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Dating Iron Age goldwork: First direct AMS ^{14}C results from Northwestern Iberia

Primeras dataciones directas de ^{14}C AMS para la orfebrería protohistórica del Noroeste de la Península Ibérica

Xosé-Lois Armada (*)
Óscar García-Vuelta (**)

ABSTRACT

This article presents the first direct radiocarbon dates for NW Iberian "Castro culture" goldwork. Three samples were taken from a melting mass and a plano-convex ingot from the so-called Recouso (Oroso, A Coruña) and Calvos de Randín (Ourense) "hoards". The study includes pXRF analysis of the pieces from both assemblages. Identification of charcoal samples allowed us to better evaluate the results. The dates point to a period late in the Second Iron Age for both assemblages. They are the first direct chronological references for this rich goldworking tradition after more than a hundred years of investigation and they open up a line of research that offers interesting future prospects.

RESUMEN

En este artículo se dan a conocer las primeras dataciones radiocarbónicas directas para la orfebrería castreña del noroeste de la Península Ibérica, obtenidas a partir de tres muestras procedentes de una masa de fundición y de un lingote plano-convexo de los conocidos "tesoros" de Recouso (Oroso, A Coruña) y Calvos de Randín (Ourense). Los trabajos realizados han incluido el análisis mediante pFRX de las piezas de ambos conjuntos y la identificación de muestras de carbón, que permiten una mejor valoración de los resultados. Las dataciones apuntan a un momento avanzado de la II Edad del Hierro para ambos conjuntos y constituyen las primeras referencias cronológicas directas para esta rica tradición orfebre tras más de 100 años de investigación, abriendo una línea de trabajo que ofrece interesantes perspectivas de futuro.

Key words: Castro-culture goldwork; Hillforts; Galicia; Late Iron Age; Early Roman period; Plano-convex ingots; Melting mass; Handheld XRF; Absolute chronology.

Palabras clave: *Orfebrería castreña; Castros; Galicia; II Edad del Hierro; Inicios de la romanización; Lingotes planoconvexos; Masa de fundición; FRX portátil; Cronología absoluta.*

1. INTRODUCTION

NW Iberia has some of the most outstanding protohistoric goldwork in Western Europe in terms of the number of items found and their variety and technological complexity. Although we do not have an up-to-date inventory of finds, we estimate that the known repertory consists of more than 150 torcs, some 50 earrings and other smaller groups of objects including bracelets, diadems or belts, pendants, hair rings, etc. We also know of around a hundred plano-convex ingots.

Research into this rich goldworking tradition dates back more than a century and has made significant progress in recent years (Armada *et al*. 2013). However, to date it has been unable to offer a firm, agreed upon chronological proposal. A small minority of experts have defended a Roman

(*) UCL Institute of Archaeology. 31-34 Gordon Square. London WC1H 0PY. United Kingdom.
E-mail: x.l.armada@ucl.ac.uk
(**) Laboratorios de I+D de Arqueología, Instituto de Historia, Centro de Ciencias Humanas y Sociales. CSIC. C/ Albasanz 26-28. Madrid 28037. Spain. E-mail: oscar.gvuelta@cchs.csic.es
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dating for the so-called "Castro culture" goldwork, while recent publications continue to place more credence on a pre-Roman origin (González Ruibal 2006-07: 420-422; Martinón-Torres and Ladra 2011: 189-190).

There are various reasons for this chronological uncertainty. First of all, the majority of the objects –especially the torcs– are the result of chance finds in or near hillforts (1). No less important is the absence in the NW of burial sites and therefore the grave goods that in other areas provide fundamental support in the chronological debate. A third aspect to take into account is the long duration of the process of conquest: more than a hundred years (138-19 BC) went by between Brutus's first incursions and Augustus's definitive conquest of the NW (Morais 2007). In part due to the nature of the archaeological record, earlier investigations found it difficult to characterise the dynamics of the contacts with Rome and to establish precise chronologies for the period around the turn of the era. This has led to lengthy debates on the origin not only of the goldwork, but also of other typical manifestations such as the stone sculpture or the saunas, which various experts place at a time after the end of the conquest.

The most up to date repertoire of radiocarbon dates for the hillforts of the NW consists of 331 valid dates from 61 sites (Jordá Pardo *et al*. 2009: 85). In only three cases –and with varying degrees of detail in their published archaeological contexts– are there absolute dates associated with evidence of goldwork: the earring from A Graña (Meijide 1996; Parcero-Oubiña *et al*. 2009: 100-102); the earring from Picu Castiellu in Moriyón (Camino 1995; González Ruibal 2006-07: 421); and a pottery sherd with gold granule adherences and the remains of silver and copper from Chao Samartín. The last of these is part of an assemblage of metallurgical remains that their excavator places, with the support of radiocarbon dating, in the early 4th century BC (Villa 2010: 107-108). Some other gold objects have been recovered in Iron Age contexts radiocarbon dated at this site (Villa 2004: 260).

In this study we present the first results of direct radiocarbon dating obtained from evidence of goldwork in NW Iberia. By 'direct' we mean that the radiocarbon samples were physically linked to the object we aimed to date and related to its manufacture or use (2). Improvements to the procedure of radiocarbon dating using accelerator mass spectrometry (AMS) (Bronk Ramsey *et al*. 2004; Wood 2015: 65), which only needs very small samples, have led to a notable increase in the number of finds and contexts that can be satisfactorily dated. The impact of this since the late 1990s has been described as revolutionary (Bayliss 2009: 126-128). These advantages are being used to directly date metal objects and the remains of metallurgical production. In the United Kingdom AMS dating has given rise to ambitious programmes on Late Bronze Age and Second Iron Age metals (Needham *et al*. 1997; Garrow *et al*. 2009), with a growing number of studies also being carried out on iron in several countries (among others, Craddock *et al*. 2002; Scharf *et al*. 2004; Leroy *et al*. 2015). Cores made of clay and charcoal preserved inside gold objects from Colombia have also been dated using this method (Plazas 1998; Uribe and Martinón-Torres 2012). In contrast, such studies are almost non-existent in Iberian archaeology (3).

The three samples we have dated consist of charcoal remains trapped in a melting mass and a plano-convex ingot (Fig. 1). The samples from fuel used in metallurgical activities can have a long life, but they have the advantage of being linked to the production of the object. These studies are also part of a larger project that includes pXRF composition analysis of the items and the identification of some of the charcoal samples, aspects that help improve the evaluation of the results.

(1) The finds of torcs outside or in the vicinity of hillforts without associated archaeological structures could be considered to be deliberate deposits (Armbruster and Perea 2000: 109-110; Sastre and Sánchez-Palencia 2013: 303), although a lack of information hinders a more precise interpretation.

(2) Other recent publications use the "direct chronology" concept to refer to dates obtained in samples from depositional contexts containing pieces of gold, but not physically linked to the objects themselves (Nocete *et al.* 2014).

(3) Worthy of mention, however, are the conventional radiocarbon dates, published in the 1970s and promoted by H. Schubart and M. Almagro-Gorbea, of wooden shafts linked to Late Bronze Age objects, such as the ferrules from the Huelva estuary or spearheads from San Esteban del Río Sil and Monte da Penha (Vogel and Waterbolk 1972: 78; Almagro-Gorbea 1977: 521-543).

Fig. 1. Map of the Iberian Peninsula with the location of the sites where the dated objects were found.

2. MATERIALS AND METHODS

2.1. Dated materials: origin and context

The charcoal remains were detected during the study of two important NW Iberian metal assemblages, the Recouso and Calvos de Randín hoards (Fig. 2). Both hoards were found by chance some decades ago and there are many questions regarding their contextualisation and life-histories, which we will deal with here only very superficially.

The first of these assemblages appeared around 1920 during farmwork at the Recouso hillfort (San Martiño de Marzoa, Oroso, A Coruña). It currently consists of 16 earrings, various hanging elements (chains or fragments of loop-in-loop chains, decorative terminals and rings), part of a possible fastener, three plano-convex ingots and a melting mass (habitually described as an ingot)(4). According to the available information, after the initial discovery farm workers dug up finds that included pottery sherds, a possible touchstone, an iron object, two pieces of slag and another two of vegetable carbon; the whereabouts of all these is currently unknown. The discovery of the hoard was initially announced in the press and in talks given by the Galician nationalist priest and intellectual, Xesús Carro García. Carré Aldao was the first author to provide a minimally detailed description and two pictures of the assemblage in a volume without a publication date (although it came out in the 1920s) (Carré Aldao s/d: 655-659). Later, Carro Otero (1996: 27), Carro García's nephew, contradicted what had previously been published, stating that the ingots came from the second find and not the first. In any case, their link to the rest of the preserved finds is not in question.

Fig. 2. General view of the hoards: Recouso (1 earring kept at the *Museo Provincial de Lugo* not included) (above); and Calvos de Randín (1 ingot not included) (below).

Most of the Recouso finds –with the exception of an earring now in the *Museo Provincial de Lugo*– are in private ownership, although they have been on deposit in the *Museo das Peregrinacións e de Santiago* (Pilgrimage Museum)

(4) Although the Recouso earrings are usually interpreted as ear adornments, we should not rule out that they may have been part of more complex adornments. This could be inferred from the fact that sixteen pieces were found together or from the presence of one clasp, which may have belonged to the element where they were threaded (García-Vuelta and Armada 2011: 458-459). We will not deal with this matter here and instead keep to the habitual denomination given to the earrings.

since 2002 (5). The earrings all belong to a type that has parallels in NW Iberia (Pérez Outeiriño 1982), namely penannular or kidney-shaped boxes concealed by profuse filigree, granules and stamped plate decoration. At the top of the pieces there is a clasp or suspension element in the shape of cylinders or bolts, whose attachment to the body is concealed by granulation and/or rings, to which chains are attached. In the hollow interior of the body there are laminar reinforcements and a non-metallic core material. The last of these features has been documented in other gold objects, for example in the British Isles (La Niece and Cartwright 2009; Cartwright *et al*. 2012). In addition to the results we present in this article, our study, for which full publication is forthcoming, included the systematic documentation of all the preserved finds, their pXRF analysis, the SEM-EDX analysis of three earrings and the characterisation of the interior fillings (García-Vuelta and Armada 2011). The charcoal samples were taken from an object (inv. number D-552), previously thought to be a plano-convex ingot (Pérez Outeiriño 1992: 115; Carro Otero 1996), but which actually is a melting mass, as we argue below (Fig. 3).

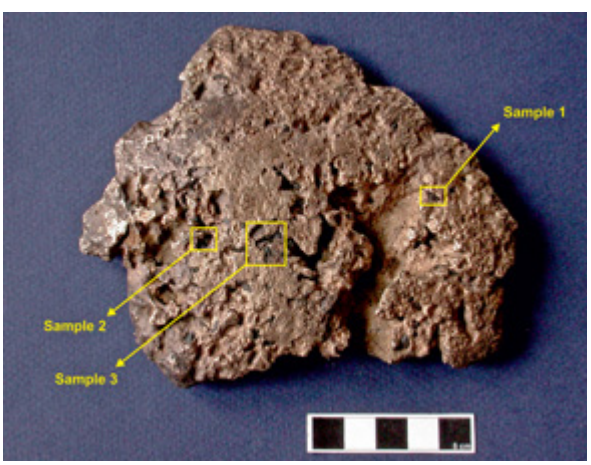

Fig. 3. Recouso melting mass: location of the samples.

(5) They were purchased on an undetermined date by the Galician intellectual Felipe R. Cordero Carrete and currently belong to his heir, Manuel Mucientes, who has placed them on deposit at the aforementioned museum.

Fig. 4. Plano-convex ingot from Calvos de Randín (nº 3831).

The other dated object is a plano-convex ingot from the Calvos de Randín (Ourense) hoard, which was discovered by chance in 1962 and consists of 17 similar objects preserved inside a pottery vessel (6). According to our research, which is in the process of being published, the find spot probably corresponds to the interior of the hillfort of Outeiro da Cerca, which is consistent with the identification of the remains of a circular construction and pottery sherds at the time of the find (Lorenzo 1970)(7). Following their recovery by the authorities, the finds were taken to the Archaeological Museum of Ourense. The sample was taken from the object with inventory number 3831 (Fig. 4), corresponding to number 3 in Lorenzo's article (Lorenzo 1970: 230-231).

2.2. Methods

The charcoal remains were identified during the study of both metal assemblages in their respective museums by means of a topographic

(6) Having reviewed the pottery sherds, Lorenzo (1970) suggests the possibility that there was more than one container vessel, although we believe it could be material collected at the site of the find but not necessarily linked to storing the cakes.

(7) We have been able to add to the details on the circumstances of the find given by Lorenzo (1970) thanks to information from the *La Región* newspaper, originally published in 1962 and reproduced in its "Historia en 4 tiempos" section on 24-I-2012, page 21. We were kindly informed of this article by Beatriz Comendador and José Rodríguez Cruz.

inspection of the objects, assisted by the use of binocular loupes. The charcoal is visible on the surface having been trapped in the irregularities and contractions formed as the metal cooled (Fig. 5). The samples were extracted under our supervision by conservation experts in the museums where the hoards are kept (8).

The D-552 melting mass from Recouso preserves multiple charcoal remains on its bottom face. We extracted three differentiated samples, two of which (D-552-1 y D-552-3) were sent to the laboratory for dating. Samples D-552-1 and D-552-2 were subjected to an anthracological study using optical and electron microscopy (9).

From the Calvos cake 3831 we obtained two samples from the bottom part: one from the upper middle area and another from near the edge. Both samples were subsequently put together in the laboratory to obtain a large enough mass for dating.

The Calvos de Randín sample and the two from Recouso were sent for dating to Beta Analytic at different times. The analyses were carried out with AMS, using acid/alkali/acid as the pre-treatment method (10). The results were calibrated using the OxCal 4.2 software (Bronk Ramsey 1995; Bronk Ramsey and Lee 2013) and the Intcal13 calibration curve (Reimer *et al*. 2013) and are presented following the conventions established in Millard (2014; Wood 2015: 68-69).

As we have already indicated, both assemblages were subjected to chemical composition analysis using pXRF. The analyses were carried out in the museums under our supervision by a technician from the Kemia S.L. company using a portable InnovX Delta Premium device with an X-ray tube excitation source (4W at 40 KV and 100 μA). The equipment was calibrated in advance to analyse 100% metallic objects using the fundamental parameters technique and was also previously adjusted using certified standards. The analyses were carried out with the analyser mounted on a stand with fixed acquisition times of thirty seconds. The results were processed using InnovX Systems software and are presented in % by weight, normalised to 100%.

Fig. 5. Optical microscope image of one of the samples in the Calvos de Randín ingot (nº 3831) before its extraction.

3. RESULTS

The results of the dating and their calibration are shown in table 1, with the ranges of greatest probability to 1 and 2 s highlighted in bold type. The Calvos de Randín sample and one of the two Recouso samples yielded an identical result (2140 ± 30 BP), whose calibration to 2 s has its range of greatest probability between 213 and 88 BC (71.2%). The other Recouso sample provided a radiocarbon age 30 years more recent, with a single probability span of two s between 204 and 46 BC.

As we have already indicated, two carbon samples from the Recouso melting mass were studied by our colleague María Martín Seijo. Oak (*Quercus* sp. deciduous) was the only taxa identified; the presence of tyloses inside earlywood vessels indicates that these fragments belong to the heartwood of the stem (Fig. 6).

The chemical composition analyses helped us to ascertain the nature of the two pieces from which the samples were taken. Table 2 shows the average results of the spectra obtained from the

(8) Luis Méndez (Archaeological Museum of Ourense) obtained the samples from Calvos de Randín and Yolanda Porto (Incipit, CSIC) those from Recouso.

(9) Study carried out by María Martín Seijo (Grupo de Estudo para a Prehistoria do NW Ibérico-GEPN, Universidade de Santiago de Compostela-USC).

(10) http://www.radiocarbon.com/pretreatment-carbon-dating.htm

Site	Lab. Code	Conventional Radiocarbon Age (BP)	Date Cal. BC (1 σ)	Date Cal. BC (2 σ)	13C/12C Ratio (δ 13C)
Calvos de Randín	Beta - 318863	2140±30	345-322 (11.0%) **206-148 (42.2%)** 141-112 (15.0%)	353-295 (19.5%) 230-220 (1.5%) **213-88 (71.2%)** 77-57 (3.2%)	-24.7 ‰
Recouso	Beta - 333064	2140±30	345-322 (11.0%) **206-148 (42.2%)** 141-112 (15.0%)	353-295 (19.5%) 230-220 (1.5%) **213-88 (71.2%)** 77-57 (3.2%)	-23.8 ‰
	Beta - 333063	2110±30	**181-92 (68.2%)**	**204-46 (95.4%)**	-23.6 ‰

Tab. 1. Conventional radiocarbon age and calibrated results of the Calvos de Randín and Recouso dated samples (OxCal 4.2 software; Intcal13 calibration curve).

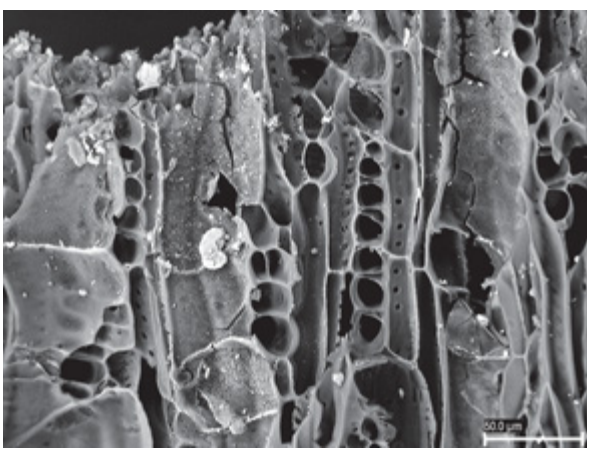

Fig. 6. SEM image of the Recouso charcoal sample (tangential section).

three cakes and the Recouso melting mass, all of which reveal ternary alloys of Ag-Au-Cu with silver in the highest concentration, high values for gold and significant percentages of copper, which of necessity must be considered an alloyed element (11). Of particular note is the similarity in the composition of the different objects, although the melting mass has the lowest silver content and a copper content of more than 17%. This specimen is also different to the other three in size, weight and surface appearance. The spectra obtained (Tab. 3) confirm that the differences in the colouring and surface are linked to significant changes in composition, with differences in silver of around 50% between the zones with a greater or lesser presence of that metal, as well as with significant variations in the percentages of gold and copper. The values obtained on the bottom face were more uniform, with silver content varying between 47.6 and 53.8%.

We believe these data allow us to rule out the traditional identification of this specimen as a plano-convex ingot and endorse its interpretation as a melting mass, probably the result of a combination of various castings and/or the remains of material that failed to homogenise. Nevertheless, the average value of the compositions from the different zones is quite similar to that documented in the three cakes of the assemblage, although with a higher Cu content, as we have already mentioned. While these data cannot be considered conclusive, they allow us to put forward the hypothesis that the melting mass corresponds to the processing of material to be used for the manufacture of plano-convex cakes.

The averaged and normalised result of the spectra of cake 3831 from Calvos de Randín (Tab. 2) show a composition of 92.5 Ag, 6.6

(11) In both the Recouso and Calvos de Randín pieces the Cu, Ag and Au results are normalised to 100% and do not include trace elements. Some of the spectra from Recouso cake D-554 are affected by surface contamination and present a high iron value, making the normalised result slightly different to those of pieces D-553 and D-555.

Object	Type	Weight (gr.)	Cu (%)	Ag (%)	Au (%)
Calvos de Randín 3831	Plano-convex cake	351.4	6.6	92.5	0.9
Recouso D-553	Plano-convex cake	711.7	12.3	65.9	21.7
Recouso D-555	Plano-convex cake	110.2	12.3	65.1	22.6
Recouso D-554	Plano-convex cake	157.0	9.8	71.0	19.2
Recouso D-552	Melting mass	1391.2	16.5	63.6	19.9

Tab. 2. Chemical composition (pXRF) of the Calvos de Randín plano-convex ingot (nº 3831) and the Recouso plano-convex ingots and melting mass (in wt%, normalised; trace elements not included).

Analysed area	Cu	Ag	Au
Top surface (area 1)	0.3	99.3	0.4
Top surface (area 2)	9.1	80.3	10.6
Top surface (area 3)	22.1	50.1	27.8
Top surface (area 4)	14.3	63.9	21.8
AVERAGE (Top surface)	11.5	73.4	15.1
Bottom surface (area 1)	23.4	50.2	26.4
Bottom surface (area 2)	25.2	47.6	27.2
Bottom surface (area 3)	21.2	53.8	25.0
AVERAGE (Bottom surface)	23.3	50.5	26.2
AVERAGE	16.5	63.6	19.9

Tab. 3. Chemical composition (pXRF) of the upper and lower surfaces of the Recouso melting mass (in wt%, normalised; trace elements not included).

Cu and 0.9 Au (12). These results are very similar to those from the majority of the other 15 cakes analysed from this assemblage, with silver values of between *c*. 92 and 98.5%, copper values between 1 and 6.5% and a gold content of less than 1% (13). In fact, the piece from which the sample was taken is that which has the highest copper and lowest silver levels in the majority group, in which the general trend is for compositions with silver values nearing 95%. The homogeneity shown by the compositions of the Calvos de Randín cakes is also reflected in the weights, the majority of which are between the 360 and 370 gr. Cake 3831 weighs only 351.4 gr, making it one of the lightest in the assemblage.

4. DISCUSSION AND CLOSING REMARKS

After more than a hundred years of research, the chronological information regarding the so-called "Castro culture" goldwork is still insufficient to be able to propose a reliable periodisation of its origin, evolution and principal manifestations. With the aim of mitigating these difficulties, Perea (2003: 146-148) proposed a chronological model in terms of probability applied to the torcs, distinguishing four phases based on the formal and technological characteristics of each of them: an early period (7th-6th c. BC), a transition period (5th c. BC), a classic period (4th and part of the 3rd c. BC) and a transgression period (from the second half of the 3rd c. BC). The data currently available do not allow us to adequately test this proposal, but they suggest that the most typical "Castro culture" goldwork did indeed originate in the Second Iron Age and appears to have undergone significant development in the 2nd and 1st centuries BC, linked to the increasing complexity and social transformation processes that were occurring during that period. These changes in Iron Age society –which can be associated with new forms of power brought about in part by the threat presented by the Roman troops– is also reflected in other aspects of the material culture, such as the stone statues and architecture (González Ruibal 2006-07; Parcero-Oubiña *et al*. in press).

(12) The analytical results from both Calvos de Randín and Recouso are detailed in two articles that are currently in preparation.

(13) Only one piece, No. 3839, has a silver content lower than 80% and a copper content higher than 20%.

We must also not forget that this type of jewellery was probably used over a long period and may have been passed from generation to generation, meaning that the chronologies of their manufacture and deposition may not necessarily be close to each other.

In this article we attempt to shed some light on this question. As one of our objectives is methodological in nature, we argue that the direct dating of goldwork (in particular) and metallurgy (in general) is as viable in NW Iberia as in other geographical areas. To date it appears that the best finds for this type of study are the plano-convex ingots and other remains linked to metallurgical production. Obviously, a fundamental aspect is the topographic review of the finds using a binocular loupe with the aim of identifying organic remains suitable for dating. At the same time, we aim to show the advisability of accompanying the absolute dating with parallel studies that give us an enhanced knowledge of the materials and an improved evaluation of the chronological results. In this particular case, that complementary information is provided by the anthracological study and the chemical characterisation of the alloys.

What do these results suggest? In general terms, these results are consistent with the available chronological panorama for "Castro culture" gold which, as we have already pointed out, appears to have undergone significant development from the 2nd century BC onwards. The three dates fit perfectly into that scenario, as their two sigma calibration ranges (213-88 and 204-46 cal BC) indicate. The dated samples come from the fuel used in the metallurgical processes and, given that they may be long-lived, the results are subject to certain margins of uncertainty. The two dates from Recouso, with 30 years difference between their respective radiocarbon ages, are probably a reflection of this problem; however, their calibration indicates a considerable degree of overlap between them. In turn, this type of sample has the advantage of being associated with the moment the object was manufactured.

The characterisation of the objects sampled also allows some chronological observations to be made. Despite the temporal proximity suggested by the Recouso and Calvos dates, it is obvious that we are looking at assemblages of different natures. The missing Recouso finds include a supposed touchstone, two pieces of slag and another two of carbon, which could indicate an area of metallurgical activity or a goldsmith's hoard (14). This supposition is reinforced by the melting mass considered here, which we interpret as an intermediate stage in the production of plano-convex ingots such as the three that accompany it. The topographic study of the earrings from the assemblage showed traces of use and repair in most of the specimens, which, together with the presence of the clasp, could suggest a complex adornment stocked for recycling. If our interpretation is correct, the earrings would have had to have been manufactured some time before the melting mass and the ingots.

For its part, the homogeneity demonstrated by the ingots from Calvos de Randín, both in weight and chemical composition, suggests we are dealing with a proto-monetary hoard typical of the early days of the Roman presence in the NW, when jewellery, unrefined metal and the first coins coexisted as elements of transaction and the accumulation of wealth (García-Bellido 2011). Thus, in Centeno's opinion (Centeno 2011: 359), coins would have been used by the local population as small metal ingots that could be broken into parts in trading transactions during a period we could place between the 2nd century BC and the beginning of the Roman Empire. In this respect we have to remember that Strabo (III, 3, 7) tells us that these peoples made payments using cut pieces of silver. Centeno highlights the similarities between the Calvos ingots and those of the main hoard from the Alvarelhos hillfort (Trofa, Porto), which consists of more than 5000 denarii and at least nine plano-convex silver ingots, two of which bear the CAESAR mark (Centeno 2011: 364-365). In his opinion, this hoard from Alvarelhos may have been part of the treasury of a military unit that, for unknown reasons, fell into indigenous hands, the ingots having been procured by the Roman army in some part of the Spanish Plateau before they arrived in the NW (15).

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(14) In the hillfort of Chao Samartín (Asturias) remains have been found that point to a similar environment (Villa 2010: 106-110).

(15) The coins in the hoard are dated between 211 and 27 BC (Barbosa 1998-2002: 62-63; Centeno 2011: 365, n. 59). In García-Bellido's opinion (García-Bellido 2004: 75-76), the hoard *llega allí formado en gran parte, y por su montante podría ser oficial,* while the metrology of the cakes would indicate a local nature, having been received by the army by way of taxes at

It is also perfectly possible that the Calvos de Randín ingots, some of which bear cuts, were meant to be used for goldwork. However, it should be pointed out that the alloys we find in both the Recouso and the Calvos de Randín cakes are virtually unknown in "Castro culture" goldwork, as can be seen in a review of both the main analytical repertoires (Hartmann 1982; García-Vuelta 2007; García-Vuelta and Montero-Ruiz 2007) and the compositional data published in other specific studies (16). Although some of the analyses of the Foxados torcs published by Hartmann (1982: 114-115, Nr. 2969-2976) show a high silver content, the only item with a chemical composition similar to that of the Recouso cakes is the torc terminal with inventory no. A.70-606 from the hillfort of Viladonga (Ladra and Martinón-Torres 2009: 34-36, 40; Martinón-Torres and Ladra 2011)(17). On the other hand, although it is still necessary to advance in the analytical characterisation of the few silver pieces we have from the "Castro culture" area, to date the only finds we have with a silver content of more than 90%, as found in the Calvos de Randín ingots, are a torc and two bracelets from the Seoane collection recently received by the Museum of Betanzos (Ladra *et al*. 2014)(18). Thus, bearing in mind the marked differences between the ingots and known finished artefacts, we can suggest that if ingots such as those of Recouso and Calvos were indeed conceived as metal stock for the production of objects, they would not be melted and cast directly, but modified in their composition by additional alloying.

an early date –27 BC or somewhat earlier– as can be surmised by their stamping with the name of Caesar rather than that of Augustus.

(16) Apart from the mentioned repertoires, the publications that include analytical data on NW Iberia protohistoric goldwork are compiled in García-Vuelta and Montero-Ruiz (2007: 92-93) and Armada *et al.* (2008). New data have subsequently appeared in the publications of Ladra and Martinón-Torres (2009), Perea *et al.* (2010), Martinón-Torres and Ladra (2011), Guerra and Tissot (2013, 2015) and Ladra *et al.* (2014).

(17) This piece is preserved in the Viladonga Hillfort Museum and consists of a fragment of rod with a hollow terminal that is also incomplete. The two analyses carried out on the terminal gave values of 6.1 and 8.4 Cu, 63.7 and 65.4 Ag, and 30.2 and 26.3 Au; the rod is made of an Ag-Cu alloy, but was subsequently gilded with mercury amalgam (Martinón-Torres and Ladra 2011: 191-193).

(18) We should however point out that in the silver torc from Sobrado dos Monxes (MAN, inv. 1972/64/6) the Ag percentages are 89.2 and 89.1 in the ring and the terminal respectively (García-Vuelta and Montero-Ruiz 2007: 102).

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