

Visigothic filigree in the Guarrazar (Toledo) and Torredonjimeno (Jaén) treasures

Alicia Perea

ABSTRACT: *The Guarrazar treasure is a group of Visigothic votive crowns and crosses found in 1858. A second treasure was found at Torredonjimeno in 1926, and both of them are now scattered in Spanish and French institutions in Madrid, Barcelona, Córdoba and Paris. The Guarrazar objects are better preserved, with the complete crown and cross of King Reccesvinthus as its highlight, although a large part was destroyed or lost. In contrast, the Torredonjimeno treasure is a huge quantity of highly fragmented crowns and crosses. It is the biggest group of Visigothic jewellery in Europe, which is very scarce and poorly studied. This paper discusses only a small part of the Visigothic jeweller's skill, that related to filigree work. Visigothic craftsmanship should not be considered as medieval, but as the last manifestation of the technology of antiquity.*

Introduction

The arrival of Berber troops in the Iberian Peninsula in 711 and the capture of the Visigothic kingdom's capital the same year are just two key events of the historic context that led the Umayyads to the height of power with the conquest of the far West. These events explain the discovery of two treasures: Guarrazar, close to Toledo, and Torredonjimeno, in the upper basin of the Guadalquivir river (Fig 1), consisting of crowns and crosses that it was customary for the Visigothic kings and the civil and ecclesiastical nobility to offer great churches. These are the only examples of metalwork of any significance for understanding gold technology in the Visigothic era; only a few grave goods from the period have been preserved, and we believe that most of the Visigothic gold was plundered, melted down and recycled to the benefit of the invading troops.

Other historical events, closer to our own time, are involved in the story of both treasures, and scholars' interpretations of them. A tangle of historical circumstances have prevented the dispassionate scientific study of these two related groups of objects. To resolve this situation, since 1995 there has been a co-ordinated research programme on Visigothic goldwork. The first

phase of this culminated with the publication of the complete study of the Guarrazar treasure by an international team (Perea 2001a), from the archaeological, historical, historiographical, analytical and technological points

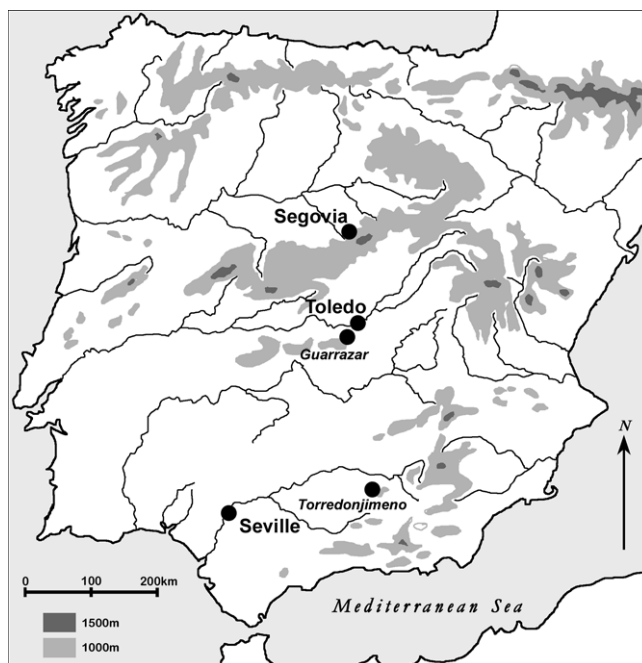


Figure 1: Map showing places mentioned in the text.

of view. The second phase, conceived to complete our knowledge of Visigothic goldwork, is to study the treasure of Torredonjimeno. The technological study and the analytical work on the metal and the gemstones has been completed, although the results are still provisional.

One of the aspects of interest is the filigree work. The wire used in the manufacture and ornamentation of the crowns and crosses of both treasures is an important technical element when characterising Visigothic goldwork and demonstrates connections with Mediterranean and Central European technology. In this respect we would say that Guarrazar and Torredonjimeno represent the last manifestations of the goldwork of antiquity and do not relate to medieval precious metalwork in any way.

The Guarrazar treasure

The Guarrazar treasure was found by chance near Toledo in 1858. It was carefully hidden in two specially prepared holes lined with Roman concrete (*opus signinum*) within a Visigothic cemetery, beside a building whose nature – oratory or church – has been hotly debated by various authors (Balmaseda 2001, 99–106). The excavations carried out after the treasure was found brought to light the inscribed stone slab of the presbyter Crispin, dated to the end of the 7th century (Velázquez 2001, 340–346).

The reason why the treasure was hidden can only have been the arrival of the Arab troops in the kingdom's capital in 711. It must have formed part of the liturgical artefacts and votive offerings made by Visigothic kings, nobles and bishops to a church in Toledo. After it was found, much of it was sold and subsequently melted down. The surviving pieces, consisting of a number of crowns and crosses, were sold in France and acquired for the Cluny Museum in Paris. Only a small part of the treasure was offered to Queen Isabel II as a gift by those who found it to beg her pardon for their acts of vandalism and plunder. In 1941, thanks to an agreement between the Vichy government and Spain to exchange works of art, part of the Guarrazar treasure returned to Madrid. It is currently divided between the National Archaeological Museum and the Royal Palace in Madrid, and the Cluny Museum.

According to the 19th-century records all the pieces had been badly damaged and were repaired before being sold in order to increase their value. We have confirmed that all of them have been manipulated to a greater or lesser extent, some broken up, others dismantled and many of the gemstones removed from their settings, but the damage was exaggerated for political and economic

reasons. All the crosses are in good condition. The crowns have suffered more from the ravages of time and greed: sapphires, emeralds, garnets, glass and pearls were removed to be sold one by one. However, the goldsmith who restored them before they were sold in Paris did a model piece of restoration for the time, and respected the originals absolutely, restricting himself to adding links in damaged chains, replacing gemstones in their settings and straightening bent plates.

We can describe Guarrazar as a royal treasure because it included at least two royal crowns, one of King Reccesvinthus (649–672), which is preserved whole, and the other of King Suinthilanus (621–631), which was unfortunately stolen from the Royal Palace in 1921, but for which we still have illustrations (García-Vuelta 2001). These royal crowns differ from others in their size and because they have letters hanging from the rim of the diadem that spell out the formula: + [name of the sovereign] rex offeret.

The double-plate Reccesvinthus crown and cross

The Reccesvinthus crown, the most complex and spectacular of the crowns, is the only piece that we can be certain was associated with the cross that presently hangs from its apex. It is made in the form of a double cylinder, that is, it consists of two concentric plate cylinders, the one on the inside plain, and the one on the outside decorated. It is also divided into two halves joined by hinges. The outer plate has a pierced pattern of leaves and scrolls. The corners of the plant design are set with groups of five cabochons arranged in a square with one in the middle. The whole of the outside surface of the plate was inlaid with garnets, most of which have now been lost (Fig 2).



Figure 2: Detail of the outer plate of the Reccesvinthus crown, with pierced work inlaid with garnets, and cabochons with sapphires and pearls. The rim is finished with a thick wire worked in lenticular segments. Image width c.65mm. [See also Plate 1]



Figure 3: Letters on the Reccesvinthus crown, worked in cloisonné inlaid with garnets, hanging from loop-in-loop chains. Height c.40mm. [See also Plate 2]

From the lower edge of the crown hang loop-in-loop chains to each of which is attached a letter of the legend: *RECCESVINTHUS REX OFFERET* (Fig 3). These letters are also worked in cloisonné with the same type of inlaid garnets.

The cross is the most ornate one, and has a unique structure, conceived as a miniature building (Perea 2001b, 167–71, pl 94–98), which is formed of 105 different gold elements, separately worked and then soldered together. It is also unique as it has a definite association with the crown, unlike the other crosses where it is not possible to be sure which one came from each crown, especially as crosses could be offered on their own.

The simple gold plate crown

Among the group of large crowns made from old plate is this unique example belonging to the Cluny Museum (Fig 4), but as far as is known it does not belong to any identified king. It is thought to be one of the oldest



Figure 4: The simple gold plate crown set with cabochons of sapphires, emeralds, amethysts, rock crystal, pearls and glass. The rim is reinforced with short lengths of beaded wire. Diameter 168mm. [See also Plate 3]



Figure 5: One of the four open-work crowns hanging from a figure-of-eight chain. Diameter 120mm. [See also Plate 4]

crowns in the treasure, dating to around the 6th century, and perhaps at that time the standard formula had not yet been established.

Its structure is a cylinder, divided into two halves joined by hinges. It thus has the same structure as the Reccesvinthus crown. The entire surface of the cylinder is covered with three rows of settings for cabochons of various shapes and colours, in no apparent pattern.

The open-work crowns

Four open-work crowns (Fig 5) have been described as the simplest jewels of the Guarrazar treasure. However, they are not simple from the technical point of view. The apparently simple design requires considerable skill and good planning of the work because the crown is made from a single base sheet in the shape of a cylinder with squares cut out to form the open-work. Curved spindle-shaped sheets were soldered along the straight lines, and alternate circular and square capsule-shaped settings for cabochons were soldered at the corners.

These crowns are the ones that have suffered most damage and they were repaired in the 19th century using a lead-tin solder and small pieces of gold sheet for reinforcement.

Crowns of repoussé sheet

Four other crowns of repoussé-decorated sheet have been preserved (Fig 6). They are the smallest and lightest of the crowns, and the most fragile and delicate. Their structure is very simple: a cylinder divided into two halves joined by a system of hinges. The edges of the sheet are reinforced with worked wires (see below).



Figure 6: One of the four repoussé-decorated sheet crowns. The two halves are hinged and the rim is reinforced with a twisted square-section wire. Diameter 115mm.

It is worth noting the inscription that appears in the central part of the Royal Palace crown: it states that *Abad Theodosius* offers the crown. The letters were not stamped with a separate punch for each one, but were



Figure 7: One of the six sheet metal crosses with cabochons of sapphires, amethyst, rock crystal and mother-of-pearl. Height 150mm. [See also Plate 5]



Figure 8: Detail of the cabochons on a sheet metal cross. [See also Plate 6]

engraved freehand by combining small, triangular punch marks and chiselled lines with exceptional mastery, which is seen particularly in the curves. These display the characteristic fan-shaped mark left by the chisel as it traces a curve.

Crosses of gold sheet

Six other crosses in the treasure are much simpler than the one that hangs from the Reccesvinthus crown; they are all made from gold sheet, strengthened with a moulded band along the edges to support the weight of the cabochons on the front and back (Figs 7–8). Three of these crosses are kept in the National Archaeological Museum, two in Cluny and one in the Royal Palace. In all cases, coloured gemstones cover the arms of the cross, those at the ends being white cabochons of mother-of-pearl. This arrangement is also characteristic of Byzantine goldwork of the period.

Two of the crosses contain inscriptions. The example from Cluny has the front covered with cabochons with the inscription on the back (Fig 9). It has been engraved freehand and states that a person called *Sonnica* offers the cross to the Church of *Santa María in Sorbaces*,



Figure 9: Detail of the inscription on the Sonnica cross. Cross is 105mm high.



Figure 10: One of the two arm-coverings from a processional cross, length 310mm. The gold plate is pierced and was inlaid with garnets; cabochons of sapphires, pearls and glass. [See also Plate 7]

which has not been identified. In the example from the Royal Palace, the inscription is the only decorative element on the cross, and the characteristics of the letters exactly match that on the repoussé crown preserved in the same place. In this case, it is a certain *Lucetius* who offers the cross.

The processional cross

All that remains of what must have been an exceptional processional cross are two arm coverings (Fig 10). They are, in our view, the oldest of the jewels in the Guarrazar treasure, and perhaps of Italian origin. The ornamentation on the plate used for the covering is very similar, in technique and design, to that of the Reccesvinthus crown (cf Fig 2), which must have been designed and made in imitation of this great cross. The leaves and scrolls, studded with inlaid garnets, most of which have now been lost, form the ground for a series of cabochons arranged in the way we have already seen in the gold sheet crosses: square, coloured cabochons in the centre and circular, white pearls at the edges.

Chains and rosettes

These crowns and crosses were votive offerings made by kings and nobles to the church, to be hung up and seen by the people who would stare in wonder at the sight of such wealth. So all the crowns had a device for suspending them, which consisted of a clasp in the form of a double rosette, forming the apex where three or four lengths of chain attached to the crown converged, and from which hung a vertical chain from which the central cross was suspended.

There are two main types: loop-in-loop chains (eg Fig 4, top), made from wire links displaying clear helicoidal (spiral) marks on the surface, demonstrating that the wire was made using the ancient Mediterranean method



Figure 11: Chain with links in the form of pear-tree leaves, edged with beaded wire, from the Reccesvinthus crown. Link length 55mm.

of twisting a fine strip of metal sheet. Others are figure-of-eight chains (Fig 5, top right), common in Roman goldwork. Many of these chains were lost or damaged and were replaced at the end of the 19th century by imitations that are easy to identify at low magnification although they pass undetected to the naked eye. The surface of the modern wire never has helicoidal marks because it has been drawn through a steel draw plate that leaves a light, perfectly lineal, surface finish.

As in all other respects, the suspension chain of the Reccesvinthus crown is also exceptional (Fig 11). The links are in the shape of pear leaves, with chiselled and open-work decoration; the edge is finished with a thick, beaded wire imitating granulation. A hook and a ring are soldered onto the back of the leaf to join each link to the next. The shape is reminiscent of some 7th-century Byzantine goldwork.

The Torredonjimeno treasure

The events and circumstances that connect Torredonjimeno treasure with that of Guarrazar are certainly surprising and have therefore had a negative impact on its study. However, there are also very important differences when interpreting the two finds.

The treasure of Torredonjimeno was found casually in 1926 on the Majada del Garañón estate while working the land in an olive grove (González 2002, 188–193). It was covered by some stones and mixed with chalk or plaster, the remains of a possible attempt to hide it. The farmer who found it was not aware of its value and, probably because of its fragmentary state, gave it to his children to play with. Some years later, in 1933, part of the treasure appeared on the antiquities market and was acquired by the National Archaeological Museum and

the Museo Arqueológico in Córdoba. In 1935 another part reached the Museo de Arqueología de Cataluña, where various other pieces joined it between the end of the Civil War and 1949. There is no sign of any buildings in the site of the find, nor any other clues that might provide information about the circumstances of its concealment.

The similarities of the pieces to those belonging to the Guarrazar treasure are considerable (Casanovas and Rovira 2003). There are many votive crosses, some of the same type, many with inscriptions, and at least two crowns with a suspended legend, because letters in two different sizes have survived, exactly the same as those from the royal crowns of Guarrazar – but there are also notable differences.

Most of the objects are highly fragmented and very poorly preserved, with the gemstones removed from their settings. It was thought that most of the damage had occurred while they were in the possession of their finder before being sold on the antiquities market. However, after a topographical examination of the surfaces with a binocular microscope (low power magnification), we think that all the objects had already been broken up when they were buried, which changes the interpretation of their concealment. The breaking up, and probable disappearance of other pieces in the set, must have been the result of plundering an important church when the Arab invasion of 711 took place; the plunderers would have broken up the jewels so they could carry them more easily as they escaped. The fact that they were found near Torredonjimeno is not sufficient evidence for the claim, which has been made, that they belonged to a church in the area. We think it is more likely that the place where the treasure was found, in the upper reaches of the Guadalquivir, was on the route away from the site plundered, perhaps an important church in Seville (García Moreno 2003, 40).

Neither has the recent history of the pieces in each of the museums where they are kept helped the conservation of the remains. The restoration of some of the pieces has been very aggressive, and solely concerned with the requirements of their exhibition. For example, a cross with cabochons has been restored using fragments of three different crosses; the arms of some crosses have also been joined by riveting metal plates to the original sheet.

Hanging letters and chains

A series of cloisonné letters, in two different sizes, inlaid with garnets (Fig 12), suggests that the treasure



Figure 12: A pendant letter E, showing the cloisons that originally held garnets. Height 32mm.



Figure 13: A chain link in the form of a leaf. Length 22mm.

originally contained two royal crowns. From the technical point of view the letters are exactly the same as those preserved on the Reccesvinthus crown (Fig 3). However, no remains of their diadems or other crowns exist, even though fragments of crosses have been exhibited as if they formed part of a diadem.

The chains with leaf-shaped links (Fig 13) also imply the existence of royal crowns, although they are more simply made than the one that suspends the Reccesvinthus crown (Fig 11).

Plate crosses with cabochons

A considerable number of whole and broken crosses, possibly as many as twelve, are of the same type as the Guarrazar crosses adorned with cabochons (Figs 14–16). There are differences of workshop, quality of



Figure 14: One of the gilded silver sheet crosses with glass cabochons. Height 97mm. [See also Plate 8]



Figure 15: Detail of another gilded silver sheet cross with glass cabochons. Height 144mm. [See also Plate 9]



Figure 16: Detail of the cabochons of a fragmented gilded silver sheet cross. Height 104mm.

manufacture and the material used, since some of them have been made from silver, or fire-gilded silver (*ie* gilded with an amalgam of gold and mercury).

Crosses with dedication

There are many simple gold plate crosses with an inscription on the arms, which are sometimes also adorned with cabochons or repoussé motifs (Figs 17–18). They include the names of those who dedicated them, such as Aureli, Ebantius and Trutilla, but they also mention saints Justa and Rufina, the patron saints of the basilica church of Hispalis (Seville).



Figure 17: Fragmented silver cross with dedication. Width 71mm.



Figure 18: Fragmented silver cross with the dedication of Ebantius Constantinus. Width 91mm. [See also Plate 10]

Cloisonné crosses

These (Fig 19) and the types described below have no parallels in the Guarrazar treasure. They are the smallest items in the treasure and therefore less fragmented. Their shape and technical characteristics are highly standardised, which contrasts with the considerable variation in the previous group.

They are small crosses made of sheet metal in the shape of an open box, one for each arm of the cross, plus a central cloison, usually quadrangular, although some are circular.



Figure 19: One of the low gold cloisonné crosses with a typical conical pendant. Cross 66mm high.

The inlays contained in these boxes have not survived in any of the examples, despite the fact that a loose gemstone or glass has now been used to restore them. A pendant stone used to hang from the base of the cross.

Plain sheet crosses

Crosses cut from a plain sheet of metal are relatively abundant and have no ornamentation (Fig 20). The material used to make them is varied: very low purity gold alloys, silver and, in particular, fire-gilded silver have been identified, the same range of metals as for the crosses with cabochons.

Spherical pendants

We do not know the type of object originally associated with a series of large pendants consisting of a sphere of coloured glass held in a cage made of strips of gold or gilded silver; the cage is adorned with conical pendants (Fig 21). Their shape and structure are highly standardised. They may have been elements to complete the decoration of large crowns, or individual offerings, like the crosses.



Figure 20: A fragmented plain sheet cross of gilded silver. Width 48mm.



Figure 21: Spherical pendant made of a glass sphere in a golden cage with conical pendants. Sphere diameter 34mm.

The Guarrazar and Torredonjimeno filigree

The Guarrazar collection contains good examples of a filigree technology that is the direct descendant of the ancient Mediterranean and Near Eastern tradition, which dates back to the middle of the third millennium BC (Athanasopoulos *et al* 1983; Perea 1990), although it is Hellenistic and Roman goldwork that offers the most sophisticated examples (Higgins 1980; Deppert-Lippitz 1985). However, original Visigothic variations are also present, such as the thick ornamental wires displaying a high standard of workmanship.

Strip-twisted wire

The wires used in the chains, and the loop-in-loop technique, demonstrate a technological continuity with the Mediterranean area. All these wires have a circular cross-section and are made by the system of twisting a strip of metal sheet. This is demonstrated by the clearly-visible helicoidal (spiral) line, both on the links of very fine wire and on the thicker ones, showing the Visigothic goldsmith was not interested in the process of smoothing the surfaces.

Because of these traces, there has been little difficulty in distinguishing the copies made by the goldsmith who restored the crowns in the 19th century. The alloy they used is of the same fineness as the ancient material, but the wire was made using a steel draw plate, which leaves distinct traces of a different kind.

To judge by the pieces of original chains preserved in the Guarrazar treasure, the Visigothic goldsmith used

all the remnants of wire lying around in his workshop without worrying about minor differences in gauge or method of manufacture. This can be seen in the chain that suspended the open-work Reccesvinthus cross; one of the links was made from a wire previously used for beading tests. This case is particularly interesting because it documents the ancient technical process of beaded wires made from a hollow or solid wire that was twisted and then rolled on a horizontal surface with the help of a cutting tool (Thouvenin 1971; Oddy 1977; Ogden 1982; Whitfield 1998).

Beaded wire

Examples of beaded wires are found in the small repoussé gold plate crowns of the Guarrazar treasure and they all display a good quality that demonstrates the craftsmen's familiarity with the technique. In the example from the Cluny Museum the entire rim of the crown is reinforced with a border of different types of wire. The sequence is: one beaded wire, two rows of plain wire with a circular cross-section, thicker than the previous one, twisted in opposite directions to form an ear of wheat (herringbone) motif, and then another beaded wire.

The Royal Palace repoussé gold plate crown also has a rim of beaded wire. This displays the best quality, because of the regularity of the segments and its small cross section. The beaded wire edging a pendant in the shape of an Alpha displays exactly the same characteristics; it must have belonged to a processional cross, together with an Omega that has now been lost.

Other wire types

A wire of a different type was used for the rim of one of the repoussé crowns in the National Archaeological Museum. In this case it is a twisted wire with a square cross-section. As we can see, all these wires fulfil two functions, one ornamental, to hide the irregularities of the rim, and the other structural, to give it greater rigidity and reinforce the cylindrical plate.

Looking at the original contributions of the Visigothic goldsmith, there is the rim of thick wire worked in lenticular segments that edges the Reccesvinthus crown (Fig 2, bottom and Fig 3). The thick cross-section of this wire means it cannot have been made using the twisting method; in this case the wire was worked by plastic deformation, that is, hammered. The lenticular segmentation, very regular and deep, could only have been achieved by using an *organarium*, or swage block, a tool similar to that described by the monk Theophilus in *De Diversis Artibus* (Brepohl 1987, 69–70). This

technique and the thickness of the wire meant that the length needed for the crown could not be made in a single piece, so it was made in several lengths and separated by an element consisting of a line of four spheres (Fig 3, top left).

The same motif of four spheres had already been used to edge the simple gold plate crown (Fig 4), in my view older than the Reccesvinthus crown. This type of thick worked wire must also have been produced using swage blocks, and also displays great perfection.

Another beaded wire made in a similar way but much thinner, edges the leaves of the chain that suspends the Reccesvinthus crown (Fig 11). In this case the work is less meticulous, and the solder joining the wire to the edge of the metal sheet has distorted the surface in several places.

All the above examples are from the Guarrazar treasure. The craftsmen's techniques displayed in the Torredonjimeno treasure are technically much poorer than those of Guarrazar, bearing in mind that both treasures are of the same chronological period.

The few chains that have been preserved in the Torredonjimeno treasure have the same characteristics as those seen in Guarrazar, and the wires have helicoidal marks, as they were made by the same process of strip-twisting. However, there are no traces of beaded wires; they have been systematically replaced by wires with a square cross-section, lightly and irregularly twisted: an example is another pendant in the form of the letter Alpha, exactly the same as the example from Guarrazar, except for the beaded wire around the edge.

In the absence of crowns, in the Torredonjimeno treasure we only have the gold plate crosses covered by stones in which the edges are sometimes reinforced with a wire that has a square cross-section that has been twisted very irregularly, apparently with little care (Fig 14, cf Fig 6). Only in one case has a cord been used, made of two plain wires twisted together.

Discussion

It is not easy to explain these differences between the two treasures, taking into account that both of them must be placed in the same time frame, and that both contain royal crowns; this is not therefore a problem of simple provincialism, as has been suggested, but a complex problem of transmission of technological knowledge. In

my opinion Torredonjimeno is normal and Guarrazar the exception, because it is a case of selective technological persistence, that is, of a specific technology being preserved in certain workshops, in this case the royal workshops that operated in the capital of the kingdom, Toledo, in the period of Reccesvinthus.

If we had to characterise the Visigothic technological domain system in the Iberian Peninsula (Perea 1999), filigree work would not be one of the diagnostic techniques. This ancient tradition was probably in the process of being lost for various reasons, mainly of an economic nature: the high cost of raw material, which involved the use of alloys with a high gold content; the high cost of craftsmanship, measured in terms of hours of specialised work. The result is a gap in the transmission of technological knowledge, and consequently technological skills were lost, as seen in the jewels of Torredonjimeno treasure. We know that grave goods containing gold were rather exceptional in Visigothic cemeteries; for example, of the 275 tombs excavated in El Carpio del Tajo (Toledo) (Ripoll 1985), only two contained gold jewellery, and the same is true of the necropolis of Castiltierra (Segovia), one of the largest and richest of those excavated to date. Here a piece of gold was uncovered that had formed part of the scabbard of a sword, decorated with beaded wires, and also a pendant edged with the same type of wire (Arias *et al* 2004). Both objects are dated to around the 6th century and are therefore rather earlier than the collection from Guarrazar and Torredonjimeno, or at least only contemporary with the earliest pieces of the first treasure.

The year 711 marks the end of a paradoxical society. It was one that showed signs of great cultural vitality – remember Isidore of Seville – but was also immersed in a deep political crisis. This contradiction affected all spheres of social and economic activity: it can be seen in the constant debasement of the gold coinage (Grierson and Blackburn 1986; Peixoto 1995), but also in the sublime creation of jewels such as the Reccesvinthus crown. The decline in technological skill that we have observed in the Torredonjimeno treasure is just one more example of the contradiction that ultimately led to the downfall of the Visigothic kingdom in such a short space of time. Guarrazar and Torredonjimeno play the lead in the final act of the ancient world.

Notes to figures

The objects shown in Figures 2–11 are from the Guarrazar treasure and those in Figures 13–21 from the Torredonjimeno treasure. Those shown in Figures

2, 3, 5–7 and 10–12 are in the Museo Arqueológico Nacional, Madrid; those in Figures 4, 8 and 9 are in the Cluny Museum, Paris; that in Figure 13 is in the Museo Arqueológico y Etnológico de Córdoba; and those in Figures 14–21 are in the Museo de Arqueología de Cataluña, Barcelona.

References

- Arias I, Balmaseda L, Díaz S, Franco A, Novoa F, Papí C 2004, 'Caracterización de las piezas de oro de la necrópolis visigoda de Castiltierra', in A Perea, I Montero and O García-Vuelta (eds), *Tecnología del Oro Antiguo: Europa y América. Ancient Gold Technology: America and Europe* (Madrid: Anejos de Archivo Español de Arqueología 32), 301–314.
- Athanassopoulos F, Banon E, Barchi N E, Ellis M, McCallum L R, Nash J A, Orr C G 1983, 'The technology of loop-in-loop chains in the third millennium BC', *American Journal of Archaeology* 87(4), 547–548.
- Balmaseda L 2001, 'De la historia del hallazgo y la arqueología', in A Perea (ed), *El Tesoro Visigodo de Guarrazar* (Madrid), 63–117.
- Brepohl E 1987, *Theophilus Presbyter und die Mittelalterliche Goldschmiedekunst* (Leipzig).
- Casanovas A and Rovira J (eds) 2003, *Torredonjimeno. Tesoro, Monarquía y Liturgia*, exhibition catalogue (Barcelona).
- Deppert-Lippitz B 1985, *Griechischer Goldschmuck* (Mainz am Rhein).
- García Moreno L A 2003, 'El tesoro de Torredonjimeno. Su contexto histórico', in A Casanovas and J Rovira (eds), *Torredonjimeno. Tesoro, Monarquía y Liturgia*, exhibition catalogue (Barcelona), 31–43.
- García-Vuelta O 2001, 'Las imágenes de Guarrazar', in A Perea (ed), *El Tesoro Visigodo de Guarrazar* (Madrid), 297–309.
- González J (ed) 2002, *San Isidoro. Doctor Hispaniae*, exhibition catalogue (Seville).
- Grierson P and Blackburn M 1986, *Medieval European Coinage. Vol I: The Early Middle Ages*. Cambridge University Press.
- Higgins R 1980, *Greek and Roman Jewellery* 2nd edn (London).
- Oddy W A 1977, 'The production of gold wire in antiquity. Hand-making methods before the introduction of the draw plate', *Gold Bulletin* 10(3), 79–87.
- Ogden J 1982, *Jewellery of the Ancient World* (London).
- Peixoto J M 1995, 'Métodos físicos e químicos de análise no estudo da composição das ligas de que são feitas as moedas', in M P García-Bellido and R M Sobral (eds), *La Moneda Hispánica: ciudad y territorio* (Madrid: Anejos de Archivo Español de Arqueología 14), 15–24.
- Perea A 1990, 'Estudio microscópico y microranalítico de las soldaduras y otros procesos técnicos en la orfebrería prehistórica del Sur de la Península Ibérica', *Trabajos de Prehistoria* 47, 103–160.
- Perea A 1999, 'Project Au for the study of goldwork technology and the concept of technological domain systems', in S M M Young, A M Pollard, P Budd and R A Ixer (eds), *Metals in Antiquity* (Oxford: BAR International Series 792), 68–71.
- Perea A (ed) 2001a, *El Tesoro Visigodo de Guarrazar* (Madrid).
- Perea A 2001b, 'De los talleres y los orfebres', in A Perea (ed), *El Tesoro Visigodo de Guarrazar* (Madrid), 119–200.
- Ripoll G 1985, *La Necrópolis visigoda de El Carpio del Tajo (Toledo)* (Madrid: Excavaciones Arqueológicas en España 142).
- Thouvenin A 1971, 'La fabrication des fils et des filigranes de métaux précieux chez les anciens', *Revue d'Histoire des Mines et de la*

Métallurgie 3(1), 89–108.

Velázquez I 2001, 'Las inscripciones del tesoro de Guarrazar', in A Perea (ed), *El Tesoro Visigodo de Guarrazar* (Madrid), 319–345.

Whitfield N 1998, 'The manufacture of ancient beaded wire: experiments and observations', *Jewellery Studies* 8, 57–86.

The author

Alicia Perea has worked since 1993 as a scientist at the Department of Prehistory, CSIC (Consejo Superior de Investigaciones Científicas), Madrid where she is coordinator of the research group on archaeometallurgy. She is scientific director of 'Project Au', a long-term research programme based on the study of the process

of transforming precious metals, in order to determine the mechanisms which govern technological persistence, change and transmission, and ultimately social change, from the beginning of metallurgy to the end of Antiquity. Some of her major publications are *Orfebrería Prerromana. Arqueología del Oro* (1991), *Arqueología del Oro Astur* (1995, with J Sánchez-Palencia), *Memoria de Iberia. Cuentos, relatos e historias sobre el mundo de los Iberos* (1999) and *El Tesoro Visigodo de Guarrazar* (2001).

Address: Departamento de Prehistoria, Instituto de Historia, CSIC, Serrano 13, 28001 Madrid, Spain.
e-mail: perea@ceh.csic.es