Archaeological and Anthropological Sciences (2019) 11:5691–5704
https://doi.org/10.1007/s12520-019-00901-9

ORIGINAL PAPER

Dating the early Christian baptisteries from Idanha-a-Velha—the Suebi-Visigothic Egitania: stratigraphy, radiocarbon and OSL

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Received: 12 April 2019 / Accepted: 11 July 2019 / Published online: 30 July 2019

Abstract

The results of the excavations carried out by one of the authors in the early Christian baptisteries of Idanha-a-Velha, in Suebi-Visigothic *Egitania*, are presented. Chronostratigraphic data (stratigraphic sequence, typological analysis) are compared with radiocarbon and luminescence dates in order to establish a hypothesis concerning the construction date of both north and south baptisteries. The results have shown that the baptisteries are dated earlier than what had been proposed based on their constructive typology. The dates proposed in this article will generate a change in the paradigm established for this type of constructions in the Iberian Peninsula.

Keywords Lusitania · Late Roman · Early Medieval · Christian architecture · Dating analysis

Introduction and background

Idanha-a-Velha

During the Roman period, the hamlet of Idanha-a-Velha (Idanha-a-Nova, Portugal) was the capital of the *civitas Igaeditanorum*. *Igaedis* (probable name of the city) dominated a large territory, rich in gold mines (Figs. 1 and 2). It is uncertain whether the city had been inhabited prior to the arrival of Rome, or whether it was founded *ex nihilo* by the Romans, perhaps in the 30s BC (Mantas 1988, 2006). An inscription, dated to 16 BC, records the solemn gift of a sundial to the *Igaeditani* by a citizen from *Emerita*, capital of the province, which suggests the city's status as the capital of a *civitas* by the beginning of Augustus's reign (Étienne 1992; Redentor and Carvalho 2016). Thenceforth, the capital of the *Igaeditani*, located in a strategically important spot on the road from *Emerita* to *Bracara Augusta*, was to remain a prominent location in the map of inner north Roman *Lusitania* (Carvalho 2012a, 2012b). The importance of the city is manifested by a truly exceptional epigraphic repertoire and various architectural remains, including the city wall (which probably outlines the urban perimeter in the late imperial period) and the *forum* (where the podium of the main temple, currently serving as foundations for a Templar tower, is still visible). Recent excavations have dated the *forum* to the Augustan period. It is possible that construction was begun in AD 4–6, when the *territorium* of the *civitas* of the *Igaeditani* was established (Carvalho 2009).

The city was to retain its importance over time. The city was conquered by the Suebi in the opening decades of the fifth century. In the Suebic period, the city, known then as *Egitania*, was made a bishopric (Alarcão 2012: pp. 117–123). The

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Fig. 1 Location of Idanha in the Iberian Peninsula

diocese of *Egitania* is mentioned for the first time in the proceedings of the Council of Lugo, convened in 569, and, soon afterwards, is mentioned again during the Second Council of Braga, convened in 572; both councils were attended by *Adoricus*, *Egitaniae episcopus* (de Almeida 1956: p. 37, Palol 1968: p. 132, Vives Gatell 1963: p. 85). It is generally accepted that the

Fig. 2 Idanha-a-Velha from the south

Fig. 3 Location of the two baptisteries in relation with church of St. Mary. (1.) North Baptistery. (2.) South Baptistery. (3.) Church building, with the remains of the possible bishop's palace around it. (4.) Wall, with a possible Late Imperial origin, with reconstructions in Medieval times (currently in study). (5.) Keep of the Templar castle, located over the podium of the roman temple in the forum

elevation of the city to diocesan rank must be dated somewhat before 569 (de Almeida 1965: pp. 39–41) and it is even possible that this creation dates back to the fifth century. In 585, the city was annexed by the Visigothic kingdom, but it retained its episcopal rank; its bishops were regular participants of the various councils convened in Toledo in the course of the seventh century (Jorge 2002: pp. 75–76). Several Visigothic kings issued coins in the city, from Reccared (586–601) to the last, Roderic (710–711) (Garcia-Bellido Garcia De Diego and Blazquez Cerrato 2001: p. 179). The most remarkable remains of the Suebi-Visigothic period are the baptisteries. The remains of the primitives Christian temples in the city—inside the walls—are probably beneath the church of St. Mary (Cristóvão 2002: p. 22), which was probably built in the late ninth or early tenth centuries; the plan of the church of St. Mary is probably adapted to a previous ecclesiastical building (Real 1995: pp. 17–68, Alarcão 2012: pp. 118–120, Fernandes 2016: p. 270). D. Afonso Henriques, the first king of Portugal, donated *Egitania* (known then as *Ydania*) to the Knights Templar in 1165; the city was a bishopric until 1199, when the see was transferred to Guarda, where it remains.

In the 1950s and 1970s, Fernando de Almeida directed several excavations in Idanha-a-Velha, especially in the church of St. Mary and its nearby structures, which were at the time known as 'Paço dos Bispos' (Figs. 3 and 4). Following these excavations, Fernando de Almeida published several works about *Egitania*, which are still a key reference for the study of Idanha-a-Velha. Beginning in the early 1990s, the 'Direção Regional de Arqueologia de Coimbra (IPPAR)' and the Council of Idanha-a-Nova promoted several excavations in this historical village, within the context of a wider project aimed at valorising its heritage. Excavations carried undertaken near the church of St. Mary led to the discovery of a second baptistery to the north of the church, which stresses even further the importance and complexity of what is one of the most outstanding architectural complexes in the Late Roman and Early Medieval Hispania.

The baptisteries

The *South Baptistery* was discovered to the south of the church of St. Mary—it abuts the external wall of the southern

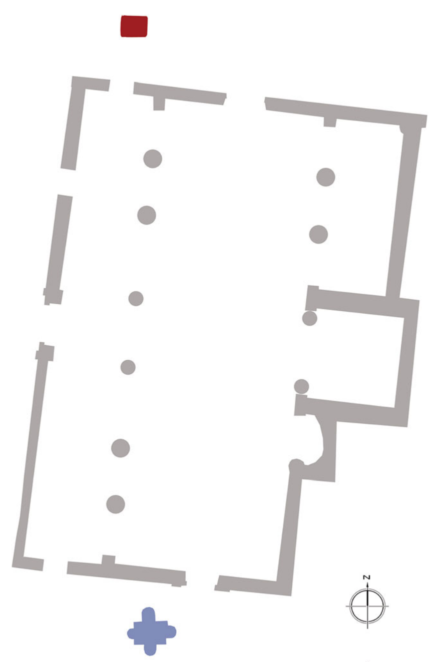


Fig. 4 Location of the baptisteries and the church of St. Mary

Fig. 5 South Baptistery with the location of the stratigraphic sequence represented in Fig. 8

nave—by Fernando de Almeida in 1962, (de Almeida 1965, 1966). The plan of the building forms a cross, the type of which led de Almeida to argue for a Near Eastern origin, as well as North African influences (Fig. 5). According to de Almeida's reports, no associated material that could be used to date the construction of the building was found; de Almeida suggested that the baptistery would be coetaneous with the church of St. Mary, probably built at the time of the creation of the bishopric in the sixth century, but he also mentioned the possibility that the baptistery could be earlier, possibly associated with a church that predated the episcopal see (*Id.*: pp. 134–136).

Subsequently, the South Baptistery and its relationship with the church of St. Mary—which has also been interpreted as a mosque (Torres 1992: pp. 173–174) and as a bishop's palace in relation to a Christian complex (Caballero Zoreda 2006, Fernandes 2006)—has been examined by other authors. The Visigothic chronology of the baptistery and its relationship to a primitive Suebi-Visigothic church of St. Mary—elements of which were found in the excavation, while others were reused in the walls of the current church, for instance several capitals dated to the second half of the sixth century (Domingo Magaña 2011: p. 66)—have been broadly confirmed: Fernandes 2006, 2009) dates it to the fifth–seventh century, while Torres (1992) narrows its construction date down to the sixth–seventh centuries; Barroca (2012: p. 184) dates the construction of the building to the second half of the sixth century, making it coetaneous with the earliest written references to the bishopric of *Egitania*. The dates in the second half of the late sixth century are largely based on typological parallels in Jordan and North Africa (Schlunk and Hauschild 1978: pp. 149–150, Ulbert 1978: pp. 149–153). This chronology, based on typological criteria alone, has attracted considerable criticism (Godoy Fernández 1995: p. 324). The stratigraphic relationship of the baptistery with the other structures suggests that the baptistery is earlier than the current Cathedral (Cristóvão 2002: p. 22)—the baptistery was partially cut by the southern wall of the church, which was perhaps built around 875, as part of the plan of the rebel muladi *Ibn-Marwan* (Torres 1992), or (re)built in the late ninth or earlier tenth centuries after the conquest of the city by Alfonso III of Asturias (866–910) (Real 1995).

In 1998/1999, new excavations were undertaken. The visible remains were cleared and some materials that were lying in their vicinity were collected; a small *sondage* was opened next to a wall that projects perpendicularly from the southern façade of the church. In 2005, the sectors that had not been excavated by Fernando de Almeida were excavated down to the foundations of the current church, as a way to protect the remains of the South Baptistery.

The *North Baptistery* was discovered more recently, in 1998, nearly fitting the outside of the northern sector of the church of St. Mary (Cristóvão 2002). The earliest excavations of this area were undertaken between late 1998 and early 1999. The second, and last, excavation season was initiated in 2005, when the baptistery was fully excavated (Fig. 6). The surviving remains include a rectangular water cistern with small steps on both ends (as in the South Baptistery, the top step and the cistern's rim were lost). It was dated to the '4th or early 5th century' (*Id.*: pp. 14–15). Soon after the excavation began, remains of walls associated with the baptismal pool were found; it is believed that they belong to the Early Christian temple, that is, with the church which is related to the baptistery, as previously suggested by Sánchez Ramos and Morín Pablos 2014: pp. 410–412).

This chronology, however, has been challenged: 'the temple could be of a later date, when baptism by immersion gave way to baptism by aspersion' (Fernandes 2006: p. 63); others have even suggested the possibility of the North Baptistery being later than the one to the south (Caballero Zoreda 2006: pp. 270–271) or, simply, have regarded the evidence available as insufficient to establish a precise chronology.

That is, the dates that have been suggested for both baptisteries are unconfirmed. These dates are merely based on constructive and stylistic features, the historical contextualisation

Fig. 6 North Baptistery with the location of the stratigraphic sequence represented in Fig. 11

Table 1 Samples, material, baptistery and method

Sample	Material	Baptistery	Method
IV-4A	Mortar	South	OSL, ^{14}C
IV-4B	Brick	South	OSL
IV-5	*Opus signinum*	South	OSL
IV-7A	Joint mortar	North	OSL
IV-7B	Brick	North	OSL
IV-7C	*Opus signinum*	North	OSL, ^{14}C
IAV1	Charcoal (Esteva-*Cistus L.*)	South-UE 31	^{14}C
IAV2	Animal bone	South-UE 31	^{14}C
IAV3	Animal bone	North	^{14}C
IAV4	Human bone	North	^{14}C

of their construction and the stratigraphic relationships between the surviving structures.

The aim of the present work is to reassess the construction and abandonment dates of the baptisteries to the south and north of the church of Idanha-a-Velha. In order to do this, we have combined the stratigraphic and stylistic evidence of the material found in the recent excavations with absolute dating techniques, including ^{14}C and optically stimulated luminescence (OSL) of the *opus signinum*, mortars and bricks used in the baptismal structures.

Methodology

The recent excavations (1998/1999 and 2005)

Both baptisteries were stratigraphically excavated under the direction of José Cristóvão. Whenever possible, archaeological contexts (UEs) were defined and manually excavated, latest first. As such, the material collected was sequentially contextualised according to the chronological order of deposition and divided into phases (construction, abandonment and post-abandonment). The whole process was carefully recorded through the use of standard context sheets, photographs and drawings. The material found in the different contexts (from pottery to organic material) was comprehensively compiled.

Luminescence dating

The best option concerning the dating of the baptisteries was the analysis of the materials used in their construction, chiefly mortar and bricks. Both materials are susceptible of absolute dating by luminescence (Sanjurjo-Sánchez 2016; Urbanova et al. 2015), and several samples were taken (see Table 1). Two mortar samples were also analysed by ^{14}C with AMS (see next section).

The technique chosen involved optically stimulated luminescence (OSL) of the quartz present in the mortar binders and the brick tempers. The analyses were carried out at the Laboratorio de Luminiscencia, Universidad de A Coruña (Spain). In red light conditions, two brick samples were selected (IV-4B and IV-7C), and a layer (2 mm thick) was cut off with a low velocity saw. The remaining material was fragmented (not ground) in a steel mortar, dried and sieved. Concerning mortar samples, the external layer was cut off to a depth of 5 mm, because it consists of a more porous material. The remaining samples were also fragmented in a steel mortar. In both cases, the diameter of the resulting samples was 180–250 μm. These samples were treated with hydrochloric acid and hydrogen peroxide in order to eliminate carbonates and organic matter, respectively. Afterwards, the sample was submerged in heavy liquid in order to separate the quartz from the feldspars and the heavy minerals, and the quartz was treated with hydrofluoric acid in order to eliminate any other minerals from both the core and the surface of the sample. The purity of the quartz was then tested by measuring the infrared stimulated luminescence (IRSL) signal in several aliquots, to ensure that no trace of feldspar was detected.

A few quartz grains (~ 50) were mounted on stainless steel discs and the equivalent dose (D_e) was measured on a Riso DA-15 automated TL/OSL reader device equipped with 0.120 ± 0.003 Gy s^{-1} $^{90}Sr/^{90}Y$ beta-sources and a 9235QA photomultiplier tube (PMT). An optical Hoya U-340 filter was used to measure the UV-range emission, after optical stimulation using blue diodes.

The blue-OSL (BL-OSL) single aliquot regenerative dose (SAR) protocol (Murray and Wintle 2000, 2003) was used to assess the D_es. Measurements were performed at 125 °C for 40 s after 10-s preheating. Preheat temperatures of 200 °C were chosen after performing preheating temperature tests

Table 2 Concentration of K, U and Th in the samples and estimated doses (D_β beta dose, D_γ gamma dose, D_c cosmic dose, D_r annual dose)

Sample	U (ppm)	Th (ppm)	K (%)	D_β (mGy/a)	D_γ (mGy/a)	D_c (mGy/a)	D_r (mGy/a)
IV-7A	4.00 ± 0.20	10.05 ± 0.50	3.24 ± 0.03	2.94 ± 0.78	1.99 ± 0.10	0.18 ± 0.01	5.11 ± 0.28
IV-7B	7.81 ± 0.39	12.30 ± 3.66	3.73 ± 0.04	3.78 ± 0.52	0.74 ± 0.09	0.18 ± 0.01	4.71 ± 0.19
IV-7C	3.32 ± 0.17	8.02 ± 0.40	2.42 ± 0.02	2.22 ± 1.17	1.24 ± 0.09	0.18 ± 0.01	3.64 ± 0.54
IV-4A	1.92 ± 0.10	2.62 ± 0.13	2.74 ± 0.03	2.09 ± 0.74	0.54 ± 0.05	0.18 ± 0.01	2.82 ± 0.37
IV-4B	3.78 ± 0.19	9.39 ± 0.47	2.49 ± 0.02	2.45 ± 0.87	1.02 ± 0.07	0.18 ± 0.01	3.67 ± 0.36
IV-5	4.40 ± 0.22	6.95 ± 0.356	3.40 ± 0.03	2.96 ± 0.63	0.47 ± 0.07	0.18 ± 0.01	3.61 ± 0.27

on all samples. The test-dose response was measured after heating to 180 °C. For signal integration, the first 0.8 s were used with the last 4 s for background subtraction.

To obtain the annual dose rate, the U, Th and K contents of mortars and bricks have been obtained combining X-ray fluorescence spectrometry (XRF) for the K content and inductive coupled plasma-mass spectrometry (ICP-MS) for U and Th concentrations (Table 2). The porosity and water saturation of the samples were measured to correct the effect of water content. The quartz etching step was corrected for assessing the beta dose (Brennan 2003). The conversion factors published by Guerin et al. (2011) were used to assess the beta and gamma contributions to the annual dose rate and the procedure of Prescott and Hutton (1994) for assessing the cosmic dose. For the gamma dose, we followed a geometrical model based on the position and volume of materials surrounding the dated samples (Feathers et al. 2008). Since for some samples surrounding material had been removed during excavation, we assumed an infinite matrix with the observed present surrounding materials, but including an additional error that depended on the removed volume.

Mortar radiocarbon dating

In order to obtain an independent dating for some samples, two mortar samples were selected for radiocarbon dating. Radiocarbon dating of mortars is a complex, and often unviable, process due to several factors (Sanjurjo-Sánchez 2016), especially the presence of non-charred geological calcite (Heinemeier et al. 2010); a slow hardening of the mortars (Elert et al. 2002); and the dissolution and re-precipitation of calcites once the mortar is hard (Sanjurjo-Sánchez and Alves 2012). The first of these problems is especially common, and often results in the overestimation of the age of the mortar, whereas the second and the third tend to lead to its underestimation.

In order to select the most adequate samples, we analysed the samples by XRF. The samples selected were those with a better ratio of binders and tempers. The isotopic fractionation of the calcites—C ($\delta^{13}C$) and O ($\delta^{18}O$)—was also measured in order to determine the presence of geological or re-precipitated calcites. The data was compared with available fractionation data for lime mortars (Rafai et al. 1991, 1992; Letolle et al. 1992); mortar re-precipitation (Macleod et al. 1991); weathered and unweathered lime and sand (Dotsika et al. 2009); and pollution sources in construction materials (Sanjurjo-Sánchez and Alves 2011, 2012). Based on these tests, two samples were selected for ^{14}C dating by AMS (Table 1). The analyses were carried out in the Centro Nacional de Aceleradores (CSIC) (Seville, Spain). Calibration was based on OxCal 4.1 (Bronk Ramsey and Lee 2013) and Reimer et al.'s (2013) calibration curve.

C14 dating of organic matter found in the archaeological contexts

In parallel to the stratigraphic and morphological analysis of the material found in recent excavations, four samples were selected for radiocarbon dating. In the South Baptistery, two organic samples were collected from UE 31, one of the most recent deposits, cut by the construction of the baptismal structure. This context was especially rich in chronologically diagnostic ceramic material, so these results could be valuable in terms of cross-referencing different dating methods. Unfortunately, the context was partially excavated of old, and no organic samples related to the collapse of the structure could be identified. The two samples found in UE 31 correspond to an animal bone (AV2) and a fragment of wood identified as belonging to the *Cistus L.* species gum rockrose (IAV1) (Table 1).

In the North Baptistery, the situation is altogether different. In this case, we could not identify the contexts cut by the construction of the baptistery, but we were able to find several samples related to collapse and re-occupation levels, which can provide an end date for the use of the structure. Specifically, we selected a human bone (rib-vertebra) from a burial (IAV4) located over the southern side of the baptismal structure (Fig. 7), and an animal bone (IAV3) from inside the baptismal cistern (Table 1).

Sample treatment (in the case of bones, the extraction of collagen) and analysis were carried out by Beta Analytics (Miami, USA). Calibration was based on OxCal 4.2.4 (Bronk Ramsey and Lee 2013) and INTCAL13 (Reimer et al. 2013) calibration curve.

Analyses and results.

Stratigraphy and associated materials.

In the case of the *South Baptistery*, the most valuable stratigraphic sequence is constituted by the soil deposits cut during

Fig. 7 Burial over the North Baptistery

the construction of the building, which can still be found around it (Fig. 8). Some of these UEs are chronologically much earlier than the baptistery, dating probably to the Early Imperial period, and probably bear witness to the earliest occupation of the site: these contexts include a wall section (UE 83, 84 and 95) associated with an *opus signinum* pavement (UE 79) and a hearth built of *lateres* (UE 91). Some of these contexts correspond to the abandonment level of this Roman construction, for instance UEs 80 and 85 (soil deposits found sitting above the *opus* pavement and the hearth), which, in addition to Early Imperial material (Arretine, South Gaulish and Hispanic *terra sigillata*), yielded two coins: an *antoninianus* of the *Divo Claudio* series, dated post AD 270, and a *Nummus* of Constantine II, series *Gloria Exercitus*, issued between 335 and 337, which provides us with a *terminus ante quem* for the abandonment of the building. There are other contexts related to this abandonment (UE 71—sitting atop the fragmentary wall, again rich in Early Imperial material, such as Arretine *ts*, South Gaulish *ts*, Haltern 70 amphora and lamp from *Emerita Augusta*) and post-abandonment phases (UEs 28 and 29—essentially associated with tile, bone and ceramics, including African Red Slip Ware C Hayes 50 and Late Hispanic *ts*, which date the deposit to the early fourth century AD at the earliest). UE 31 sits atop of these contexts, sealing them. The context is a deposit partially cut (like UEs 28 and 29) by the trench dug for the construction of the baptistery. This context, which was found to be rich in organic matter, such as animal bones, yielded fragments of ARSW D1 and Late Hispanic *ts*, which allow for considerable chronological precision. Specifically, a shallow plate Hayes 61 A/B4 (Fig. 9 (1)), which presents the typical rim of the type (Bonifay 2004: p. 168), and a fragment from a base—reused as game counter—decorated with alternate palmettes and trefoil pattern (Fig. 9 (2)), Hayes Style A (ii)–(iii) (1972: pp. 244–245), suggest a date in the early fifth century (Hayes 1972; Bonifay 2004), as recently demonstrated in relation to Atlantic contexts in which the variant 61A/B4 is dated to the first third of the fifth century (Fernández Fernández 2014: p. 165).

In addition to African wares, the context yielded Transitional Hispanic *ts* (Fig. 9 (4 and 8)), Late Hispanic *ts*, shapes Ritt. 8T—from the Douro and Ebro valleys—(Fig. 9 (3, 5–7)), and Drag. 37T—also from the Douro and Ebro—(Fig. 9 (9–10)), as well as a fragment of a burin-decorated rim, which can be labelled as ‘regional late fine ware’ (Fig. 9 (11)). Although the context mostly yielded material dated to the fourth century, the presence of two specimens of the Drag. 37T shape, especially one, which is decorated in the second decorative style (Fig. 9(9)), points to a date in the early fifth century, as also suggested by the ARSW. UE 31 also yielded a coin issued in 337–340 (*Nummus* of Constans II (?), series *Securitas Reip*) (Fig. 10) which presents a *terminus post quem* after the mid-fourth century. This UE was overlain by another unit (UE 30), most of which was probably removed during previous archaeological work. The top elevation of this layer is at a level with the maximum preserved height of the baptistery. The deposit only yielded a trefoil-mouthed common jug.

However, we are lacking the deposits that originally rose up to the baptistery's structure's maximum height (also lost), or the baptistery's frequentation level—probably destroyed

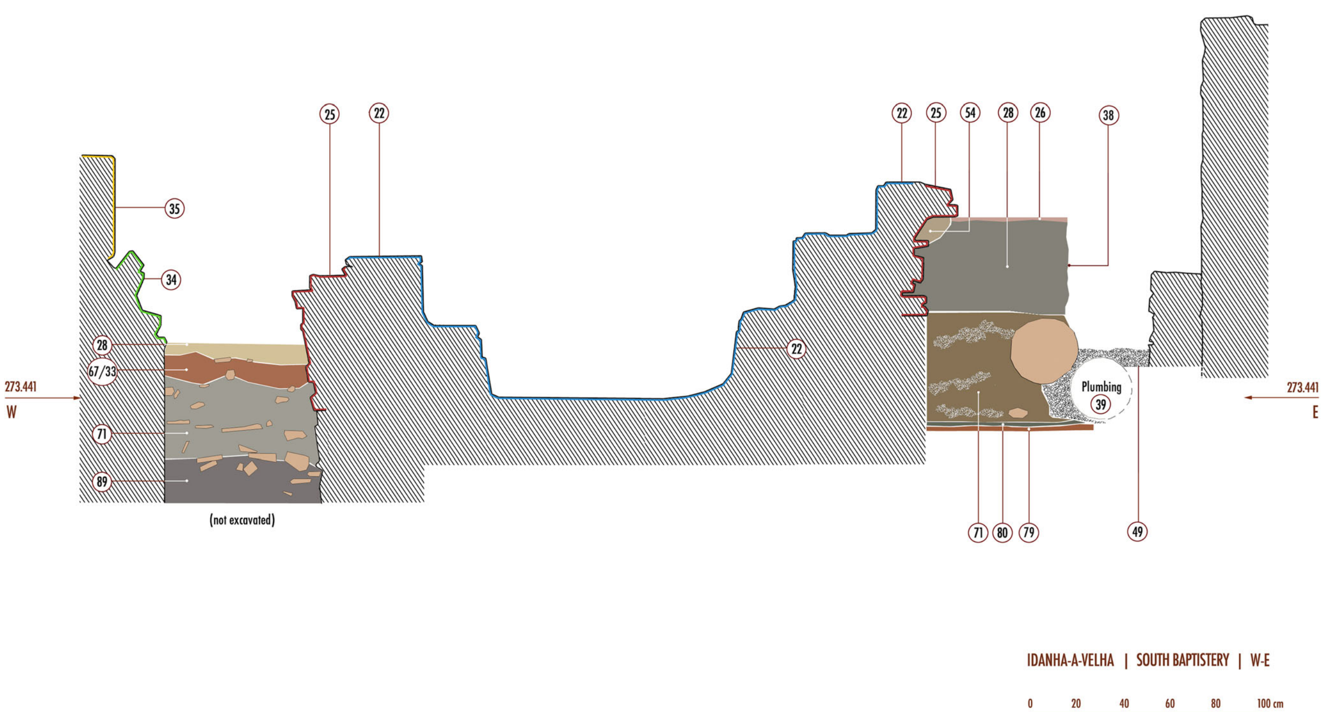


Fig. 8 Stratigraphy of the South Baptistery

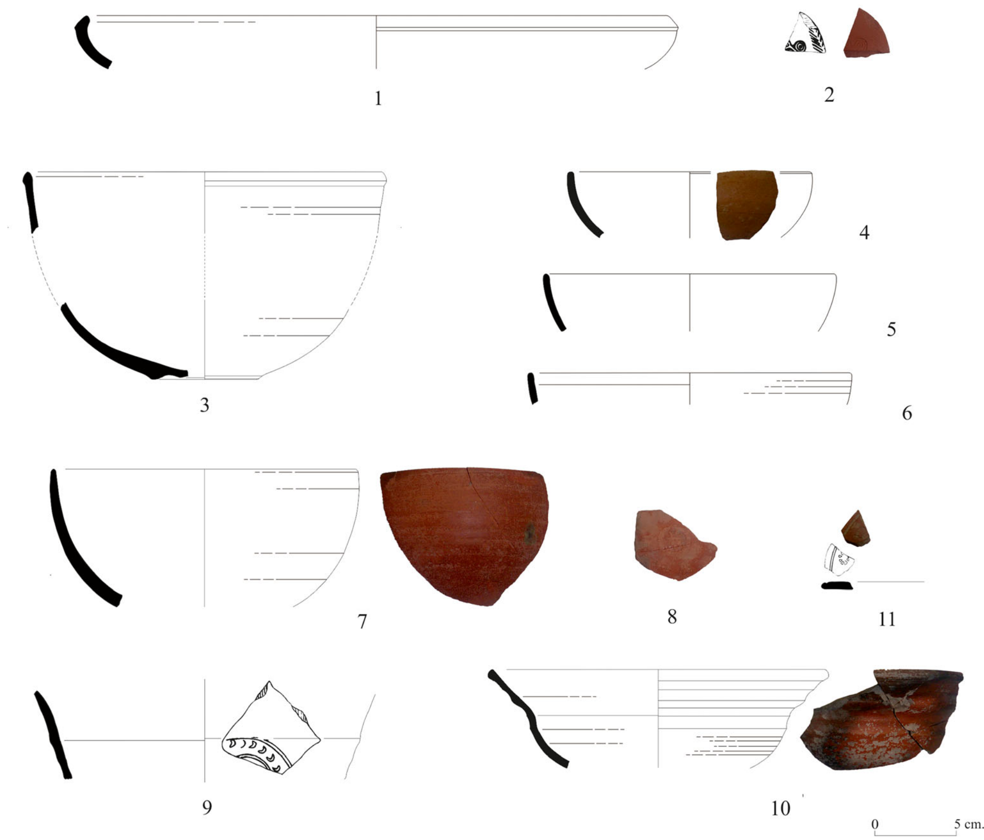


Fig. 9 Diagnostic material from UE 31, one of the most recent contexts among those cut by the foundation trench of the South Baptistery

during antiquity—which would give us a surer guide to the construction and, especially, the abandonment of the structure.

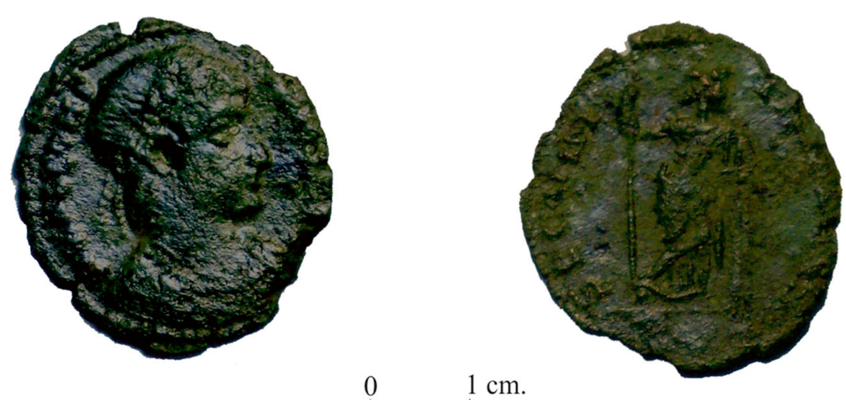
However, it seems more likely that UEs 31/30 were at a level (or nearly so), with the original maximum height of the structure. As such, they would be the latest units to be deposited before the excavation of the trench which hosted the baptismal pool, bringing us pretty close to the structure's construction date.

Be that as it may, according to the available evidence, specifically the fine wares, the South Baptistery was built after the beginning of the fifth century. Radiocarbon dates of charcoal and bone samples (see the 'Radiocarbon dating of mortars' section) from UE 31, all of which fall in the fourth century, most likely in its second half, seem to confirm this chronology.

The stratigraphic sequence documented in the *North Baptistery* is relatively extensive (Fig. 11). As in the South Baptistery, the sequence includes a series of earlier deposits cut by the construction of the building. We shall now briefly outline the sequence, further details of which will follow below.

The earliest occupation is dated to the Early Imperial period. A wall section (UE 67 and 81) and associated foundation trenches (UE 66 and 68), destruction and abandonment level

Fig. 10 Coin found in UE 31



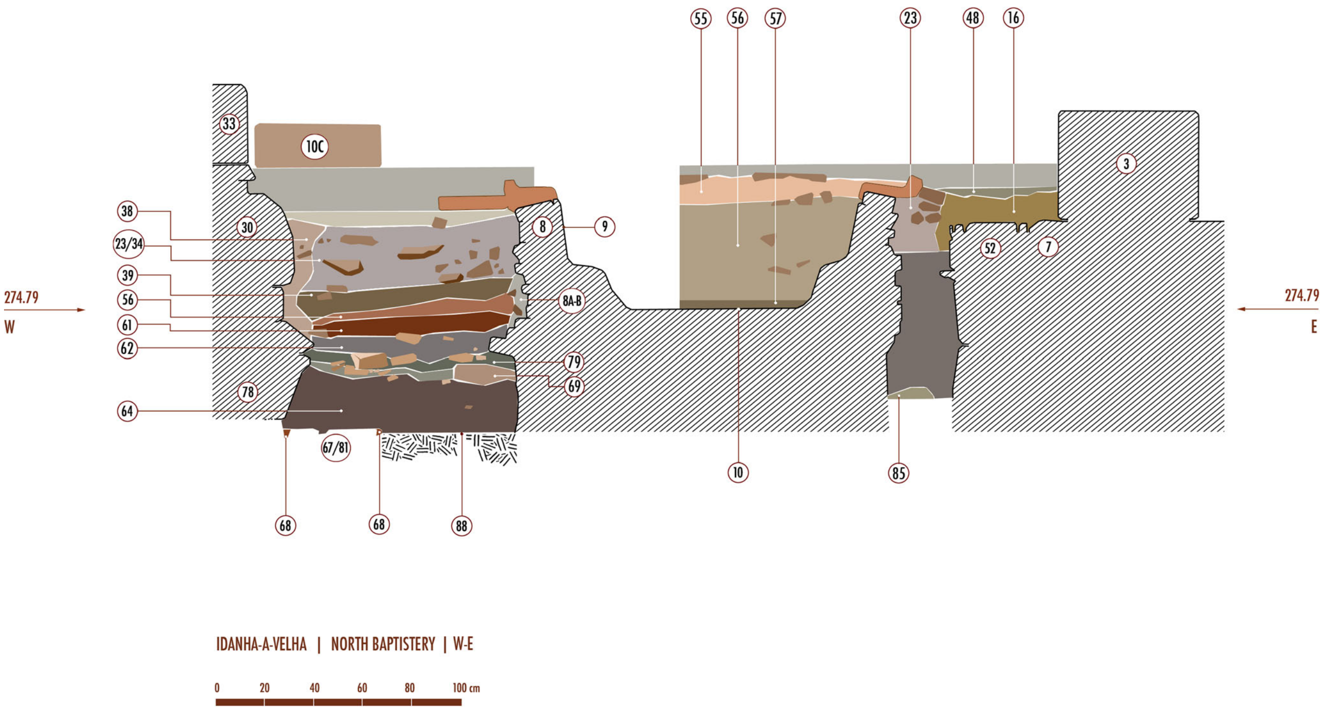


Fig. 11 Stratigraphy of the North Baptistery

(UE 64) and roof collapse level (UE 69), which were found in association with a large quantity of material dated to the Augustan period (Arretine *ts*, Italic lamps and amphorae), the mid-first century (such as South Gaulish *ts*) and the early second century (such as various shapes of Hispanic *ts*), reveal a continued occupation of this area from the Augustan period to at least the first half of the second century. A *denarius*, found in UE 64 and issued in 196–198, marks the abandonment of the Early Imperial structure, just before the beginning of the third century.

Above this, earliest sequence, a group of UEs covered and levelled the area; especially relevant were UEs 62, 61, 59, 56, 39 and 23/34, which yielded Early Imperial but also second- and third-century material (Hispanic *ts*) as well as, as we shall shortly see, material dated to the first half of or the mid-fourth century. The material found in these levels, cut by the trench dug for the construction of the baptistery (even those found in UEs 16 and 38, which correspond with the fill of the foundation trenches of the walls of an earlier feature—UEs 06, 09, 30, 31 and 78—upon which the church of St. Mary was built, and where the baptismal pool is located), is especially valuable for dating the construction of the building. These contexts have yielded ARSW C, specifically, a large Hayes 50 dish—although the specific variant is impossible to ascertain—characterised by the typically fine fabrics and slips of the ARSW C 1-2 (Fig. 12 (1)), alongside other fragments which has been impossible to identify. This sort of large bowl is dated from the late third to the mid-fourth centuries (Hayes 1972: p. 73). This date seems also to be confirmed for the deposits cut by the trench by the total absence of Late Hispanic *ts*, which is otherwise very common in the city from the second half of the fourth and the late fifth centuries, for instance in the levels cut by the construction of the South Baptistery (*vid. supra*). As noted, these productions are rare in, or even absent from, contexts dated to the first half of the fourth century (Fernández Fernández et al. 2018), but their presence increases from the second half of the century, and the first half of the fifth century. For this reason, their absence—for instance, in comparison with the sequence of the South Baptistery—from contexts that yield fragments of Hayes 50 (UEs 39 and 56) supports a *post quem* date in the first half or mid-fourth century for the construction of the North Baptistery.

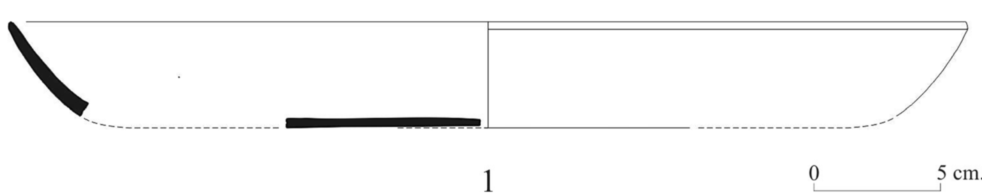


Fig. 12 Hayes 50 (ARSW C) from the contexts cut for the construction of the North Baptistery

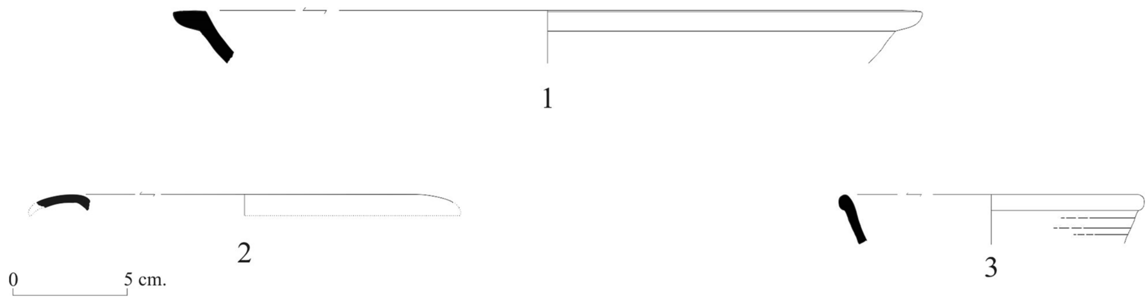


Fig. 13 Diagnostic ceramics found in the fill of the baptismal cistern

The North Baptistery sequence is also lacking in the contexts deposited in the upper part of the baptistery and the building's frequentation level. The topmost structural features are also missing; it is likely that they were removed during the medieval period, when the area was used as a graveyard.

A final sequence provides us with a potential date for the abandonment of the North Baptistery. During the 1998 excavations, the interior fill of the baptistery was excavated (Fig. 11), leading to the identification of UE 57 and 56. The diagnostic material found in association with these contexts included ARSW D1 Hayes 58B (Fig. 13 (1)), ARSW C Hayes 46 (Fig. 13 (2))—which must be considered residual—and Late Hispanic *ts* from the production areas in the Ebro and Douro valleys, shapes Ritt. 8T and Drag. 37T (Fig. 13 (3)), including several burin-decorated fragments. This assemblage suggests a late fourth–early fifth century *terminus post quem* for the abandonment of the building. In a way, this date confirms the construction date for the building and it also fits with the construction date for the South Baptistery.

The radiocarbon dates obtained from two samples, one faunal remain found in the cistern's fill and a human remain from the later graveyard, do not challenge these conclusions.

Dating by luminescence

The mortars under analysis yielded intense signals, with a high signal/background ratio. Preheat tests indicated a plateau between 180 and 220–240 °C, for which reason the preheat temperature was set at 200 °C for 10 s. The preheat tests carried out on the bricks yielded similar results. The analysis of small aliquots resulted in symmetrical and low-dispersion distributions. Based on these, D_e was established using Galbraith et al.'s (1999) Central Age Model (CAM). The calculation of the average overdispersion yielded low values, below 30%, so the model was considered an adequate methodology for age estimation. The ratio between the proportional dose and measurements provided by the dose recovery tests was within 1.0 ± 0.1 interval.

The analysis of K, U and Th yielded similar results (Table 2) for K (2.42–3.24%) and U (1.92–4.40 ppm), whereas those concerning Th are more dissimilar (2.62–12.30 ppm). This is a consequence of the different composition of the mortars. The differences in the radioisotopic content of the bricks were also significant (see Table 2). The calculation of the beta dose was carried out directly on the basis of these results (Table 2), but that of gamma dose was more complex and unreliable, because the structure of the baptisteries is partially lost and because the covering sediments have been removed. As such, the estimation of the gamma dose was based on the material surrounding each sample (Table 2) and gamma spectrometry measurements were carried out in situ; the results of these measurements and those used by applying the geometric model were similar, within a 1.0 ± 0.1 ratio.

The ages obtained for both baptisteries (Table 3) are mutually consistent, and there is some overlap. The samples from the North Baptistery (IV-7A, IV-7B and IV-7C) yielded an age range between AD 81 and AD 771, but the overlap of the results falls between AD 312 and AD 385. The range of those from the South Baptistery goes from AD 100 to AD 739, the overlap falling between AD 345 and AD473. This suggests that the North Baptistery predates the South Baptistery by several decades, although given the overlap between them and the 1σ error margin, it cannot be ruled out that both were in use simultaneously.

Table 3 Equivalent dose (D_e), number of measured aliquots (N), average overdispersion (Ov.) and ages by OSL

Sample	D_r (mGy/a)	D_e (Gy)	N	Ov. (%)	Age (a)	Year AD
IV-7A	5.11 ± 0.28	9.10 ± 0.60	38	33 ± 5	1779 ± 152	81–385
IV-7B	4.71 ± 0.19	7.59 ± 0.28	19	9 ± 2	1612 ± 88	312–487
IV-7C	3.64 ± 0.54	5.37 ± 0.30	32	20 ± 4	1473 ± 232	307–771
IV-4A	2.82 ± 0.37	4.18 ± 0.23	43	25 ± 4	1484 ± 211	316–739
IV-4B	3.67 ± 0.36	6.32 ± 0.27	21	14 ± 4	1725 ± 187	100–473
IV-5	3.61 ± 0.27	5.56 ± 0.20	39	13 ± 2	1541 ± 126	345–597

Table 4 Result of major and minor element analysis by XRF and hydraulicity, cementation and aggregate/binder values

Element (as oxide)	IV-4A	IV-5	IV-7A	IV-7C
SiO_2	46.4	48.0	63.3	52.61
CaO	37.2	14.3	1.2	8.716
Al_2O_3	7.5	15.7	20.1	16.2
K_2O	3.3	4.1	3.9	2.92
Na_2O	1.8	3.7	1.3	2.46
Fe_2O_3	1.5	5.0	5.7	5.612
MgO	0.87	5.7	2.8	7.791
P_2O_5	0.43	0.85	0.48	0.552
Cl	0.41	1.1	< 0.020	1.13
SO_3	0.34	0.80	< 0.005	0.994
Hydraulicity index	1.5	4.5	69.5	7.9
Aggregate/binder ratio	1.2	3.4	52.8	6.0
Cement index	3.6	7.0	39.7	8.6

Radiocarbon dating of mortars

The analysis by XRF of the OSL-dated mortar provided the proportion of lime and silicates present in their composition, which allows for the calculation of hydraulicity and cementation values, as well as the aggregate/binder ratio (Elsen 2006). The data (Table 4) indicate that all mortars have different aggregate/binder proportions and different hydraulicity and cementation values; mortar IV-7A is highly hydraulic, whereas the rest are non-hydraulic mortars with different aggregate/binder ratios.

Based on this data, the C and O isotopic fractionation in all four mortars was calculated (Table 5). The results of this fractionation were especially low for sample IV-4A, and significantly high for sample IV-7C. The values yielded by IV-4C are within the expected range for a mortar in which calcium carbonate has formed directly through the absorption of atmospheric CO_2 (Dotsika et al. 2009): − 6 to − 7‰ for $\delta^{13}C$ (Sanjurjo-Sánchez and Alves 2011), fractioning approximately at − 21‰ (Rafai et al. 1991) and near − 25‰ for $\delta^{18}O$. As such, the dating of the calcite in the binder should be a reliable chronological indicator of the hardening of the mortar. In sample IV-7C, isotopic relationships suggest that calcite has formed largely by absorption of atmospheric CO_2, but the fractionating yields higher ^{13}C and ^{18}O values than expected, perhaps as a result of the absorption of geological calcite (Dotsika et al. 2009). In hydraulic mortars, this can be due to the incorporation of the calcite brought in by the ceramic fragments added to the mix in order to increase hydraulicity, but to what extent this may be the case is impossible to determine.

Both samples were dated by ^{14}C by AMS, as presented in Table 6. These results suggest that sample IV-4A (South Baptistery) is dated between the second half of the third and the early fifth century, while sample IV-7C (North Baptistery) is dated between the first third of the second century and the end of the first third of the fourth century. Results pertaining to sample IV-4A are highly reliable, based on the C and O isotopic fractionating, which indicates that the carbonates in the binder were formed by absorption of atmospheric CO_2. Since the isotopic fractionating in mortar IV-7C indicates the possible incorporation of geological carbonates, probably from ceramic aggregates, it is possible that the radiocarbon results are slightly overestimated, although the resulting date ranges are consistent with other results.

Table 5 Result of isotopic fractionation for C and O

Sample	$\delta^{13}C$ (‰)	$\delta^{18}O$ (‰)
IV-7A	− 11.21	− 7.79
IV-7C	− 18.30	− 14.09
IV-4A	− 22.10	− 20.27
IV-5	− 17.70	− 8.71

Radiocarbon dating of organic samples

The organic samples selected were sent to Beta Analytic and dated by ^{14}C with AMS. Prior to analysis, bones were treated with alkalis in order to extract collagen (Table 7).

Samples from the South Baptistery (IAV1 and 2) were located in UE 31, which, based on the archaeological material recovered, are dated to the early fifth century. The results yielded by both samples (wood and fauna), in the fourth and even the early fifth century, are consistent with this chronology. These results almost match those yielded by the binding mortar (Table 6), dating to the second half of the fourth and early fifth century.

Unfortunately, the dates yielded by the organic samples from the North Baptistery are not as conclusive. The faunal remains found in the fill of the baptismal cistern (IAV3) are dated between the mid-second and the mid-third century. We may interpret that the soil used in the fill was taken from earlier deposits, and also that the fill may have been intentionally made in order to seal the feature. The other sample (IAV4) aimed to date the abandonment of the building is a human bone found in a grave that partially reused the cistern. However, the dates yielded by the radiocarbon results are much too recent (twelfth–thirteenth centuries). Therefore, the sample has no value as far as dating the abandonment of the building is concerned. As such, the radiocarbon dates from the North Baptistery do not narrow down the dates yielded by the archaeological and stratigraphic analysis and the OSL and ^{14}C dating of the mortars.

Table 6 Radiocarbon dating of mortars

Sample	Baptistery	$\delta^{13}C$ (‰)	pMC (%)	Age before calibration (BP)	Age after calibration AD (2σ)
IV-4A	South	− 23.29 ± 1.50	80.96 ± 96	1700 ± 30	255–410
IV-7C	North	− 19.23 ± 1.50	80.03 ± 0.31	1790 ± 30	133–330

Discussion and conclusions

Based on these results, it seems likely that the North Baptistery was built sometime in the mid- or second half of the fourth century, as suggested by the ceramic materials from the contexts cut by the foundation trench and the radiocarbon dates, including that yielded by the *opus signinum* which lines the inside of the cistern, although the estimates on the age of this sample may be slightly too high. The materials found inside the baptistery suggest that the building was abandoned relatively shortly after its construction, in the early fifth century or even the closing years of the fourth century. Therefore, the building was probably in use no more than 50 or 60 years. The abandonment date of the North Baptistery coincides with the chronology of the contexts cut by the construction of the South Baptistery. UE 31—the most recent of these contexts—yields a *post quem* date in the early fifth century, as confirmed by the radiocarbon dates associated with the context, which largely fall in the fourth century, one of them even reaching the early fifth century. The date range for the construction of the structure yielded by the radiocarbon dating of the mortar used for binding the bricks is broader—late third–early fifth centuries—but consistent, as is the OSL dating, with other results. Nothing can be said about the abandonment date of this building, since Fernando de Almeida's excavations thoroughly removed the contexts that covered the structure and the fills of the central cistern and its lateral wings.

The dates suggested for the construction of both baptisteries and for the abandonment of the North Baptistery are consistent with OSL dates (Tables 8 and 9), which are relatively broad but highly reliable. This technique is a reliable method to date the construction of the buildings, and its results are further narrowed down by the dates yielded by the archaeological, stratigraphic, and radiocarbon dating analyses.

Finally, the abandonment of the Early Imperial structures before the central decades of the fourth century also indicates that the urban layout to which the church of St. Mary adapted was rearranged in the mid-fourth century, presumably to make way for the original Christian cult venues (church and baptistery) inside the city, which is a remarkably early date for this sort of development.

The data which suggests that the North Baptistery was abandoned relatively soon after its construction, followed immediately by the erection of the South Baptistery, are consistent with the architectural analysis of both structures, in which similar techniques and materials were used. These analyses indicates that one baptistery followed the other in short succession, or even that they may have overlapped for a short time (Sánchez Ramos and Morín Pablos 2014: p. 413)—perhaps during the construction of the South Baptistery—as in other Iberian sites such as Son Peretó and Alconetar (Godoy Fernández 1989: p. 630). It is thus likely that the people that built both baptisteries were the same, or at least that the builders of the South Baptistery had the direct visual reference of the North Baptistery. The only differences between both baptisteries, important as they are, are their location and structure (rectangular in one case and cruciform in the other). The historical context and one of the other factors must have led to the rapid abandonment of the North Baptistery and the construction of a new baptismal feature. The new baptistery implies the foundation of a new temple. This could suggest important changes in the liturgical, religious and institutional framework, as well as the development of the Christian topography of the city.

These chronological conclusions, based on a rigorous methodology, create new working hypotheses by substantially correcting the traditional dates for the baptisteries of Idanha-a-Velha, which were based in historical-architectural criteria

Table 7 Radiocarbon dating of organic samples

Sample	Baptistery	$\delta^{13}C$ (‰)	pMC (%)	Age before calibration (BP)	Age after calibration AD (2σ)
IAV1	South	− 23.6	80.63 ± 0.30	1720 ± 30	248–390
IAV2	South	− 20.1	80.93 ± 0.30	1700 ± 30	313–406
IAV3	North	− 20.5	79.93 ± 0.30	1800 ± 30	130–260
IAV4	North	− 18.1	90.18 ± 0.34	830 ± 30	1160–1264

Table 8 Summary of the dates yielded by the North Baptistery

Technique	Sample	Age BP	AD
OSL	IV-4A	1484 ± 211	316–739
	IV-4B	1725 ± 187	100–473
	IV-5	1541 ± 126	345–597
^{14}C of mortars	IV-4A	1700 ± 30	255–410
^{14}C	IAV3	1800 ± 30	130–260
	IAV4	830 ± 30	1160–1264

Table 9 Summary of the dates yielded by the South Baptistery

Technique	Sample	Age BP	AD
OSL	IV-7A	1779 ± 152	81–385
	IV-7B	1612 ± 88	312–487
	IV-7C	1473 ± 232	307–771
^{14}C of mortars	IV-7C	1790 ± 30	133–330
^{14}C	IAV/1	1720 ± 30	248–390
	IAV/2	1700 ± 30	313–406

alone: fourth–fifth centuries for the North Baptistery and second half of the sixth century for the South Baptistery. The new dates, based on empirical OSL, radiocarbon and chrono-stratigraphic data, not only change the chronology of the baptisteries, but involve a groundbreaking methodology for this sort of structure in the Iberian Peninsula. According to our results, the North Baptistery must be dated to the mid- or second half of the fourth century, and the South Baptistery to the first half of the fifth century; there may have been some overlap between both baptisteries.

These new dates, however, must be examined within the spatial and historical context of *Egitania* and within the broader historical and liturgical framework of Hispanic early Christian archaeology. Far from merely being a new set of dates, our data put forward fresh hypotheses about early Christian liturgical constructions in urban contexts as well as the topography of Hispanic cities in the fourth and fifth centuries. It is worth stressing that the North Baptistery, which was in use by the second half of the fourth century, suggests the activity of a liturgical building which, should our conclusions be correct, would be the earliest such building known to be within the walls of a city.

Acknowledgments We want to express our gratitude towards José Luís Madeira (FLUC) for dealing with the figures. We are also thankful to Danilo Pavone, author of the photographs 5, 6 and 7. This work was undertaken within the framework of the Projecto de Investigaçao Plurianual (DGPC: 2016-2019) '*IGAEDIS*. Da *civitas Igaeditanorum* à Egitânia. A construcción e evolução da cidade e a definição dos seus territórios da Época Romana até à doação dos Templários (séculos I a XII)' – eje 3, and an agreement between the municipality of Idanha-a-Nova, Universidade de Coimbra (FLUC) and Universidade Nova de Lisboa (FCSH). The work of one of the authors has been further supported by the programme Fellowsea Marie Curie Co-Found, Universidade de Vigo.

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