perimeter acts as a first defensive line, enclosing a total area of approximately 25 ha (*ibid.*). Its defensive system connects two naturally elevated areas to the east and west, with the middle area in-between presenting the best conditions for occupation (Figs. 2 and 3). Several prehistoric burial

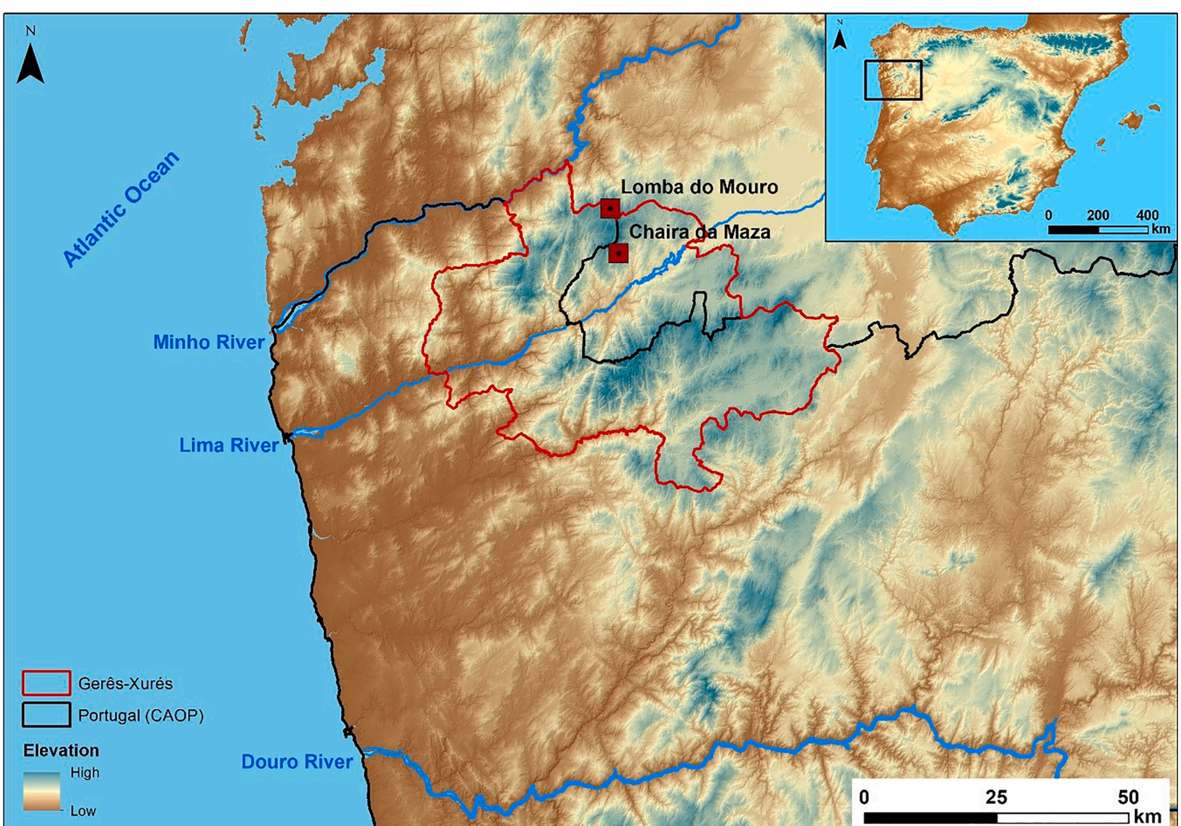

Fig. 1. Location of Lomba do Mouro and Chaira da Maza enclosures in the Iberian Peninsula (topographic data EU-DEM v1.1).

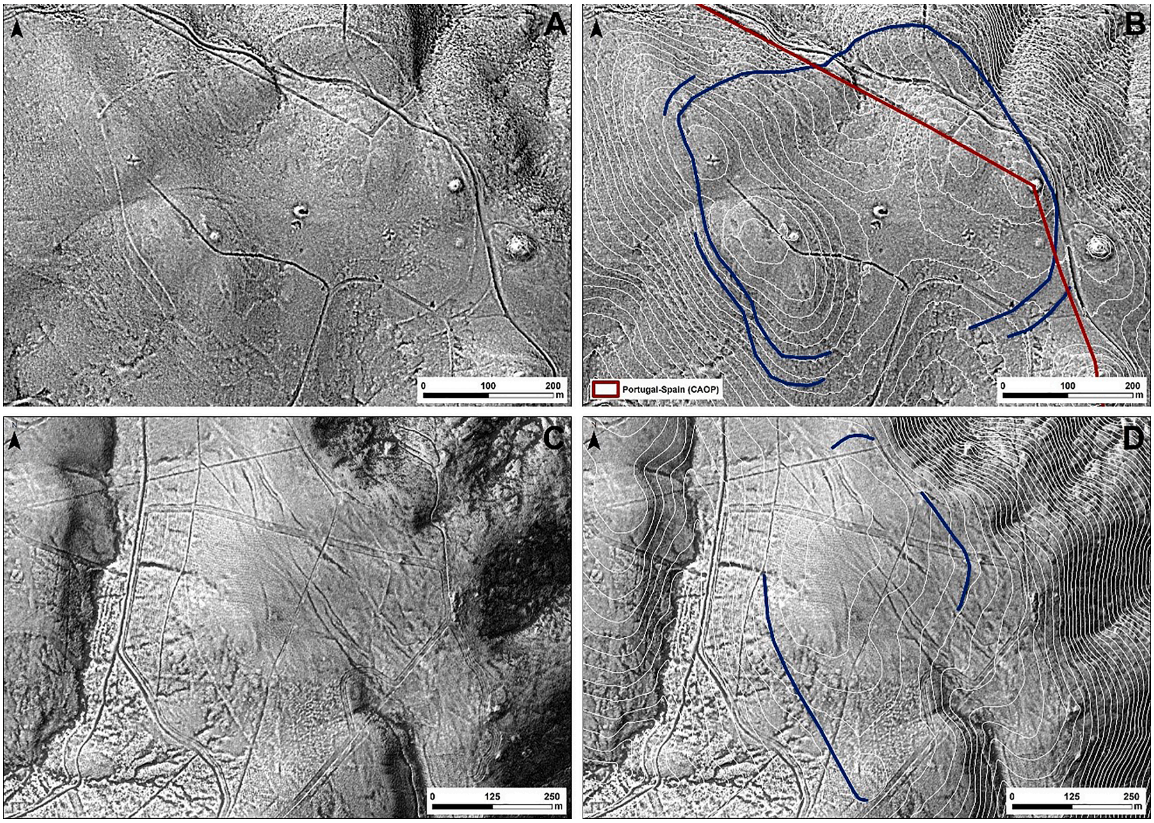

Fig. 2. LiDAR model and plan of Lomba do Mouro (A and B) (note the burial mounds as positive features in white) and Chaira da Maza (C and D). Background image: local relief visualization derived from IGN-PNOA LiDAR data (2009).

mounds were reused by the enclosure probably as observation points, especially at its southeast (on the outer wall) and northwest corners (on the inner wall), increasing its defensive efficiency (Figs. 2 and 3).

Chaira da Maza has a trapezoidal shape with straight lines and rounded corners, similarly adapted to the local topography (Costa-García et al., 2019: 34). Though here only one defensive line is visible, enclosing a total area of approximately 20 ha (*ibid.*), its defensive system connects in a similar fashion two elevated areas this time to the north and south, with the middle area in-between presenting the best conditions for occupation (Fig. 2).

3. Materials and methods

3.1. Ancient written sources

Accounts by Appian (*Iber*. 72–73) (McGing 2019: 253-254) and Strabo (*Geogr*. 3.3.1) (Deserto and Pereira, 2016: 59) describe the movement between the rivers Tagus in the South and the Minho in the North of a Roman army force led by *Decimus Junius Brutus* in the late 2nd century BC. To Rome, this campaign was supposedly retaliation against the *Callaici* for their help to the *Lusitani*, but also had exploratory benefit into a largely uncharted territory (Fonte, 2022; Gomes, 2022).

Particularly relevant for our study is the movement in the northern segment, between the Lima (Λήθης - *Lethe*) and Minho (Νίμιος - *Minius*) (Appian *Iber*. 72) (McGing, 2019: 253-254, see below). According to Strabo (*Geogr*. 3.3.1) (Deserto and Pereira, 2016: 59), Brutus used the Tagus valley as the main axis of his campaign towards the north, having consolidated ‘Ολυσιπων - *Olisipo* (Lisbon, Portugal) at its mouth and having used Μόρων-*Móron*, that could potentially be identified with the site of Chões de Alpompé (Santarém, Portugal), as an operational base for his campaign located some 500 stages from the sea (Pimenta and Arruda, 2014; Fabião, 2014; Fabião et al., 2015; Arruda et al., 2018; Fonte et al., 2020; Fonte, 2022; Pimenta, 2022). In this way, he could control the navigation on the Tagus River and ensure the army supply on its movement northward. In addition, data collected so far in the Mondego valley seems to point to this area also having played a relevant role in supporting logistically *Brutus*’ campaign, in particular the sites of Arruelas (Imperial, 2022) and Santa Olaia (Silva et al., 2021) in Figueira da Foz, Portugal. However, there is no secure archaeological evidence to date about the movement northwards of *Decimus Junius Brutus* campaign between the rivers Douro and Minho. There are only a few references to levels of destruction in hillforts in northern Portugal such as Cividade de Terroso (Póvoa de Varzim, Portugal) and Coto da Pena (Caminha, Portugal), although their direct connection with this specific historical episode is not properly substantiated (Silva, 2007; Fonte, 2022; Gomes, 2022).

> “*Crossing the river Dorius, he brought war and destruction to many areas, demanding large numbers of hostages from those who surrendered, and reached the river Lethe. He was the first Roman to plan a crossing of this river. He did indeed cross it and advanced to another river called the Minis, and attacked the Bracari for seizing supplies being brought to him. They are a most warlike people, who also fought with their women under arms and died willingly, not a single one of them turning and showing their back or uttering a sound. Of the women who were subdued, some killed themselves, others also killed their children, preferring death to captivity. There are some towns that sided with Brutus at the time, but revolted soon after, and Brutus subjected them again.*” (App. *Iber*. 72) (McGing, 2019: 253-254).

The sources include a highly symbolic episode during *Brutus*’ northern raid. When they reached the Lethe River, the legionaries refused to cross, arguing that it was the legendary river of Oblivion. To cross it would be to leave all their memory and lives behind. *Decimus Junius Brutus*, who was a renowned augur in Rome (Cic. *De Amicitia*, 6),

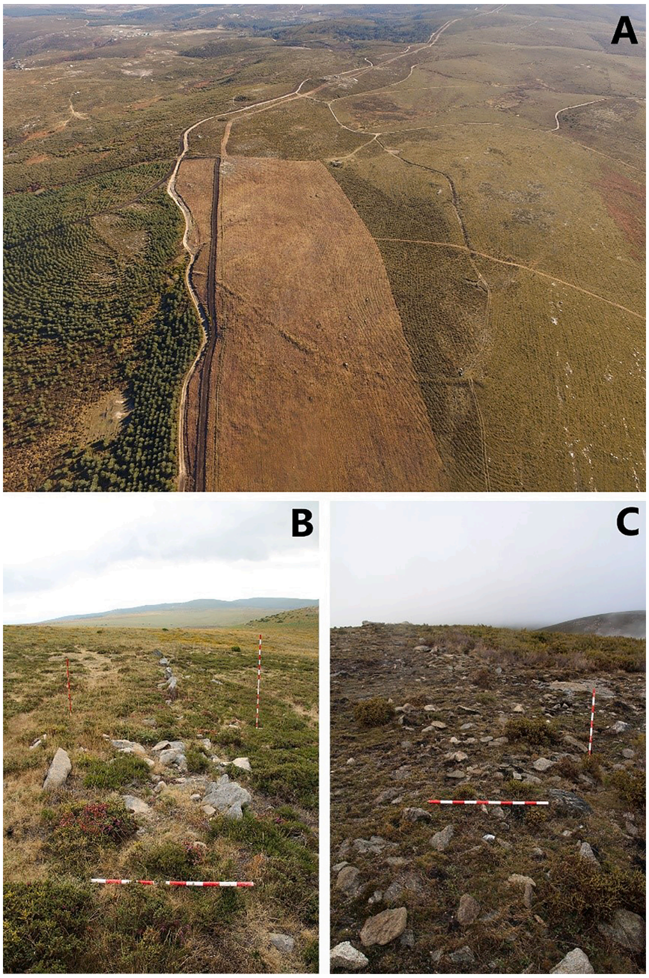

Fig. 3. Lomba do Mouro oblique aerial view where the double defensive line is visible (A); ground view of Lomba do Mouro defensive wall (B); ground view of Chaira da Maza defensive wall (C).

crossed it first and called his men to prove that he had not lost his memory (Livy, *Periochae*, 55.10). The passage allows us to understand how the Romans had constructed a propagandistic image of the Iberian Northwest as a wild space outside civilisation[1].

3.2. Archaeological fieldwork at Lomba do Mouro

Following our initial inspection of the site to prepare the documentation necessary for its cataloguing by their respective Heritage management administrations, an archaeological survey was carried out in Lomba do Mouro. The main objective was the archaeological characterisation and absolute dating of its defensive system and consisted of archaeological excavation, geophysical (magnetic) and metal-detection surveys, and sample collection for absolute dating (luminescence and radiocarbon). While limited information was retrieved from the geophysical and metal-detection surveys, archaeological excavation and absolute dating produced interesting results so they will be highlighted here.

Three archaeological trenches targeted the defensive system, two in the inner wall (trench 1 and 2) and one in the outer wall (trench 3) (Fig. 4).

3.2.1. Trench 1 (8X1 m)

After the removal of the vegetation layer SU (stratigraphic unit) [100], a heterogeneous deposit [101] that covered a medium and large stone masonry overburden was identified SU [102]. This stone deposit covered a thin layer of sediment SU [103] and was related to SU [104], a stone wall of about 0.70 m high and 2.2 m wide, consisting of medium and large irregular dry stone. This structure was supported on the local granite bedrock. Sample LM1#1 was taken from the deposit SU [103] on the base of the inner face of the wall SU [104]. The wall has not been cut here (Figs. 5 and 6).

3.2.2. Trench 2 (8x1 m)

After stripping the vegetation layer SU [200] that covered a heterogeneous layer SU [201], the same dry-stone wall was identified here. This structure was made up of the SU [203], irregular stones of medium and large dimensions, and SU [214], two large granite slabs, one in the middle and one in the outer face of the wall. The wall SU [203] covered a thin sediment deposit SU [210] over which several slabs were placed. There were medium to large stone masonry overburden flanking this structure (SU [202] and SU [206]). A cut parallel to the internal face of the wall was made, with approximately 1 m width, to get a reading of the internal stratigraphy of the wall. Samples LM2#2 and LM2#1 were collected from SU [210] and SU [211], respectively (Figs. 7 and 8). The SU [210] was sealed by the wall SU [203].

3.2.3. Trench 3 (6x1 m)

Following the removal of the vegetation layer SU [300] and the backfill layer SU [301], a medium-sized irregular stone masonry overburden was identified SU [302]. This deposit covered a dry-stone wall SU [303] with 0.50 m high and 1.20 m wide and with a large granite slab outward sloping SU [305]. The stone wall was constructed over a deposit SU [308] which in turn is supported by the local granite bedrock SU [307]. There was a set of medium granite slabs SU [304] forming a *chevaux-de-frise* defensive feature parallel to the wall and immediately outside it. A cut perpendicular to the internal face of the wall was made, with approximately 0.5 m width, to get a reading of the internal stratigraphy of the wall. Sample LM3#1 was taken from SU [308] sealed by the wall SU [303] (Figs. 9 and 10).

3.3. Absolute dating

At Lomba do Mouro samples from the most relevant and well-sealed deposits (SU [103], SU [210], SU [211] and SU [308]) of accumulated material were collected for absolute dating (luminescence and radiocarbon). For luminescence dating protocols, four samples of around 500 g were collected by using stainless steel tubes, avoiding sunlight exposure. *In situ* field gamma spectrometry was performed in the sampling holes. After the dosimetry measurements, and from the same deposits, around 3 kg of sediment per sample were collected for radiocarbon dating. These accumulated materials were then floated to collect charred organic material which could be radiocarbon-dated.

3.3.1. Luminescence dating

Absolute dating by using luminescence techniques implies the use of chemical and dosimetry measurements, considering the luminescence age equation: Luminescence Age (ka) = Absorbed Dose (Gy) / Dose Rate (Gy/ka). The absorbed dose (De) was obtained by dosimetry, applying luminescence protocols and represents the laboratory dose of radiation (accumulated energy) needed to induce 'artificial' luminescence equal to the natural signal (Aitken, 1999). The laboratory procedures for the preparation of a quartz coarse grains fraction of samples were performed following standard laboratory protocols Porat et al. (2015), Rodrigues et al. (2013, 2019). Quartz purity check (Duller, 2003) and the dose

[1] In the documentary "In the footsteps of the first war: the Roman army between Galicia and northern Portugal" (https://youtu.be/fXGZVPHf3Oc), produced as a part of our dissemination effort, we have explored further the consequences of this episode, probably the most popular episode of Roman conquest nowadays in Northwest Iberia.

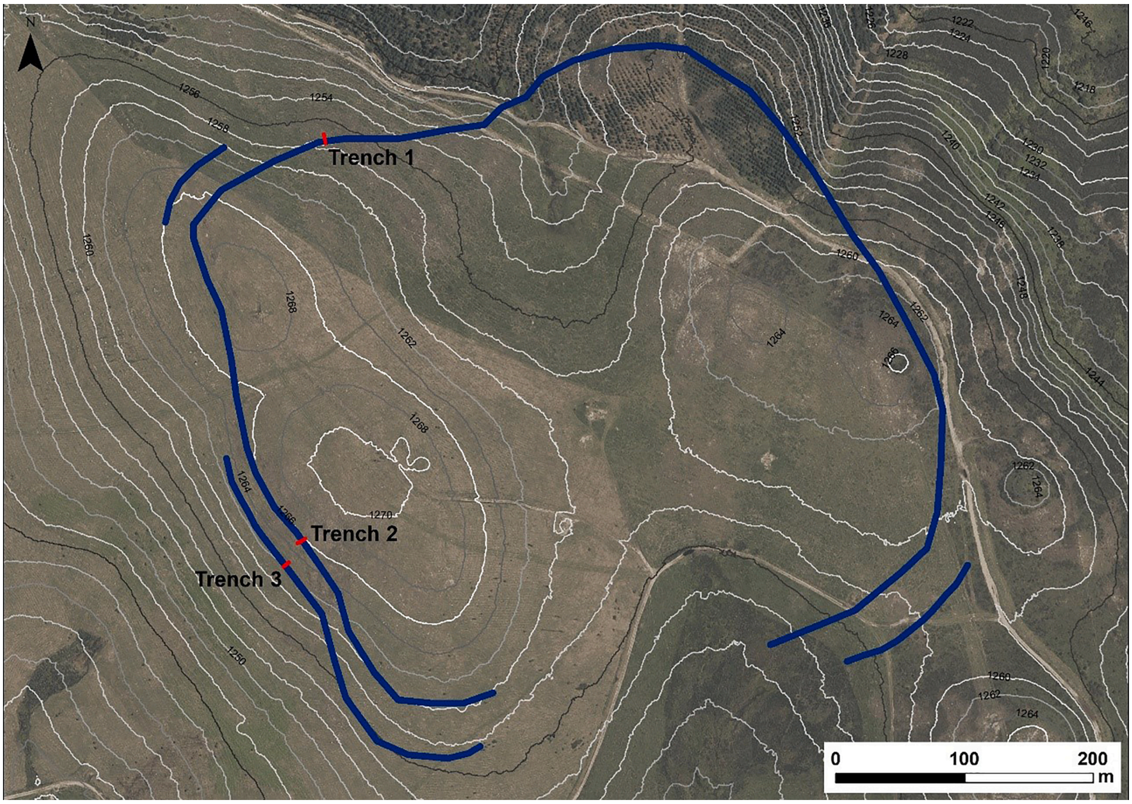

Fig. 4. Location of the archaeological trenches in the Lomba do Mouro enclosure. Background image: 25 cm orthophoto (2021) from DGT (Direção-Geral do Território).

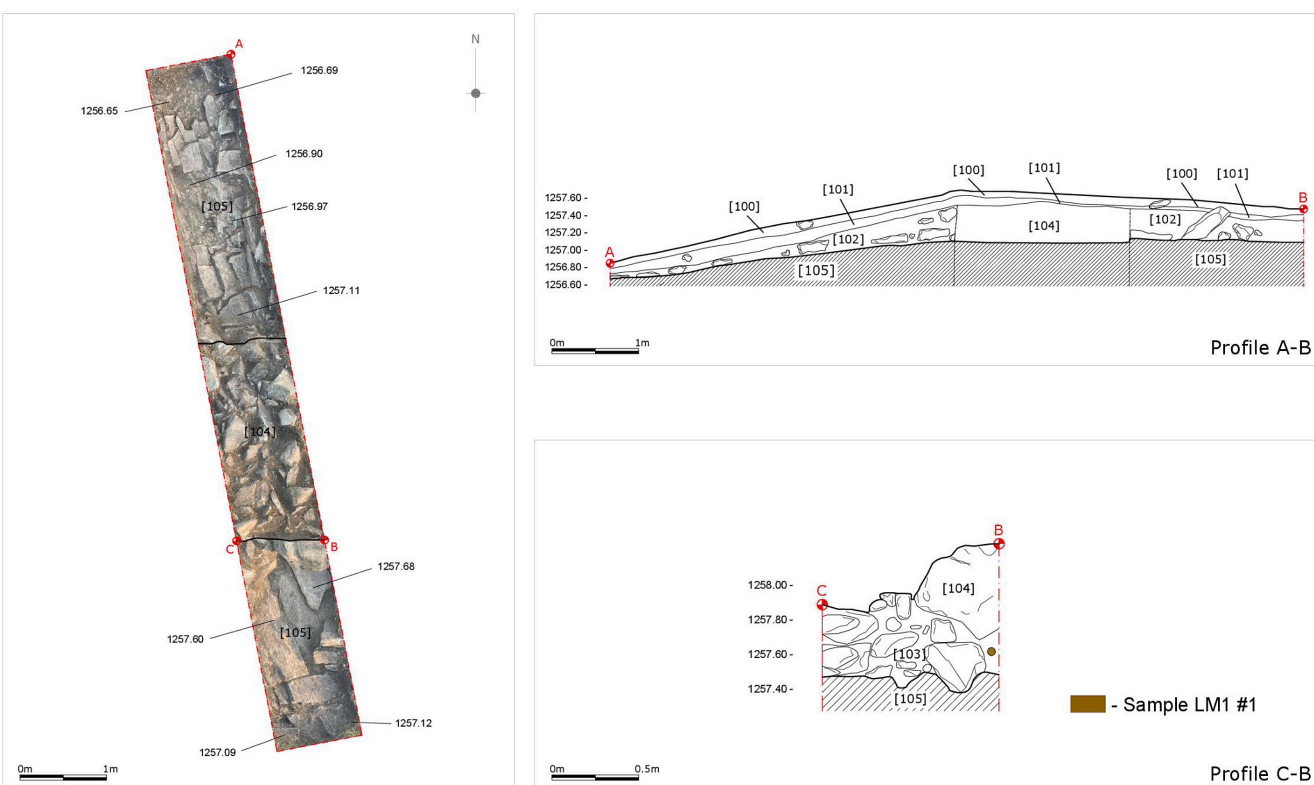

Fig. 5. Plan and stratigraphy of trench 1 and sample LM1#1.

Fig. 6. Trench 1: view of the inner wall (left) and place where the LM1#1 sample was taken at the base of the inner face (right).

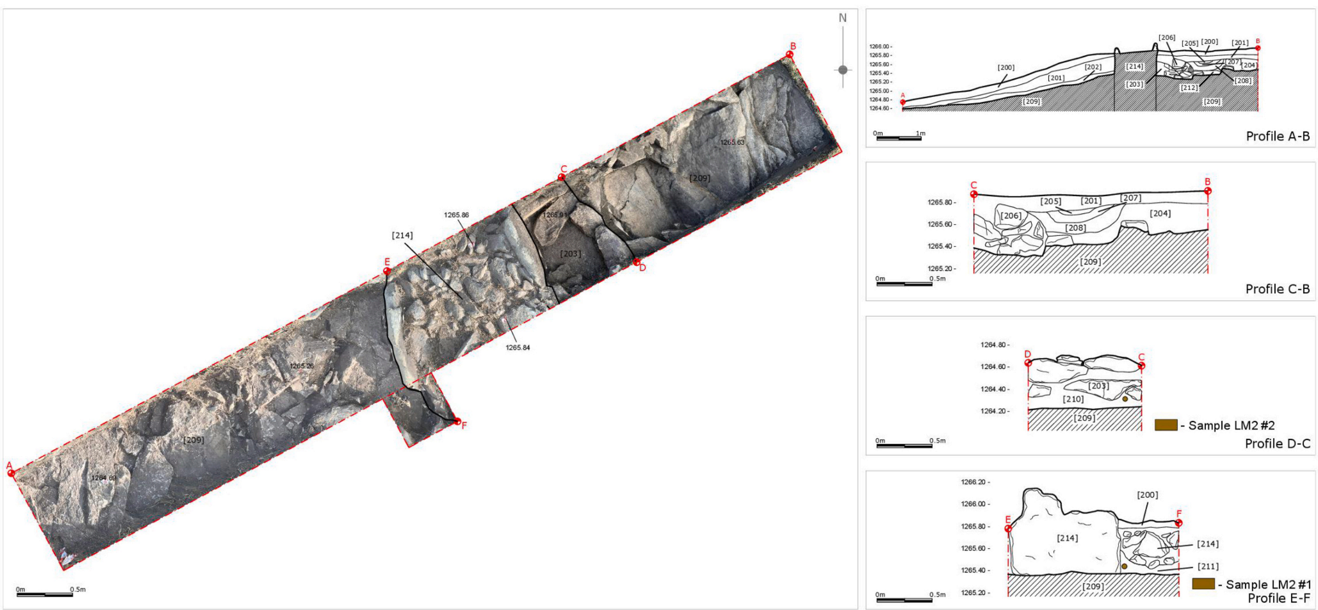

Fig. 7. Plan and stratigraphy of trench 2 and samples LM2#1 and LM2#2.

Fig. 8. Trench 2: view of the inner wall before it was cut (left) and place where the LM2#2 sample was taken from under some slabs at the base of the inner wall after a cut parallel to the inner face was made (right).

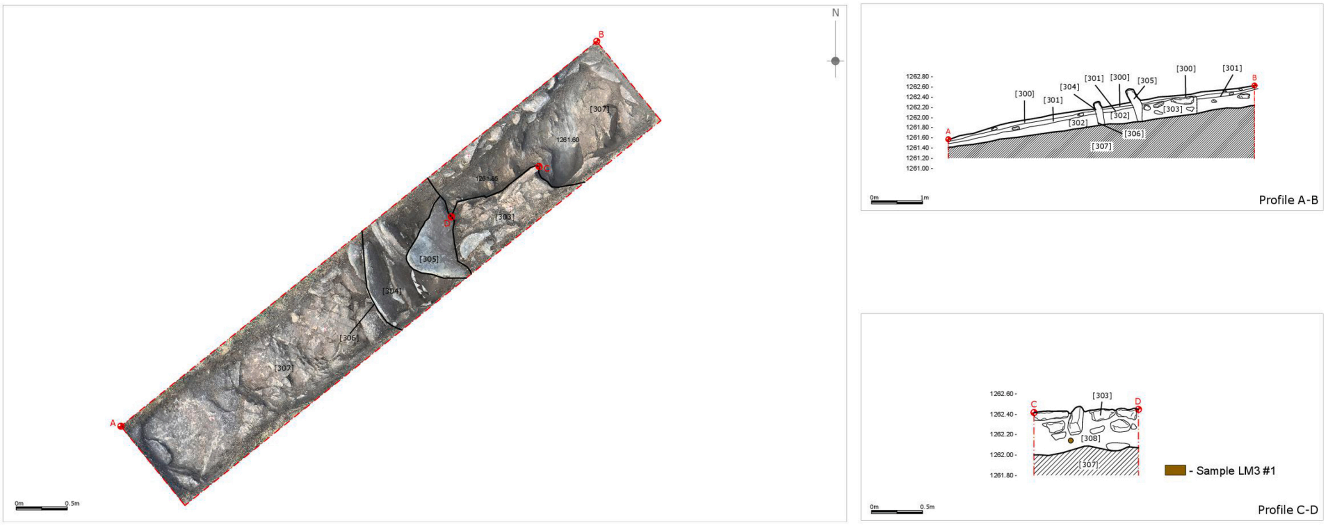

Fig. 9. Plan and stratigraphy of trench 3 and sample LM3#1.

Fig. 10. Trench 3: view from the outside of outer wall with its *chevaux-de-frise* (left) and view from the inside where the perpendicular cut made in the outer wall to collect the sample LM3#1 is visible (right).

recovery test (Murray and Wintle, 2003) were conducted, and luminescence quantitative measurements were performed using a SAR-OSL (Single Aliquot Regenerative-Optically Stimulated Luminescence) protocol with an internal pre-heat test (Murray and Wintle, 2000). Twelve (samples LM2#1 and LM3#1) or twenty-four (samples LM1#1 and LM2#2) aliquots were measured using Risø readers DA-20 equipped with a $^{90}Sr/^{90}Y$ beta source delivering 0,072 ± 0.002 Gys^{-1} (Risø reader 1) or 0.107 ± 0.00 Gys^{-1} (Risø reader 3) with Hoya U-340 detection filter. The accepted results (following the criteria described in Rodrigues et al., 2022; Eixea et al., 2023) were analysed statistically to estimate the absorbed dose for the sample using the robust mean and the respective uncertainty calculated by Robust Statistics V1.0 (AMC, 2002).

The dose rate (Dr) was estimated by using a conventional protocol and included alpha, beta, gamma and cosmic radiation, based on chemical analyses and dosimetry measurements and defines the rate at which energy is absorbed from the flux of nuclear radiation. It was evaluated by assessment of the radioactivity of the sample and its surrounding burial material. This was carried out both in the laboratory (chemical analyses and estimative of cosmic radiation) and in the field (*in situ* gamma spectrometry) (Adamiec and Aitken, 1998; Aitken, 1999; Burbidge et al., 2014; Marques et al., 2021; Prescott and Hutton, 1988; Prescott and Stephan, 1982; Richter et al., 2003; Zimmerman, 1971). The chemical composition of the studied samples was obtained by using a lithium metaborate/tetraborate fusion with subsequent analysis by

Inductively Coupled Plasma (ICP) and ICP/MS (Mass Spectrometry), performed at Activation Laboratories Ltd. (Actlabs, Canada: https://www.actlabs.com), using their standard analytical techniques and detection limits. The dose rate was corrected to the water content and granulometry of the studied material (Odriozola et al., 2014; Rodrigues et al., 2019).

3.3.2. Radiocarbon dating

No organic remains suitable for radiocarbon dating were recovered during excavation. Hence, sediment from four different stratigraphic units was processed by flotation to obtain smaller plant macroremains. The bucket flotation method was used (Helbaek, 1969; Fuller, 2007): 1.54 L of sediment from each deposit was placed in a bucket with water. After more dense mineral particles sank, the floating material, including plant macroremains and charred fragments, was recovered using a 0.25 mm mesh.

The results of the sediment flotation revealed the near absence of organic material, allowing only the recovery of a few charcoal fragments smaller than 2 mm. There were 2 fragments recovered from SU [103], 1 fragment from SU [210], 2 fragments from SU [211] and 7 fragments from SU [308]. Although these fragments were below the minimum dimensions recommended for charcoal taxonomic identification (Chabal, 1992), they were separated for microscopic analysis as they were the only ones recovered.

The taxonomic identification of charcoal was carried out through the observation with a reflected light microscope (100x and 200x) of the three sections: cross, longitudinal radial and longitudinal tangential, compared with wood anatomical atlases (Schweingruber, 1990) and the charcoal reference collection of ICArEHB (Interdisciplinary Centre for Archaeology and Evolution of Human Behaviour). One charcoal fragment recovered from each deposit was selected for radiocarbon dating and washed with hydrochloric acid before graphitization and analysis by AMS. The charcoal fragment from deposit [308] could be assigned to the Ericaceae family (undetermined genus). The remaining fragments were given as undetermined due to the impossibility of identifying anatomical features that enable further taxonomic identification.

Additionally, one sediment sample from the SU [308] was dated by AMS. Following the methods proposed by Martínez Cortizas et al. (2016) and Ferro-Vázquez et al. (2018) for acidic pedosedimentary environments, the sediment was dispersed in ultrapure water for 16 hr and wet sieved through a <50 µm mesh, thereby eliminating sand- and gravel-sized minerals and macroscopic organic remains such as rootlets. The sieved sample was then chemically fractionated using the standard acid–alkali–acid procedure for 14C samples, and the alkali-soluble fraction was used for graphitization and AMS measurement.

The dates were calibrated using the program OxCal 4.4 (Bronk Ramsey, 2009) and the IntCal 20 calibration curve (Reimer et al., 2020).

4. Absolute dating results

The results of chemical and dosimetric analyses, required to achieve and discuss the reliability of the luminescence age, are described in Table 1. The content of K, Th and U obtained *in situ* by gamma spectrometry are on average 3.9%, 16.9 mg/kg and 6.7 mg/kg, respectively. Considering the chemical analysis performed, the average chemical contents of K, Rb, Th and U are 4.3%, 312 mg/kg, 16.9 mg/kg, and 8.8 mg/kg, respectively. The estimated water content during the burial time ranges between 21% and 26%. The dose rate average obtained is 5.9 Gy/ka. Considering the results of the quartz purity (OSL/IRSL depletion ratio around 1) and recovery dose tests (in the range of 0.98–1.10), a quantitative SAR-OSL protocol was applied for the determination of De. The robust mean of the results obtained for all samples ranges between 11.9 Gy and 14.6 Gy, with uncertainties between 2% and 15%. The uncertainties are a consequence of the dispersion of the absorbed dose within each sample, which is not negligible. Attending to the De and Dr obtained, the luminescence ages of the samples were calculated and ranged between 1.9 ka and 2.5 ka, with uncertainties between 3% and 16%. LM2#2 and LM3#1 results (collected internally from deposits formed when both walls were built and immediately afterwards sealed by the inner and outer walls, respectively) point to a construction date of both walls around the 2nd century BC, albeit with some degree of uncertainty. These are in accordance with the chronology expected for the construction of the walls and both were consistent. Meanwhile, the luminescence age obtained for sample LM2#1 (collected from within the inner wall and related to a context of its sedimentation) points to a chronology where the wall was no longer in use and the camp was already likely abandoned. LM1#1 probably reflects the existence of a palaeosoil over which the wall was built here, though in this area it was not possible to cut the wall, so we were unable to do a detailed internal stratigraphic observation here.

While the radiocarbon dates are fairly inconsistent both among themselves and with the luminescence ages, they still allow for some

Table 1
Chemical content of K, Tb, Th and U determined by chemical and dosimetric analyses, water contents and, dose rate (Dr) and absorbed dose (De) determined by luminescence for coarse quartz grains and luminescence and radiocarbon ages.

Sample			LM1#1	LM2#1	LM2#2	LM3#1
SU			[103]	[211]	[210]	[308]
In situ gamma spectrometry	K	%	4.25	3.88	3.89	3.89
		±	0.05	0.05	0.05	0.05
	Th	mg/kg	19.47	16.37	15.51	16.20
		±	1.80	1.52	1.44	1.51
	U	mg/kg	6.76	6.94	7.03	6.06
		±	0.62	0.64	0.64	0.56
FUS-ICP	K	%	4.18	4.29	4.54	4.29
		±	0.005	0.005	0.005	0.005
FUS-MS	U	mg/kg	7.70	11.40	7.70	8.20
		±	0.050	0.050	0.050	0.050
	Th	mg/kg	20.70	16.50	14.60	15.70
		±	0.050	0.050	0.050	0.050
	Rb	mg/kg	299.00	310.00	321.00	319.00
		±	1.00	1.00	1.00	1.00
Water Content		%	26.00	24.00	21.00	23.00
Dr		Gy/ka	5.80	6.20	6.00	5.80
		±	0.10	0.10	0.10	0.10
De		Gy	14.6	11.9	13	13
		±	0.3	0.9	1	2
Luminescence Age		ka	2.50 ± 0.08	1.9 ± 0.2	2.2 ± 0.2	2.2 ± 0.3
		cy	560 BC- 400 BC	80 BC – 320 AD	380 BC – 20 AD	480 BC – 120 AD
Radiocarbon Age		cy	cal BC 1135–1046	cal AD 63–216	Greater than Modern	cal AD 11–122 & cal AD 432–598

interesting considerations that make the latter more reliable considering the specifics of these extremely shallow archaeological contexts (Table 1). For instance, sample LM2#1 taken from the infill of the inner wall indicate through both its radiocarbon date (cal AD 63–216) and the luminescence age (1.9 ± 0.2 ka) that the structure was already abandoned around the 2nd century AD (Fig. 7 and Table 1). The radiocarbon date of sample LM3#1 (cal AD 11–122) taken from a deposit sealed by the outer wall is relatively close to the luminescence age (2.2 ± 0.3 ka). The other radiocarbon date taken from the same deposit, which has followed a different sampling method, gave a much later date (cal AD 432–598) (Fig. 9 and Table 1).

5. Discussion: Integrating the evidence

Of the two Roman military sites discussed in this paper, Lomba do Mouro seems to be a particularly suggestive example of a camp built in an unfavourable terrain -perhaps forced by various logistical or strategic factors- and where the army tried to reinforce its weak points in the best feasible way (i.e. what Pseudo Hyginius (*Met.* 56) called *castra necessaria)*. Though morphological irregularity due to adaptation to the terrain is a constant feature shown by the camps documented so far in the mountains of northern Iberia (Camino Mayor et al., 2015; Costa-García, 2018; Peralta Labrador et al., 2019), the over-fortification of Lomba do Mouro may represent a reaction to an actual or figurative threat motivated by the stress of a campaign in which the troops were perhaps under constant pressure. This has been extensively documented in small enclosures such as Monte Curriel.los (Camino Mayor et al., 2007), but not at a large site. Yet, the absence of material culture and of other diagnostic archaeological features such as *claviculae*, as well as the particularities of these structures and contexts, imply that the dating and historical contextualisation of these sites relied heavily on absolute dating methods.

Luminescence and radiocarbon dating use dissimilar materials and date distinct events. In our case, radiocarbon dating proved to be less reliable, with inconsistency both between different radiocarbon dates, and between radiocarbon and luminescence dates. Possible reasons include bioturbation processes caused by the local vegetation root system reaching the geological substratum and interfering with the sediments. Indeed, abundant small and medium-sized roots were observed during excavation, which makes this scenario plausible. With the small size of the charred materials recovered meaning that they could more easily be displaced from their original position due to bioturbation, the dated charcoal fragments may correspond to post-abandonment burning events that subsequently moved through the sediment strata down to the archaeological layers. The date obtained for the soil organic matter sample (which is also more recent than expected) must similarly be interpreted by taking into consideration the morpho-stratigraphic conditions on site. The shallow soils and scarce stratigraphy mean that the archaeological layers may have been subject to intrusions and infiltrations of organic matter through the dry-stone walls over time. This made it possible for relatively modern organic matter from the surface to be incorporated to the deeper organic pool, thus artificially rejuvenating its radiocarbon age.

The prerequisite for luminescence dating is that the “clock” in a sample was reset prior to or at the event of interest (i.e., removal of the relevant trapped charge through either heat, light, or a combination of both) and that the sample remained in a closed environment afterwards (for the “clock” to accurately record time since the event of interest). However, several phenomena, either at the level of the formation of the context/event, or at the post-depositional level, can disturb this presupposition. Phenomena like bio/pedoturbation may have a significant effect on luminescence ages (Bateman et al., 2003). Post-depositional mixing processes can have a considerable impact on luminescence dating and, depending on their nature, result in ages that are too old or too young. Nevertheless, incompletely bleached samples, promoted by rapid events, usually lead to great variability in De. High values occur because some grains were not reset in the events of deposition and thus inherited a residue of the geological signal. In our luminescence dating results, a dispersion, and a consequent uncertainty, was observed for all samples, but without a consistent correlation with the applied preheat temperature of SAR-OSL protocol. The dispersion may be a consequence of the presence of a residual geological signal, a reflection of inefficient bleaching of quartz grains due to ineffective or rapid exposure to sunlight, which gives a higher absorbed dose to some aliquots. The dispersion may also reflect the presence of grains with lower absorbed doses, more recently exposed to sunlight, possibly due to bioturbation phenomena. However, in samples LM2#2 and LM3#1, sealed by the inner and outer walls respectively, any potential post-depositional solar exposure events are unlikely (only bioturbation and rapid events could be considered). Consequently, both dates were consistent and were provided by the robust average of a representative set of measured aliquots. Therefore, the luminescence dates of samples LM2#2 and LM3#1 are most useful to approximately date the construction of both the inner and outer walls of the Lomba do Mouro enclosure to around the 2nd century BC. This raises in turn the strong possibility that this enclosure, together with that of Chaira da Maza, was constructed as part of *Decimus Junius Brutus* expedition across the Lima River to the Minho.

6. Conclusion

The archaeological survey conducted in the Lomba do Mouro enclosure made it possible to understand how the walls were built and to recover sediment samples in contexts sealed by the walls. These were dated through luminescence, applying SAR-OSL protocol to coarse quartz grains (160–250 μm), and ^{14}C. Luminescence dates point to a construction date of both walls around the 2nd century BC, albeit with some degree of uncertainty. The uncertainties are the result of absorbed dose dispersion motivated by an incomplete bleach of the quartz geological signal. This phenomenon could be caused by a quick event of sun exposure of these sediments due to the construction of the ramparts in a brief period by a large military contingent. The size, morphology, location, and approximate dating of the Lomba do Mouro enclosure, in conjunction with ancient written sources, are consistent with a late-Republican Roman military camp.

Lomba do Mouro is a massive enclosure of c. 25 ha delimited by two stone walls capable of holding a large military garrison - up to 15,000 men, according to some estimates (Richardson 2004). The Chaira da Maza enclosure is in the same mountain range, has a comparable size and shows a similar construction technique in its wall. Both sites could be part of a penetration route of the Roman army through the Laboreiro Mountain around the 2nd century BC, when the first Roman military expeditions to Northwest Iberia took place. From the ancient written sources, we know that one of the most active areas of the expedition commanded by *Decimus Junius Brutus* was precisely the region between the rivers Lima and Minho, where both enclosures are located. It is difficult to securely link both sites with this specific expedition at this stage, but we cannot exclude this hypothesis either.

The study presented here highlights the need to use complementary dating methods. This is particularly important in contexts where soil formation is slow and exposure to erosion more significant and where the sealing of archaeological layers through time is not guaranteed, and contamination processes are possible. The study of ephemeral structures such as Roman camps presents considerable difficulties per se, to which we must add others related to the depositional and post-depositional processes affecting these sites. Nevertheless, despite being discovered only very recently, the in-depth study and characterisation of many Roman military sites in Northwest Iberia is now well underway. By using integrated methodologies like those applied at Lomba do Mouro -remote sensing, surface and geophysical surveys, test trenches excavation, sampling for absolute dating of the defensive systems and palaeoenvironmental studies- substantial progress is being made in our knowledge of other military sites in the region. This allows us to better quantify the spatial and chronological aspects of the Roman expansion in the area between the 2nd and 1st centuries BC and its impact on local landscapes and societies and construct archaeology-led narratives about historical processes that until recently were poorly understood.

CRediT authorship contribution statement

João Fonte: Conceptualization, Investigation, Resources, Writing – original draft, Writing – review & editing, Visualization, Project administration, Funding acquisition. **Ana Luísa Rodrigues:** Investigation, Writing – original draft, Writing – review & editing, Visualization. **Maria Isabel Dias:** Investigation. **Dulce Russo:** Investigation. **Tiago do Pereiro:** Investigation. **José Carvalho:** Investigation. **Sérgio Amorim:** Investigation. **Carlos Jorge:** Investigation, Visualization. **Patrícia Monteiro:** Investigation, Writing – original draft. **Cruz Ferro-Vázquez:** Investigation, Writing – original draft. **Jose Manuel Costa-García:** Investigation, Writing – original draft, Writing – review & editing, Visualization. **Manuel Gago:** Investigation, Writing – original draft, Visualization. **Ioana Oltean:** Investigation, Writing – original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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