The Heritage of ‘Maître Alpais’

An International and Interdisciplinary Examination of Medieval Limoges Enamel and Associated Objects

Edited by Susan La Niece, Stefan Röhrs and Bet McLeod
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The Heritage of 'Maître Alpais'

Introduction

Bet McLeod and Stefan Röhrs

The medieval collections at the British Museum were re-assessed by a multi-disciplinary team comprising curators, scientists and conservators in preparation for the new Medieval Europe gallery, which opened in March 2009. This publication has derived from the several cross-departmental researches, analyses and technical investigations undertaken for that purpose, both within the British Museum and in collaboration with colleagues throughout Britain, continental Europe and the United States. Analyses in the Centre de Recherche et de Restauration des Musées de France, Paris (C2RMF), with the assistance of a grant from the Access AGLAE Eu-ARTECH Program, proved significant for the conclusions reached.

A medieval champlevé enamelled ciborium in the British Museum formed the focus of study, which sought to place it firmly within an historical and cultural context. The study widened to include the renowned ‘Maître Alpais’ medieval ciborium in the Musée du Louvre, Paris, two electrotype copies of the Maître Alpais ciborium at the Victoria and Albert Museum, London, and another ciborium in the National Museums Scotland, Edinburgh.

A ciborium is a covered container that holds the consecrated wafers used in the Christian ritual of communion, and is one of the most significant of all liturgical vessels. Ciboria differ in form and scale, but all the ciboria under review are of rounded form and have a foot; two of the ciboria in this study – the ones from the British Museum and the National Museums Scotland – are now missing their cover.

Studies were carried out on both the iconographic programmes and design concepts, encompassing as they did the decorative repertoire of Limousin enamellers and the cross-cultural influences between Islam and Christianity in the medieval period. The significance of the Maître Alpais ciborium, and other high-quality exemplars of medieval champlevé enamelling, was fully acknowledged in the 19th century, when electrotype copies were produced and widely sought after. The complex issues of connoisseurship and museum acquisitions in the 20th century formed an essential part of the researches.

Wide-ranging scientific investigations of the medieval and more recent objects under review were carried out in London, Paris and Edinburgh to identify the materials and manufacturing techniques used at different periods. The medieval enamels are made in the champlevé technique. An ongoing international programme, which has produced a large database of analyses of medieval enamels, indicates that two different glass compositions were used in succeeding but overlapping production periods. For the purposes of this study, ‘bead’ refers to the applied, turquoise-coloured, opaque glass decoration; ‘cabochon’ denotes the applied, translucent, differently-coloured rectangular and oval glass decoration. The analysis of colouring additives in the glass beads, cabochons and enamels of the ciboria studied here has been instrumental in designating a medieval or post-medieval date to the pieces. All these studies were of equal import in contributing to the understanding of the objects, and are vital in their assignment to their relevant production periods.

Little is known about the practices or organization of individual Limoges workshops. The Maître Alpais ciborium is a rare example: from its inscription it can be attributed to a particular maker. This ‘signature’ has aroused much interest and comment since the 19th century. The study of medieval objects, such as the ciborium in the British Museum, most probably inspired by the Maître Alpais ciborium, can help to better understand the influence of a workshop, or group of workshops under the same master.

Several approaches to the study and comparison of the objects were utilised, emerging from the different disciplines of art history, scientific analysis and conservation. This multi-layered and broad investigation brought together the current state of knowledge and expertise in this field. The researches, and the results deriving from them, have provided the opportunity to assess the history of these objects from a new vantage point. These on-going researches were presented to an international audience at a study day at the British Museum in November 2008. The subsequent conclusions are herewith presented in this volume.

Note

1 The term ‘electrotype’ is used interchangeably with the term ‘electroform’ in this publication.
Figure 1 The British Museum ciborium, reg. no. P&E 1853,1118.1; ht 120mm; max. width 162mm; diam. at rim 154mm
A Ciborium in the British Museum

Bet McLeod

The British Museum ciborium (Fig. 1 opposite) previously labelled as ‘Limoges c. 1200’, consists of a hemispherical bowl on a truncated conical foot, the cover missing.1 It is formed of copper, and the decoration is carried out in gilding, enamel and glass. For ease and consistency of terminology, ‘beads’ shall denote the turquoise-coloured opaque glass decoration; ‘cabochons’ the rectangular- and oval-shaped translucent glass decoration; ‘enamel’ the opaque champlevé enamel ground.

The body of the bowl is decorated in a lozenge pattern outlined by gilt bands with engraved double line decoration at the borders. The bands are further embellished with turquoise-coloured opaque glass beads in units of three; there are 144 spaces for the beads, with 6 beads missing, making a total of 138 extant beads. The bands are punctuated at the interstices with differently-shaped and -coloured, translucent glass cabochons: 8 rectangular-shaped cabochons at the rim, in brown and light blue; 6 extant oval-shaped cabochons of the 10 oval-shaped spaces in the middle register, in brown and green; 10 oval-shaped cabochons in the lowest register, in blue and brown. Around the cabochons is a motif of punched circular decoration. The lozenge pattern around the central body of the bowl is framed by a wide triangular lozenge in the uppermost register immediately below the rim, and by a narrow triangular lozenge in the lowest register immediately above the foot.

Within the three upper lozenges are reserved and engraved half-length figures of angels; those in the uppermost register with wings outstretched, those in the middle register with wings folded, those in the lower register with upright, crossed wings. The angels in the uppermost, middle and lower register are arranged in four pairs with heads turned to look at each other. Of the angels in the middle register, all except one hold a book in the left hand; four angels also have their right hand raised. In front of the breast of one angel is a large disc with a floriated cross. There is extensive loss of gilding throughout, but a certain amount of gilding remains within the engraved details of the angels and within many areas of the bands forming the lozenges.

The colour of the opaque champlevé enamel ground is of medium blue, while all the angels are nimbed in green and yellow with red accents, and rise from a calyx of red, white and blue. The reserved decoration comprises highly-stylized S-shaped rinceaux, single hook-like motifs above the heads of the angels in the lower register, and at the lowest register, a stylized, upright fleur-de-lys motif. Around the rim is a band of engraved decoration composed of pseudo-Kufic lettering. The rim is now pierced with four holes at opposite points, two with brass riveted attachment loops, one damaged and with losses. The foot, now missing its inner sleeve, consists of openwork foliage, inhabited by four figures, two naked and two in short tunics, the figures with applied heads and glass eyes (see Fig. 1, p. 56).

History

The British Museum ciborium was first published in 1852 by J. Greville Chester (1830–92), the great collector and antiquarian, who noted its similarity to the Maître Alpais ciborium in the Musée du Louvre, which is dated to c. 1200.2 Greville Chester stated that the British Museum ciborium was found in the ground near Sudbury, Suffolk.3 It is not clear from his report exactly when or at which precise location the ciborium was discovered, nor whether the additions (brass loops riveted to the rim) were extant when it was found. No comments have hitherto been published about these additions, nor any proposals put forward for the second-stage use of the ciborium.4 The pierced holes and the riveted loops indicate the ciborium was probably suspended after the additions were made, which might suggest that the ciborium was adapted to become a censer, if it did indeed continue to be used in a liturgical context. The brass loops appear to be typical of late 16th- and 17th-century work,5 and these additions could have been made during the turmoil in England brought about by the Reformation in the 16th century, or the Civil War in the 17th century.

What may possibly have brought the ciborium to Greville Chester’s attention was the 1841 publication by Alexandre du Sommerard, which illustrated the Maître Alpais ciborium in colour.6 The next publication of the British Museum ciborium was by A.W. Franks in 1854.7 Franks, too, commented on the similarity with the Maître Alpais ciborium, but also noted ‘it is not so elaborate as the specimen preserved in the Louvre’, and put forward a date of ‘middle of the fourteenth century’.8 In the 1924 British Museum publication, A Guide to the Medieval Antiquities, the British Museum ciborium was illustrated for the first time, and O.M. Dalton again referred to its similarity to the Maître Alpais ciborium, proposing a date of the 13th century.9

Evaluation

There are a number of elements of the ciborium that have aroused comment, leading to a more in-depth examination and review of certain decorative motifs and techniques in order to place the ciborium more securely in a historical context.

Beads and cabochons

The exceptional number of beads (144 intended, 138 now extant) and their prominent disposition on the gilded bands form an intrinsic part of the decorative concept of the ciborium (Fig. 2). Turquoise-coloured beading is a characteristic element within the decorative vocabulary of Limoges enamels of the late 12th and early 13th centuries. It can be found, for example, in the crown and borders of the loincloth of a corpus figure of Christ, dated to 1210–20,10 on the orphreys and books of Apostle figures, dated to a Limousin workshop c. 1231,11 and as a detail
on a eucharistic dove, dated to 1215–35. On these and other similar examples, however, the beading is applied as highlights on three-dimensional pieces or relief figures rather than forming one of the principal elements of the design, as on the ciborium. It should be noted that the Maître Alpais ciborium has only 8 turquoise-coloured opaque glass beads, and these are placed in the lowest register of applied decoration on the bowl.

It is not known whether the workshops that produced ‘beaded’ examples made the beads themselves, or bought in pre-formed beads from an outside supplier. If pre-formed beads were purchased from a supplier, that supplier might have been a particular Limousin workshop, or group of workshops under the same master, that specialized in making beads. The supplier, however, might also have been a merchant who imported the beads from another centre of manufacture, possibly Venice, which had a documented trade in beads and ‘cakes’ of glass. As Stefan Röhrs has established, the beads on the ciborium are formed of a different composition than that of the champlevé enamel ground, making the ciborium one of a number of ‘beaded’ pieces where the beads are of a different type of composition than the ground enamel. The composition of the enamel ground is of a production date of before c. 1235, and the composition of the beads is of a production date of after c. 1175, thus placing the production of the ciborium within the date range of c. 1175–c. 1235. This author here suggests that it is possible that the beads are simply of a ‘different’ type of composition because they were manufactured outside of the geographical region and technical tradition of the Limousin. Seen in conjunction with the influences from the Islamic world on other aspects of the decoration of the ciborium, such as the pseudo-Kufic script and the geometric concepts of the design, it is possible that the commissioner of this ciborium wished it to have a somewhat different aesthetic appearance than that of the Maître Alpais ciborium, and that the beads which contributed most to this difference in appearance were imported from Islamic regions. Without any archaeological evidence of bead moulds, for example, or waster beads, and without any documentary evidence of a trade in beads of the type under discussion and as used by the Limousin craftsmen, it is not possible to pursue this suggestion, which remains as speculation.

The six missing beads on the ciborium allow an examination of the depressions, worked from the front, that hold the beads. It is not known what form the underside of the beads take, but some of the gilt metal collars that secure them have been more closely rubbed over than others. This not only gives the appearance that some beads have been inserted more deeply than others, but the appearance that the beads are not uniform in size. Based on a physical comparison, the beads on the British Museum ciborium are smaller in scale than those on the Maître Alpais ciborium, but from photographic comparisons appear to be larger than those on the corpus figure and the eucharistic dove cited above. This does suggest that pre-formed beads could be acquired in a number of sizes, or, if the beads were made in the same workshops that made the objects, they were sized to each individual object as part of the design concept.

The cabochons, similarly, could have been made in the same workshop that made the ciborium and were sized accordingly, or could have been acquired pre-formed from a specialist workshop, or from a merchant trading in cabochons. It should be noted that the British Museum ciborium contains eight translucent, rectangular, shaped cabochons in the band nearest the rim, while, by contrast, the Maître Alpais ciborium only has this type of translucent, rectangular, shaped cabochons on the cover, with none on the cup. One can only speculate as to whether the cover of the British Museum ciborium would also have had this type of cabochon in the band nearest the rim, which could have resulted in a prominent ‘double band’ of this type of cabochon around the centre of the ciborium.
**Gilding**

The extensive loss of gilding from the ciborium is appropriate for an object of medieval date, yet the gilding where it survives on the bands forming the lozenges is unusual in its too-regular wear pattern that takes a rhythmic, wave-like form. The beading may have protected areas of the surrounding gilding from complete loss as a result of handling or cleaning, yet the gilding continues to be disturbing to this author.

**Marks**

Another point of particular interest is the two engraved zigzag lines on the reverse of the conical foot, each approximately 4mm in length (Figs 3–4). As illustrated in the most recent publications, marks can be found engraved in a straight line forming numerals, letters, conjoined letters or patterns. Marks can also be found engraved in a simple zigzag line, as on the reverse of a plaque from a casket, or as more complex zigzag geometric patterns, as on the reverse of a plaque of ‘Christ in Majesty’. While some marks might be interpreted variously as trial engraving marks, or constitute a numbering or placement system, they generally appear singly on two-dimensional works such as plaques or medallions. As the foot of the Maître Alpais ciborium retains its inner sleeve, it is not known whether it, too, has these marks on the underside. It is also apparent that there are different hands and different tools used in the making of marks, and as yet no conclusion has been drawn as to their meaning or significance. The occurrence of the two zigzag marks on the foot of the British Museum ciborium remains something of a puzzle.

**Stylistic assessment**

When looking at the differences between the Maître Alpais ciborium and the British Museum ciborium, it is necessary to bear in mind the vicissitudes of fate and time, and the subsequent paucity of *comparanda*, illustrated sources or documentary sources. It is not known how, when or if the British Museum ciborium, a remarkable survival, fits into a ‘family’ of ciboria produced in the same workshop, or in different workshops under the same master, or even in the same workshop tradition but at different dates, to a different cost and time commission, or to different aesthetic demands.

There are no such definitive links as exist, for example, in the group of the much-studied Morgan, Warwick and Balfour ciboria. One can only speculate as to whether the original cover to the ciborium would have had the same lozenge pattern enclosing angels, and a similar decorative scheme of turquoise-coloured opaque beads. Based on the extant examples that still retain their covers, including the Maître Alpais ciborium, it is most probable that the decorative and iconographic scheme of the bowl and the cover would have corresponded in some way, and that the original cover would have had some form of a knop.

**Reserved and engraved heads, and colour palette of the nimbus**

One of the principal differences between the two medieval ciboria under review is the use of reserved and engraved heads on the British Museum ciborium rather than the applied heads used on the Maître Alpais ciborium. This difference in technique reflects the corresponding stylistic development that was common to Limousin workshops in the first decades of the 13th century, as the portrayal of reserved figures, draperies and foliate decoration moved towards a more naturalistic ‘early Gothic’ style. The green and yellow palette with red highlights in the nimbed angel heads is again typical of the decorative palette used around the end of the 12th century and beginning of the 13th century, as seen, for example, in the plaque of the ‘Death of the Virgin’.

**Reserved geometric decoration**

This ‘Death of the Virgin’ plaque is also interesting for its affinities to a decorative technique found on the British Museum ciborium (Fig. 5) that of reserving the copper ground in small square and rectangular sections within red areas of decoration, usually found in the rinceaux decoration. The ‘Death of the Virgin’ plaque, dated to c. 1200 is associated with two other Limoges plaques, each of which has the same decorative technique. This decorative technique was also used by the workshop that produced the Orense series of relief figures of apostles and saints, dated to c. 1174–1213, where it can be seen in rayed and nimbed heads as well as the rinceaux decoration; the same technique can also be found on a relief figure of ‘St Peter’, dated to c. 1185–1200.
Angel motifs  
The use of half-length angel figures within shaped reserves, either with applied heads or reserved and engraved heads, is a traditional and frequently-used element in the decorative vocabulary of Limoges enamels. The motif can be found on such significant works as the ‘Chasse of the Holy Innocents’, of c. 1190–1210,31 and another chasse, decorated with angels and saints and dated to c. 1205–15.32 It was also used on many smaller ecclesiastical items, such as chrisamatories, that date to c. 1200–10.33 The same iconography is used on the knops of crosiers, both in enamel,34 and in gilded openwork,35 again testifying to the enduring popularity of this motif in the Limousin repertory. The three different arrangements of the angel wings found on the ciborium is to be noted; this variation in design is also seen on the Maître Alpais ciborium.

Stylized rinceaux and upright fleur-de-lys motif  
The rinceaux motif on this ciborium has become so stylized as to resemble an S-shaped stem, but this is paralleled on other examples, such as cruets and medallions for coffers.36, 37 The motif can also be found in such larger items as gemellions.38 In each of these examples the motif is found contained within a fully defined geometric space, such as a circle, rectangle or lozenge, and it is likely that such a well-defined space, dictated by the design, results in the cursory nature of the motif. The S-shaped stem, however, can also be found in stylized rinceaux that are not confined to a space, but flow freely over an entire field.39 These particular examples do, however, date to the second and third quarters of the 13th century, and probably reflect the standardization and degeneration of the rinceaux motif. The upright and highly-stylized fleur-de-lys motif is also found on smaller liturgical objects of a later date, such as a pyx,40 and the form could again be attributed to the standardization of a more complex form.

Conclusions  
The British Museum ciborium undoubtedly demonstrates the continuation and survival of traditional artistic conventions and ornamental motifs employed by Limousin craftsmen over a number of decades. These include the use of winged angels within a shaped reserve and a colour palette of medium blue with nimbed heads in green and yellow with red accents. The disposition of the angels, with three different arrangements of their wings, and the engraved delineation of the faces are most accomplished, which might suggest a date of c. 1200, the artistic peak of Limoges production. The standardization, however, and the cursory nature of the decorative repertoire, such as the S-shaped rinceaux, may indicate a production date of the second and third decades of the 13th century. The use of a singular decorative technique, such as the reserved geometric decoration, found on extant examples dating from c. 1174–c. 1215, probably reflects a continuation of this motif used in particular workshops. The use of turquoise-coloured opaque beads as the principal decorative feature may indicate a strong individual style of a master, or a distinct workshop group, or an aesthetic preference of the commissioning patron. A commission by a patron more familiar with an ‘Islamic’ style may perhaps explain the combination of turquoise-coloured opaque glass beads and pseudo-Kufic script.

The design of the ciborium clearly took as its prototype the Maître Alpais ciborium (c. 1200), but it is not possible to determine exactly the sources that produced such a markedly different result. This author would therefore posit a date of c. 1210–25 for the production of the British Museum ciborium.

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Notes

1 The British Museum, Department of Prehistory and Europe, reg. no. P&E 1853, 1118.1.
2 Musée du Louvre, département des Objets d’art, reg. no. MRR 98, see Antoine, Fig. 1, this volume.
3 Chester, 1852, p. 388.
4 van Bellegem and La Niece, this volume.
5 I am grateful to Geoff Egan for this suggestion, pers. comm., 27.11.2008.
6 Du Sommerard, 1841, pl. III, fig. 3.
7 Franks, 1854, p. 29.
8 Ibid.
9 Dent, 1924, fig. 47, p. 41.
14 Chasse with the Adoration of the Magi, the Massacre of the Innocents and Angels, Williamson, 2005, nos. 67, 52; Chasse with the Three Wise Men, Guéret, Musée de la Sénatorerie, reg. no. A1.
16 The British Museum, Department of Prehistory and Europe, reg. no. P&E 1859,0110.1.
22 Chasse with the Adoration of the Magi, the Massacre of the Innocents and Angels, Williamson, 2005, nos. 67, 52; Chasse with the Three Wise Men, Guéret, Musée de la Sénatorerie, reg. no. A1.
24 I am grateful to Danielle Gaborit-Chopin for this information, pers. comm., 27.11.2008.
25 Zarnecki, 1984, nos 278, 279, 280.
26 O’Neill and Egan, 1996, nos 70, 77, 244.
31 Musée du Louvre, reg. no. OA10406.
34 Musée du Louvre, reg. no. OA10407, O’Neill and Egan, 1996, no. 82, p. 273.
39 Chasse with the Adoration of the Magi, the Massacre of the Innocents and Angels, Williamson, 2005, nos. 67, 52; Chasse with the Three Wise Men, Guéret, Musée de la Sénatorerie, reg. no. A1.
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The Heritage of ‘Maître Alpais’

Stefan Röhrs

Medieval Limoges metalwork is often elaborately decorated by means of coloured enamel, sometimes used in conjunction with beads and cabochons made of glass. Various types of glass were used to make the enamels, beads or cabochons, as these separate decorative elements were applied and worked differently. Technological changes took place during the medieval period, and new glass compositions were introduced, leading to a wide variety of glass compositions found on Limoges metalwork. The analysis of the glass composition, therefore, can be indicative of production periods. With reference to the enamel, two medieval production periods can be characterized, whereas for glass in general, the medieval material can be differentiated from 19th century production. The analyses of the vitreous materials of the British Museum ciborium (reg. no. P&E 1853,1118.1) were carried out to resolve questions concerning the authenticity and history of restoration of the object. As the piece shows similarities in its decoration to the renowned ciborium of Maître Alpais in the Musée du Louvre (reg. no. MRR 98), the results of the analyses will be compared in this paper to the published data from the Maître Alpais ciborium and from other Limoges objects.

Materials and manufacture

Champlevé enamelling is carried out by heating ground glass onto a prepared copper base. A depression, or field, in the shape of the desired design is firstly cut out of the copper base, and a paste of powdered glass mixed with a binding material is then placed in the depression. Depending on the effect desired by the artist, one or several colours could be applied to each field. The paste was dried carefully and then the object was placed in a furnace at about 800°C to fuse the paste and adhere it to the base, thus creating enamel. During the firing, the paste shrinks in volume, and the process of filling and firing was repeated until the enamel surface became slightly proud of the copper surface, after which it was ground and polished down to become flush with the copper surface. After the enamelling process was completed, the remaining undecorated metal surface was gilded. Gold amalgam (a gold-mercury alloy) was used, and was fired at about 250–350°C, a lower temperature than necessary for the enamelling. A large part of the mercury volatilises during firing, and some of the gold diffuses into the copper surface, ensuring good adherence of the gilding to the metal. The majority of the beads and the cabochons on Limoges objects are made from glass, but were applied like the gemstones which they imitate, and were often set in a metal collar. Beads and cabochons, therefore, are held by a mechanical fixing, whereas by contrast, enamels are fused onto the copper by heat and are fixed by chemical bonding. Most of the cabochons were made from translucent glass, and the enamels and beads are made from opaque glass.

Glass, the raw material for enamels, beads and cabochons, is made from sand and a fluxing material which allows the sand to melt at a lower temperature and to form a glass. Additionally, colorants and opacifiers are needed to give the glass the desired appearance. Depending on the date and region of production, and the purpose of the glass, different approaches were found to the technological challenges. Earlier work has shown that two compositional groups can be distinguished for the blue, green, turquoise, white and yellow enamels, all of which are made from soda-lime-silica glass. This glass is characterized by its high sodium (soda), calcium (lime) and silicon (silica) content.

The first group is low in magnesia (MgO) and potash (K₂CO₃), whereas the second group contains a large amount of Magnesia and Potash, therefore the resulting glass is richer in these elements. The opacifier used with this type of glass is tin oxide. This type of glass was used to make the enamels, beads or cabochons, as these objects are made from glass, but were applied like the gemstones which they imitate, and were often set in a metal collar. Beads and cabochons, therefore, are held by a mechanical fixing, whereas by contrast, enamels are fused onto the copper by heat and are fixed by chemical bonding. Most of the cabochons were made from translucent glass, and the enamels and beads are made from opaque glass.

The second type of glass used for the enamels is also a soda-lime-silica glass, but with higher magnesia and potassium oxide values. These higher values are due to the use as flux of halophytic plant ash, a desert and coastal plant, which is rich in sodium carbonate (soda). The magnesium and potassium contents of this ash are higher than in the mineral soda, and therefore the resulting glass is richer in these elements. The opacifier used with this type of glass is tin oxide. This type of glass is similar to contemporary Islamic glass from the Mesopotamian area.

In the medieval period a wide range of glass types was available for the production of cabochons. Soda-lime-silica glasses were used, but forest glass and lead glass were also in use. Forest glass receives its name from the use of wood ash as a flux material and differs in composition from other glass in its much higher potassium content. Lead glass is rare in the medieval period, but was sometimes used to make cabochons. The contents of the minor compositional elements are essential in order to distinguish medieval lead glass compositions from those of the 19th century.

Analytical method

Proton induced X-ray emission (PIXE) and proton induced gamma ray emission (PIGE) measurements were carried out on the British Museum ciborium at the Centre de Recherche et de Restauration des Musées de France (C2RMF). A 3 MeV proton beam was used for the experiments. The set up of the detectors allowed simultaneous measurement of PIXE- and PIGE-spectra at the same time. A high purity germanium detector was used...
to detect gamma-rays for the PIGE analysis. Sodium gives a nuclear reaction which allows a quantification of its content by PIGE. All other elements were quantified by PIXE. Two detectors were used for the acquisition of the x-ray spectra. A 50 μm Al filter was used in the ‘high energy’ (HE) region and an ultra light filter on the detector for the low X-ray energies. The DOS version of the GUPIX–software was used for the calculation of the PIXE data. Iron was used as the pivotal element to link the values of the HE detector to the results of the matrix calculation. For the batch calculation, the batch software developed at C2RMF was used.

Results and discussion

All of the opaque enamels, other than the red, are of the same type, having a soda-lime-silica glass composition with very little magnesium and potassium oxide (both < 1 wt%, see Table 1). This indicates the use of mineral soda for the glass production. The presence of antimony suggests that the opacifier used was calcium antimonate. The red opaque enamels contain more magnesium and potassium oxide (2.2 wt% and 1.1 wt% respectively) and traces of both tin and antimony oxide. As often found in champlevé enamels, the glass type found in the red seems to differ from the other compositions. The red glass, therefore, should be discussed separately from the other colours.

It has been shown in earlier studies that the red glass is a mix of the mineral and the vegetal sodas, irrespective of the production period. The potassium-rich glass type which seems to be typical of Mosan champlevé enamel, was, however, not found in these analyses. Opaque red enamels are coloured by red copper (I) oxide crystals, cuprite, which are dispersed within the glass. The high iron content of these reds is worth noting. Freestone and colleagues have shown that the high iron content of glass helps to precipitate the copper oxide from the molten glass. Four of five red areas analyzed contain about 5 wt% Fe₂O₃ and only 1.5 wt% CuO. The fifth red differs slightly in composition, containing more CuO than Fe₂O₃ (1.9 wt% and 1.5 wt% respectively), and containing 11.9 wt% PbO instead of less than 4 wt% as found for the other four red enamels.

The turquoise-coloured beads are different in composition from the enamels. Their high sodium and calcium contents indicate the use of a soda-lime-silica glass, with lead and tin added to this base. Tin oxide was added to make the glass less transparent, while lead was added in order to help precipitate the minute, finely-dispersed tin oxide crystals from the molten glass. Another difference in composition is the magnesium and potassium content, which is over 2 wt% for both. This indicates the use of a halophytic plant ash, and might be made following a recipe from the Islamic tradition as mentioned in the introduction.

The use of two different opacifiers on the British Museum ciborium is worth noting. Published analyses show that tin appears as an opacifier in champlevé enamels at the end of the 12th century. In most cases, the use of tin is present with a seemingly pure halophytic plant ash glass. In Figure 1 the sum of potassium and magnesium is plotted over the production date of an object based on its stylistic dating by art historians. A magnesium plus potassium sum over about 3.5 to 4 wt% indicates the use of halophytic plant ash. If the value is below that, mineral soda was used. The graph shows that before 1175 only calcium antimonate was used as an opacifier for enamels. This date marks the first appearance of tin oxide as an opacifier in champlevé enamelling in Limoges. In an intermediate period, from approximately 1175 to 1230, both types of opacifier were being used, followed by a period when only tin-opacified vegetal soda glass was used. In the intermediate period, when mixed vegetal and mineral soda glass compositions were being

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<th>white</th>
<th>red</th>
<th>red</th>
<th>Beads</th>
<th>turquoise</th>
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used, a combination of both tin and antimony is found as the opacifier. These compositions with mixed opacifiers are marked by triangles in Figure 1. Some glasses with mixed opacifier contain quite low magnesium and potassium and seem therefore to be exclusively made from mineral soda glass.

Some objects, including the British Museum ciborium, contain both the mineral and the vegetal soda glass in combination. The data points of the British Museum ciborium are shown in black in Figure 1. The difference in the composition between the beads and the enamel can be seen in relation to the differences in manufacture of these decorative elements. But this hypothesis is difficult to pursue, as there is insufficient published literature dealing with the compositions of the beads to make a significant study. Since the beads are technically not enamel, the terminus post quem of c. 1175 may not apply to the ciborium, as the tin-opacified plant ash glass might have been traded to western Europe from the Islamic world before this date, as this type of glass was already found in Italy in the 11th century. There is no evidence however, to indicate that this type of glass was used for beads at an earlier period than was used for enamels in Limoges. No tin-opacified glass on Limoges objects from before 1175 is reported in the literature.

Two objects which resemble the British Museum ciborium in the compositional differences between the beads and the enamel were found: an eucharistic dove from the Metropolitan Museum and a crucifix in the Musée National du Moyen Âge, Thermes et hôtel de Cluny. In both cases the beads are also turquoise in colour, with similar compositions of a halophytic plant ash glass opacified by tin oxide. Both these objects date to the early 13th century and fall therefore into the latter half of the intermediate period. The analytical results of the Eucharistic dove are plotted at the year 1225 in Figure 1. For the crucifix no data could be plotted as no numerical values of the composition are published.

The glass cabochons are made from translucent soda-lime-silica glass. Two groups of compositions can be found. One group has a low magnesium and potassium oxide composition (both <1 wt %), similar to the enamels, and are therefore probably also made from a mineral soda. In the second group, the contents of these oxides are higher than 2 wt%, apparently indicating glass made from halophytic plant ash. The cabochons of mineral soda glass are in the colours of aquamarine, blue, dark blue, light green and yellow-brown. The vegetal soda glass cabochons are green and brown. It should be mentioned that due to the limited accelerator time, not every cabochon on the ciborium were analyzed, but at least one of each colour was measured.

Few systematic studies have been carried out on glass cabochons. Some analyses of important Limoges pieces are published by Biron et al. These results show that both glass types found on the British Museum ciborium were also used for other Limoges objects, including the Maître Alpais ciborium. Interestingly, no forest glass was found amongst the cabochons. Forest glass was produced in medieval times in Central Europe and its recipe was written down by
Theophilus.

It tends to have a green tinge and therefore might not have been suitable for the coloured cabochons except perhaps for the green ones.

The dating of the British Museum ciborium, based on the compositions of its enamels and beads, indicates that it belongs to the intermediate period (c. 1175–c. 1235). If one assumes that the British Museum ciborium was made after the Maître Alpais ciborium, which is dated to c. 1200, and before the end of the intermediate period, around 1235, one can suggest a production date for the British Museum ciborium of around 1200 to 1235. This tallies well with the proposed art historical date of around 1210–25, based on the stylistic study, and corresponds with the dates given to the eucharistic dove (1215–35) and the crucifix (1210–20). Furthermore, the glass types of the cabochons have parallels in other medieval Limoges objects that have been analyzed. The analytical results for the British Museum ciborium are consistent with published data of champlevé enamelled works from Limoges, and nothing suggests that any parts of the vitreous decoration was added in post-medieval times.

Acknowledgements

The author thanks the late Joseph Salomon, the AGLAE-team from the C2RMF and the Access AGLAE Eu-ARTECH Program. The author wants to expresses his thanks to Ian Freestone, Cardiff University, for reading the manuscript. Especial thanks for many helpful discussions go to Susan La Niece, Department of Conservation and Scientific Research, the British Museum and Bet McLeod, formerly Department of Prehistory and Europe, the British Museum.

Notes

1 Stratford, 1993; Biron et al., 1996.
3 Biron et al., 1996.
4 Hawthorne and Smith, 1963, p. 53.
9 More details on the experiment are given in Röhrs et al., 2008.
11 Analysis to define which copper oxide species is present was not carried out. The CuO value is given as this is the most common species in glasses. However, in the case of the red enamel the presence of Cu₂O or both species is likely. Changes to the overall glass composition due to the presence of different species are negligible.
12 Freestone et al., 1990; Freestone, 1993.
13 Biron et al., 1996, p. 56.
14 Freestone et al., 1990.
15 The eucharistic dove (The Metropolitan Museum of Art, New York, Gift of J. Pierpont Morgan, object reg. no. 17.190.344,) is published in the exhibition catalogue of the Metropolitan Museum of Art and dates to 1215–35, see Boehm, 1996. The turquoise-coloured beads, which are visible on the figure in the catalogue, are not mentioned in the description of the object. Apparently, the turquoise-coloured beads are designated as enamel, whereas the black beads of the eyes are described as black-blue glass inset. Therefore, the table with the compositional data of the turquoise glass does not mention explicitly that this colour belongs to a bead, see Biron et al., (1996). The Crucifix in the Musée National du Moyen Âge, Thermes et hôtel de Cluny, dates to 1210–20 and was described by Taburet-Delahaye (2006, p. 33). Scientific analyses by Biron have identified the glass types but no compositional values are given in this publication.
16 Biron and Cannella, 2003; Biron and Cannella, 2005.
18 McLeod, this volume.

Bibliography


The Heritage of ‘Maître Alpais’ | 9
The British Museum Ciborium Conservation and Scientific Study

Maickel van Bellegem and Susan La Niece

This article describes the conservation treatment, scientific analyses and technical characteristics of the metal components of the ciborium in the collections of the British Museum. The ciborium (Fig. 1) has two main metal components: a wide bowl and a conical openwork foot. The bowl is decorated with enamel, gilding, cabochons and ‘beads’. The conservation treatment was conducted as part of a collaborative project to study the ciborium in preparation for the new Medieval Europe gallery at the British Museum.

To inform conservation it is important to have an understanding of the original materials used in manufacture. Later modifications as well as any historic and modern restoration or conservation interventions must also be taken into account. The lengthy treatment of the ciborium, mostly conducted with the aid of magnification, enabled detailed visual observations of the surface and material characteristics to be made. The technical observations made during the conservation treatment contributed to discussion of the date of the components of the ciborium, especially the question as to whether the turquoise-coloured beads were part of the original design. These observations provide a record of the materials used in the manufacture of this ciborium, of later additions and of its restoration and conservation history.

Analytical techniques
The analytical techniques used in this research are as follows. A stereo microscope was used for the surface investigation and X-radiography was undertaken using a Siefert DS1 X-ray tube. Exposure conditions were 90 kV for 60 mA minutes. The images were recorded on Agfa D7 radiographic film and scanned digitally at a resolution of 50 μm. The scanned images were processed in Adobe Photoshop to enhance the images to a publication standard, but without adding or subtracting any features seen on the films.

The metal components of the ciborium were analyzed by X-ray fluorescence (XRF) using an Artax μXRF spectrometer.
with a molybdenum target X-ray tube rated up to 40W and operated at 50kV and 800 μA with a counting time of 200 seconds and the results calibrated using copper-alloy reference standards.

A small metal sample, cut from the foot of the ciborium, was mounted in resin in cross-section. It was polished, then etched with alcoholic ferric chloride (FeCl₃) and examined at magnifications of up to x 500 with an inverted stage metallographic microscope (Zeiss Axiovert 100) to investigate the microstructure.

Condition
No documentary evidence is available of treatments which may have been conducted since the acquisition of the ciborium by the British Museum in 1853. Although it is in a stable condition there were various signs of wear and tear and the inside of the cup was dusty and had fly droppings and marks of fingerprints. There is considerable loss of gilding and crude metal loops or hooks have been riveted to the rim (Fig 2). The engraved details of the figures on the foot have lost sharpness due to wear. The ciborium has no cover and no liner to its openwork foot, though there are four rivets around the bottom of the foot which may have secured a liner like that on the inside of the foot of the Maître Alpais ciborium. There are three larger copper rivets securing the foot to the cup, two of which were loose, making it unstable and liable to further damage during handling. On the foot itself there are two areas of mechanical deformation, causing it to tilt to one side (Fig 3).
Much of the gilding is worn, exposing the metal surface beneath, which now has a thin brown patina. The gilding close to relief decoration has been protected from wear, particularly around the gems which project above the surface. Remains of gilding are present on the interior of the bowl, in the engraved lines on the exterior of the bowl (the ‘Kufic’ script, details on the angels and the bands defining the decorated areas) and on the foot. It is also noteworthy that two turquoise-coloured beads adjacent to a missing cabochon show slightly more wear than other beads, indicating that the cabochon was lost while the ciborium was still in use. Some of the enamel and cabochons are cracked or lost (Fig. 4).

The engraved decoration and recessed areas were covered by an accretion of wax and dirt which appeared to have accumulated over time. This accretion obscured much of the gilding and other surface details.

Conservation treatment
To improve both the clarity of the surface detail and the aesthetic appearance of the ciborium it was decided to remove the accretion. Such accretions may contain evidence of original coatings, burial deposits or previous conservation materials. The removal was carried out with great care, using a scalpel, under magnification. The accretion was pre-treated or ‘wetted’ using cotton wool moistened with white spirit to soften it, reducing the risk of scratching the metal surface with the scalpel blade (Figs 1 and 5). No discrete corrosion layers were observed in the accretion but small areas of a green, waxy corrosion were seen, which on the foot were present as pustules (less than 1mm in diameter) pushing the gilding away from below. A sample of the accretion was analyzed using FTIR and XRF, which identified the main components as corrosion products, sand grains, possible residues of a past cleaning treatment and small quantities of gold flakes with a low mercury content. Accretion covering an area of approximately 12% of the total surface of the object was left untouched for possible future research purposes (Fig. 4).

After removal of the accretion, the surface of the ciborium was cleaned with white spirit on cotton wool. The fingerprints and fly droppings on the inside of the cup were successfully removed by this treatment and fortunately had not etched the metal surface. The two loose rivets were secured by
introducing HMG Paraloid B72 (methyl ethyl methacrylate) on twisted Japanese tissue paper around their protruding edges. The consolidated area was colour matched using powder pigments (burnt umber, brick red and black) in HMG Paraloid B72. This reversible method was chosen in preference to hammering down the ends of the two loose rivets.

**Technical observations and metal analysis**

Both the bowl and foot are made from copper, approximately 4mm thick. The composition of both components is 97% copper with 2% lead and trace impurities of less than 1% nickel, arsenic, antimony and silver (Table 1). Tin and zinc were not detected (the detection limits by this method are 0.02% and 0.1% respectively). The lead is likely to be an accidental impurity in the copper rather than a deliberate addition. Results from these analyses by XRF of the ciborium foot and bowl are in good agreement with the analyses carried out in 1968 by qualitative emission spectrography, polarography and atomic absorption spectrography.  

Table 1: Analysis by XRF of the metal of the British Museum ciborium  

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<td>rim</td>
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<td>2.3</td>
<td>0.8</td>
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<td>0.05</td>
<td>0.1</td>
<td>0.1</td>
<td>&lt;0.02</td>
<td>0.02</td>
<td>rim</td>
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</tr>
<tr>
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<td>2.1</td>
<td>0.6</td>
<td>0.03</td>
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<td>0.1</td>
<td>0.1</td>
<td>0.07</td>
<td>0.02</td>
<td>foot</td>
<td>97.1</td>
</tr>
<tr>
<td>hook on rim</td>
<td>76.9</td>
<td>0.3</td>
<td>0.05</td>
<td>0.17</td>
<td>0.02</td>
<td>&lt;0.02</td>
<td>&lt;0.02</td>
<td>20.7</td>
<td>1.94</td>
<td>hook on rim</td>
<td>76.9</td>
</tr>
</tbody>
</table>

**The bowl**

Like the Maître Alpais ciborium, the bowl has a network of low-relief lozenges and triangles, which is thought to have been formed by hammering rather than casting, though it was not possible to take a sample for metallographic examination to confirm this. This lozenge pattern is visible in negative on the interior of the bowl, as might be expected of relief work formed by hammering (Fig. 2). The lozenges and triangles on the outside of the bowl are decorated with enamel and were engraved to delineate the angels’ faces and clothing. The angels are in reserve surrounded by fields of champeleve enamel applied in recessed cells. Unlike the Maître Alpais ciborium, the heads of the angels are engraved rather than applied. The engraved lines have a V-shaped profile and are cut relatively straight. The work differs from the engraving on the Maître Alpais ciborium, which shows evidence of a rocking motion in lines cut with a round-nosed graver and some recessing around the details of the figures especially the hands, to give a more three-dimensional effect. The British Museum ciborium only has engraving with a rocking motion in the zigzag line adjacent to the socket for the foot (Fig. 6) and in the background of the band with decoration of pseudo-Kufic script, but these were made with a wide, flat engraver.

The cabochons are set into recesses made in the copper wall of the bowl and held in place by hammering the copper to form a rim around them, similar to the technique seen on the Maître Alpais ciborium. This rim has been decorated with a line of circular punch marks. The space between punch marks is irregular and thus suggests a punch with a single circle was used repeatedly. The turquoise-coloured beads are similarly set in a round hole made in the body of the bowl with the metal edge pushed around the beads to fix them, but without the circular punch marks. There is not enough evidence to say exactly how the holes for the beads were made (Fig. 7).

Along the rim of the bowl there is an engraved decoration imitating Kufic script. The script is pierced at four opposing locations, destroying part of it. Two of the holes retain rivets securing hooks made from brass sheet (Table 1). The rivets appear to be constructed from a rolled up sheet of brass. Around the two other holes a rectangular patch of gilding is preserved, similar in size to the area covered by the two hooks, indicating the position of two missing hooks (Fig. 2). There is a build up of the accretion discussed above, including sand grains, in the areas surrounding the two hooks and the holes for the missing hooks.

![Figure 6 Detail of the bowl adjacent to the foot. Field of view 30mm](image-url)
As on the Maître Alpais ciborium, a ring hides the junction between the cup and the foot (Fig. 6). The ring, into which the foot fits, is made from a grooved copper strip soldered under the bowl. The joins are visually apparent though covered with traces of gilding. Unfortunately no compositional analysis was possible in this recess. The three copper rivets now holding the foot in place on the underside have large heads. Inside the bowl the rivet ends were hammered out (Figs 2 and 3). In the same area there appears to be a centring mark, presumably used in the forming or possibly in laying out the design.

The foot

The openwork foot is made of copper similar in composition to the bowl although it has no enamel. A small sample of metal (approximately 1mm wide and 2.5mm deep) was cut from the interior underside of the bottom edge of the foot. This sample was examined in as-polished condition and after etching (Fig. 8). It has numerous oxide inclusions, a common feature of unalloyed copper. The grain size is relatively large, probably attributable to extended heating of the metal. The annealing twins indicate the metal was worked and annealed. Very little evidence of cold working is present in this section, apart from a few bent annealing twins at the surface.

There are four small figures slightly projecting from the outer surface of the foot. On the inner surface, marks from hammering the figures outwards are visible. Similar hammer impressions are visible on the posts or rivets used to secure their heads (Fig. 9). Unfortunately no observations about how the posts are attached to the heads could be made. The tiny eyes were inlaid into the metal in a similar way to the turquoise-coloured beads on the bowl. Although damaged, the material of these inlays appears to be glass, but their position and small size did not allow for analysis to confirm this. On the interior of the foot are two engraved marks made with a wide flat engraver applied with a rocking motion, so producing a zigzag line.

Along the bottom edge of the foot there are two repairs using a white-grey solder, probably a high melting-temperature silver solder. The foliate decoration of the foot has been finished with engraving similar in appearance to the engraving on the bowl. On some areas of the foot, but not on the bowl, a remarkable surface texture can be observed (Figs 9 and 10) which appears as a linear pattern of cracks on the metal surface. It appears to be largely vertical in orientation,
especially on the undecorated section of the outside of the foot. Also on the exterior, there appear to be traces of gilding preserved inside these fine lines.\textsuperscript{11}

**Discussion**

Both casting (by the direct lost-wax method) and hammering (raising and sinking) were techniques described by Theophilus for the manufacture of censers,\textsuperscript{12} but Limoges enamels are mostly described as being wrought i.e. hammered or repoussé.\textsuperscript{13} This is the case for both flat and convex plaques and three-dimensional objects, such as pyxes, crosiers, Eucharistic doves and figures. They are constructed from several sheets, which, where appropriate, have been shaped and then riveted together. This bowl, with its low relief lozenge pattern, visible in negative on the inside, is of a form which is eminently suitable for manufacture by hammering. The centring mark on the interior of the bowl could have been used as an aid during hammering (sinking) of the bowl or creating the outline of the lozenge pattern.

The openwork foot on the other hand has no enamel but it too is made of copper and it was formed by hammering and cutting out the openwork. Its microstructure indicates that it was worked and annealed. The heads on the foot are attached by posts pushed through the foot and secured by hammering the ends flat on the inside, as for rivets. It is suggested that the manufacture of the dies for making the heads, or even the making of the relief heads themselves was carried out by specialist craftsmen, possibly quite separate from the metalworkers who made the vessel and carried out the enamelling.\textsuperscript{14}

The function of the zigzag markings on the interior of the foot is unclear. Stohlman has shown that similar markings were used to assist in the assembly of plaques on chasses or on book covers.\textsuperscript{15} However, the markings on the foot do not appear to be located near components that need assembly. Similar marks were made when taking samples for assaying on silver or gold items. However, it would be unusual for a copper object, even during later modification, to have been subjected to an assay test especially if it was not, as is believed in this case, gilded on the underside. Another possibility however may be that the craftsmen had taken a sample to test the purity of the copper alloy. After all, Theophilus placed great importance on the purity of a copper alloy if it was to be gilded. The presence of lead is mentioned in relation to the development of white spots during the gilding process. He describes a cupellation process to purify copper alloys and also a remedy for what to do if the white spots did occur.\textsuperscript{16} It is not clear why such tests would have been done on a (semi-) finished product and not on the source/bulk material before making the foot. Perhaps the foot was passed between craftsmen as a semi-finished product and it was the receiving craftsman who wanted to check the purity of the alloy? On the other hand it may be that the craftsman was simply testing his hand and engraver on an area that was not meant to be visible.

**Conclusions**

The recent conservation treatment has removed a substantial part of the accretion obscuring the surface and now much of the remaining fire-gilding and the surface detail are exposed. Though traces of soil have been found, there is no evidence for a corrosion layer which would be expected if the ciborium had been buried for a length of time. The metal composition has been confirmed as copper with low levels of impurities but no zinc or tin. The evidence of this study supports the conclusion presented by Röhrs that the turquoise-coloured beads were integral components of the original design.\textsuperscript{17}

There are obvious stylistic similarities with the Maître Alpais ciborium, though a difference in the engraving was observed. Perhaps this is related to different traditions of metalworking between artists, workshops, or locations. A detailed study of tool marks in the engraved decoration might, in the future, allow links to be made to other workshops. The applied heads on the foot are secured by posts or rivets, a technique which is consistent with Limoges tradition.

What is clear is that the British Museum ciborium has suffered much more use than the Maître Alpais ciborium, needing solder repairs followed by re-gilding. The brass hooks, which are fixed through the rim of the bowl obliterating areas of the pseudo-Kufic inscription, suggest the ciborium may have been re-used as a censer or hanging bowl. The overall wear of the gilding and the preserved rectangular patches of gilding around the two holes where hooks had been suggest that the vessel saw extensive use after that modification.

Although there are unanswered questions, particularly concerning workshop association, these observations can now provide a record of the materials used in the manufacture of this ciborium, of later additions and of its restoration and conservation history.

**Acknowledgements**

We would like to thank all the collaborators on this project and publication and also Pete Dandridge (The Metropolitan Museum of Art, New York) and Bill Wei (Netherlands Institute for Cultural Heritage, Amsterdam) for many helpful discussions.
Appendix

Examination of accretion removed during conservation cleaning\textsuperscript{18}

Marei Hacke

A sample of the surface accretion which was removed from the ciborium during conservation cleaning was submitted for analysis in order to identify the origin or type of accretion. Visually the sample had a crumbly, dirty, waxy appearance reminiscent of corrosion and soil.

The sample was extracted in dichloromethane (DCM) and separated into firstly the DCM soluble fraction and secondly the DCM insoluble fraction. The DCM insoluble fraction was examined under magnification and further separated into four visually distinct groups of particles which were analyzed separately by Fourier transform infrared spectroscopy (FTIR) and X-ray fluorescence (XRF):

Dried DCM soluble fraction

DCM insoluble fraction containing:
- black and brown particles (major fractions)
- green particles (waxy; only few remaining after DCM extraction)
- glass shards (very few and tiny)
- gold flakes (very few and tiny).

The dried, bright green DCM soluble fraction and the green particles had a soft-waxy feel suggesting copper metal soaps, which was confirmed by FTIR analysis, along with free fatty acids and/or esters (possibly partially hydrolyzed). The presence of the fatty material and hence the copper soap corrosion products is most likely due to residues from a wax coating on the ciborium.

The black and brown particles were very hard, of irregular shape and had a typical iron oxide ‘rust’ corrosion appearance which was consistent with their FTIR spectra (possibly also containing sulphates or silicates). In addition, calcium oxalate and calcium carbonate were identified. Calcium oxalate is most likely a product of the deterioration of fatty or other organic residues and calcium carbonate. XRF analysis of the brown and black particles showed the presence of mainly copper, iron and calcium as well as lower levels of zinc, gold, mercury, potassium, silicon, titanium and strontium. The presence of calcium carbonate and tiny fragments of glass shards in the accretion indicates that abrasive treatment(s) may have previously been carried out. However, both calcium carbonate and the tiny glass fragments may also have originated from the archaeological context (soil), along with small levels of titanium, sulphur, silicates other than glass and the high levels of iron. Copper is probably present as a corrosion product from the metal, and the low levels of zinc detected may have come from the brass hooks added to the rim. The low levels of mercury along with gold flakes in the ciborium accretion are indicative of fire-gilding.

Notes

1 Registration no. P&E 1853,1118.1.
2 For a full description of the form and decoration see McLeod, this volume.
3 The British Museum, Gallery 40.
4 The possibility that there was an original coating or colouring medium in the engraved lines, to make the engraved decoration stand out, was considered. Theophilus mentions colouration of the recesses of circular punch marks: ‘put the bowl on the coals until the punch marks take on a reddish-yellow colour on the inside’. (Hawthorne and Smith, 1979, book III, chapter 42, p. 116 and again book III, chapter 73, p. 149) Although the nature of this discoloration remains uncertain (most likely oxidation), it surely was meant to provide contrast for punch marks to stand out more.
5 See Hacke, Appendix of this chapter.
6 Barker, 1968.
7 The ‘Maître Alpais ciborium’ was examined alongside the ‘British Museum ciborium’ during a study day held at the Musée du Louvre in Paris. See also Biron et al., 1996, p. 52–5 for descriptions of engraving similarly observed on Limoges enamel objects.
8 To do this the metal surface was covered with Scotch magic tape (to protect the metal from being scratched/ rubbed against during the cutting) through which the sample was cut using a jeweller’s saw. The sample location was filled with glass micro balloons mixed to a stiff consistency with Paraloid B72 (ethyl methacrylate copolymer) in acetone, and copper coloured and black powder pigments for aesthetic appearance.
9 See McLeod, Figs 3 and 4, this volume.
10 Traces of fire-gilding are apparently overlying the solder: a soft solder would require a similar low melting temperature to that required for fire-gilding, rendering it unsuitable.
11 A similar surface texture has been observed by van Bellegem on another object in the museum’s collection (1921, 0325.1). Because of their vertical orientation on the exterior it is hypothesized they are associated with deformation of the metallographic microstructure of the metal due to hammering the metal sheet.
12 Hawthorne and Smith, 1979, book III, chapter 60 and 61, p. 130–8.
13 Biron et al., 1996, p. 50, Oddy et al., 1986.
14 Biron et al., 1996, p. 52.
15 Stohlman, 1934 and 1935.
17 Röhrs, this volume.
18 Summary of analytical request report AR2009/10 (The British Museum, Department of Conservation and Scientific Research).

Bibliography

This short note will discuss the Arabic inscriptions that appear on the Maître Alpais and British Museum ciboria. The main questions concern the style of the script and the legibility of the inscriptions, how they compare to Arabic inscriptions more broadly, how close the two inscriptions are to each other, how Arabic inscriptions came to be on the ciboria at all and what this tells us about the diffusion of the Arabic script from the Islamic lands to the West in the early medieval period. Finally we will examine what close parallels there might be in France itself for inscriptions of this type and how Arabic inscriptions appear on other ‘Limoges’ enamels.

The inscriptions

The inscriptions are in what is known as Kufic script, the name given to the angular style of script developed in the late 7th century, initially for the copying of the Qur’an. As it spread throughout the Islamic lands, Kufic was used on a range of other materials and gradually grew more elaborate and formulaic over time until it was abandoned for regular use. By the 12th century it was henceforth reserved generally for decorative purposes, for example in the headings of chapters in the Qur’an to contrast with the cursive scripts (naskh, thuluth and others) that now predominated. As will be discussed below, the Arabic script entered non-Muslim contexts through contacts between the Islamic lands and the West, in Sicily for example or in the Byzantine domains. Another route was diffusion of Islamic objects from the western Islamic lands (Syria, Egypt, Spain) bearing inscriptions and acquired as souvenirs, booty or trade. Many of these objects – especially rock crystals - were subsequently incorporated into Christian religious relics and were conserved in church treasuries. Through this wide range of contacts and circumstances, Arabic script found its way into western contexts on manuscripts, architectural decoration and elsewhere, in addition to the metalwork under discussion. The extent to which it was recognized and consciously retained as Arabic is debatable. It is more likely that this exotic element simply became one element among many in the vocabulary of motifs used by European craftsmen of the medieval period.

The script style on the ciboria corresponds to what is known as floriated Kufic, particularly popular in about the 11th century, especially in Egypt and Syria. This is where individual letters have added decorative elements which might include trefoils for example or where ends of letters are extended to form a vegetal ornament. However, while there are recognizable Arabic letter shapes in the ciboria inscriptions,
these do not make up legible texts and hence are described generally as pseudo-Kufic or Kufesque, a term which combined Kufic with arabesque first coined by George Miles who collected such inscriptions from the Byzantine period in Greece. But, such is the accuracy of the shapes of the letters, that a prototype of some kind cannot have been too far away. In other words the craftsmen may have been copying either a real inscription which they did not understand or more probably the prototype was at several removes.

Elsewhere in this volume the relationship and differences between the two ciboria are discussed and it is proposed that the earlier of the two objects is the Maître Alpais ciborium which was made about 1200, while the British Museum example was made some years later between 1200 and 1235. The inscriptions on the Louvre and British Museum ciboria differ between one and the other (Figs 1a, 1b). Both inscriptions are made up of a series of letters in groups which can be considered as units. The British Museum inscription (1b), shown here in its entirety, consists of three units: A – B – C configured slightly differently in each of the four sections. The Louvre inscription (1a) consists of two units shown here as B – C. It has a particular feature which does not appear in the British Museum inscription of double letters which have a bridge between them. This can be seen between the beginning and end of each of the units. What is clear therefore is that a common source is being used in two slightly different ways.

Let us consider now what the likely sources for these inscriptions are. In general terms as was mentioned above, Islamic objects found their way into Europe in a number of ways – both direct and indirect. There are gifts from Muslim potentates to European princes, booty and traded objects. There are also the trophies: the Pisa griffin for example that was once on the top of the cathedral at Pisa and believed to have been mounted there in the early 12th century. The attribution of this object has ranged from southern Italy to Iran with recent scholarship attributing it to 11th–12th century Spain. Another famous trophy of the Crusades was the Fatimid period textile dating to the reign of the caliph al-Musta’li (r. 1094–1101) known as the Veil of St Anne which belonged to the cathedral of Apt in the Vaucluse in France.

This last trophy is relevant because the prototypes of the ciboria inscriptions were most probably portable objects including metalwork. James Allan has shown how medieval Islamic metalwork was clearly influential on a range of objects including Limoges enamels. Textiles were made in great profusion in Egypt in the early medieval period and were exported widely. One of the interesting aspects of the inscriptions on Fatimid textiles is that they range from the legible texts which include names of caliphs and benedictory phrases, to those which are in a pseudo-script like the inscriptions on the European objects. An 11th–12th century Fatimid silk fragment in the British Museum (Fig. 2) has bands of repeated words, (likely to be pseudo-script) part of which resembles the ciboria inscriptions with a letter that loops upwards facing left in Unit A of the British Museum ciborium.

If we place the ciboria inscriptions within the wider context of objects with ‘Kufic’ or Kufesque inscriptions, we can see that there is a great deal of material to compare them with. Arabic inscriptions as decorative motifs (whether the words are legible or not) are in evidence throughout medieval Europe in a variety of contexts. There is, for example, the Adémar de Chabanes manuscript from 1034 which has Kufic inscriptions and the Apocalypse of San Severus written in Aquitaine before 1072. Two centuries later Kufic appears on the Ormesby Psalter copied between 1285 and 1320. Fatimid style inscriptions also appear in architecture in 12th–13th century painted churches in southern Italy and Maria Vittoria Fontana attributes the diffusion of these motifs to the influence of Byzantium which played a significant intermediary role between Islam and the West. As with the inscriptions on the objects, generally these are not whole texts but individual words turned into decorative motifs.

The cluster of letters found in the ciboria inscriptions were studied by Erdmann who found altogether 145 examples of these units and established that it was particularly popular in the 12th and 13th centuries in Europe, decreasing in the 14th century. Ettenhausen later defined the group as the ‘tall-short-tall syndrome’. He was particularly interested in the source and original meaning of the text suggesting plausibly that the unit described here as ‘B’ was based on the word Allah, the writing of which evolved in a number of ways. A notable

![Figure 2 Fatimid silk textile fragment (detail), British Museum reg. no. Asia 1928,1022.135](image)
feature was an arched form in the centre of the word which became more elaborate, eventually turning into a lozenge on top of the arch then a trefoil, as on the ciboria. 18

An extremely important parallel to the ciboria inscriptions and close in date is the 12th century wooden panel in the porch of the cathedral of Le Puy-en-Velay, east of Limoges in the Auvergne. 19 This cathedral was built on a rock, Mount Anis, which has Roman and early Christian origins. It was an important place of pilgrimage on the route to Santiago de Compostella in north-west Spain. Le Puy was the beginning of the route and its popularity reached its height in the 12th century. To accommodate the increasing numbers of pilgrims the cathedral underwent a number of different building phases, and extensions were built in the 11th and mid-12th century which was when the inscribed doors were put in (Fig. 3). One of the earliest references to the Arabic inscription is in an article by Archibald Christie who discusses the use of Arabic inscriptions in European contexts and who also attributes the transfer of motifs to the export of Islamic textiles to the West. 20 The cedar panel is signed by a master carver Gauzfredus and Christie notes that neither Gauzfredus nor the Reverend fathers of Le Puy, knew what it meant, for they would hardly have framed carved scenes from New Testament history with what is without a doubt part of the Muhammadan confession of Faith.

The text is indeed the repetition of a part of a phrase and it is very nearly legible. Possibly illa Allah ‘except for God’ part of the Shahada, the Islamic Profession of Faith (la ilaha illa Allah there is no god except God) and where the centre of Allah has a decorative trefoil centre. The inscriptions on the ciboria may in fact be based on a similar phrase perhaps al-mulk lillah, ‘the kingdom belongs to God’ another popular inscription on a variety of early medieval Islamic objects. 21

In terms of comparing the text on the cedar panel to the text on the ciboria, the Puy-en-Velay panel appears closer to ‘real’ script and thus perhaps closer to a source than the ciboria. Like the ciboria inscriptions it is also in units (Fig. 4) and strikingly similar is the trefoil marked by the upright letters in unit B. The same unit appears in Limoges enamels such as those in the panels from the Ortense museum, dateable to 1174–1213, and the Spanga Chasse, made in Germany after Limoges, demonstrating how embedded Arabic inscription had become. 22 Finally, another interesting parallel close to the ciboria inscriptions is a late 12th-century chalice and paten from the Petrikirche in Salzburg in the Kunsthistorisches Museum in Vienna. Here the inscriptions are also in bands and made up of units but while retaining some similar elements they are different in style. 23

The Arabic inscriptions on the ciboria are, it is clear, an exotic decorative element for which there was a fashion in medieval Europe as a result of the interaction between Islam and the West on so many levels. Far from being intended to be legible or meaningful it becomes part of the artistic vocabulary of the European craftsmen, paving the way for the appearance of similarly ‘pseudo’ Arabic inscriptions in the paintings of Renaissance Italy. 24

Acknowledgement
I am grateful to the anonymous referee for their comments and suggestions.

Notes
1 Blair, 2006, p. 1 ff.
2 James, 1998, fig. 3 for example.
4 Shalem, 1998.
6 Discussed in Ettinghausen, 1984, p. 752; Miles, 1964, p. 20.
7 Röhrs, this volume, p. 9. Not included in this discussion are the various electrotypes that are described elsewhere in this volume.
8 Shalem, 1995, p. 35.
9 Cornu, 1999, p. 337.
10 Shalem, 1998, p. 73.
11 Allan, 1994, p. 52.
13 A number of authors have studied this phenomenon starting with Longpérier, 1845–6, followed by Erdmann, 1954 and Miles, 1964.
The Heritage of ‘Maître Alpais’

Porter

14 Taburet-Delahaye and Boehm, 1995–6, p. 248; Europa und der Orient, 1989, p. 160 fig. 182. Allan, 1994, p. 53 notes that this inscription is accompanied by circles like ring punching on Islamic metalwork and therefore imported metalwork must have been a source for the design.

15 Watson, 1969.


18 Ettinghausen, 1984, figs 3 and 16.

19 I am grateful to Sophie Makariou who kindly read a version of this article for pointing this out to me. For an analysis of the cathedral see Barral i Altet, 2000 and Barral i Altet, 2004 for a brief discussion of the inscriptions. These were also discussed by Farés, 1952.

20 Christie, 1922, p. 288.


22 Gauthier, 1950, pl. 33; Taburet-Delahaye and Boehm, 1995–6, cat. no. 123.

23 Allan, 1994, pl. 6.


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L’iconographie du Ciboire de Maître Alpais
Nouveaux points de vue et vieilles questions

Élisabeth Antoine

C’est bien à juste titre que le ciboire de Maître Alpais figura récemment dans l’exposition *The Louvre and the Masterpiece* à Atlanta,1 et sa perfection formelle a déjà été maintes fois soulignée. La qualité du travail de forme, de l’émaillage et de la ciselure témoigne de l’art des émailleurs limousins à son sommet (Fig. 1). Il me semble, cependant, que cette perfection

Figure 1 Ciboire de Maître Alpais, Limoges, c. 1200. Musée du Louvre, département des Objets d’art, inv. MRR 98; ht. 301mm (ht. coupe 138mm), diam. 168mm (© Jean-Gilles Berizzi, Réunion des musées nationaux)
n'est pas seulement technique, mais aussi ‘intellectuelle’, aspect qui en revanche n’a guère été souligné jusqu’ici. Il apparaît en effet que le plaisir extrême qu’apporte la contemplation du ciboire de Maître Alpais n’est pas uniquement un plaisir visuel, dû à l’éclat de l’émail, de l’or et des verroteries, mais aussi celui que procure la beauté idéale de l’abstraction, dans un sens platonicien.

Un décor à la composition mathématique et architecturée: une coupole miniature ?
Le décor du ciboire frappe en effet par sa grande rigueur mathématique. Il repose sur un jeu de composition entre les deux demi-sphères de la coupe et du couvercle, c’est-à-dire la forme sphérique, et le chiffre quatre, c’est-à-dire le carré, ici posé sur la pointe - donc en losange - et la division de celui-ci, un triangle isocèle. Le décor se compose en effet de quatre registres superposés, comportant chacun huit motifs répétés. Partant du bord du couvercle, en allant vers le bouton, on a successivement: huit grands triangles, au fond bleu moyen, occupés par des anges en buste, les ailes croisées vers le bas et vers le haut sur la coupe (Figs 2, 3); huit grands losanges, au fond bleu lapis, occupés par des personnages auréolés tenant presque tous un livre, que nous désignerons provisoirement comme des saints. Les têtes sont formées par des têtes d’aplique rapportées, et trois types sont répétés: un saint jeune et imberbe, un saint barbu aux cheveux bouclés, un saint barbu et chauve évoquant la figuration classique de saint Paul (Fig. 3); huit petits losanges, au fond bleu moyen, de nouveau ornés d’anges en buste; huit petits triangles, ornés de rinceaux dorés sur fond bleu lapis.

Le même décor est répété de manière symétrique sur la coupe, avec un effet de miroir. Il s’agit donc d’une composition savante, parfaitement maîtrisée et pensée à l’avance. La sensation de perfection que dégage le ciboire tient donc non seulement au talent de l’orfèvre Maître Alpais, mais aussi à la qualité du programme qui lui fut donné par son commanditaire, donc au talent du ‘cerveau’ qui élabora cette construction savante.

Celle-ci repose en effet sur une belle progression mathématique: 2 (demi-sphères); 4 (registres); 8 (motifs); 16 (‘saints’); 32 (anges). Ce jeu subtil sur les formes (cercle, carré, triangle) et les chiffres (2x2x2x2x2, ou 2 à la puissance 5) exerce une séduction particulière sur l’esprit et offre un attrait peut-être paradoxal pour l’amateur d’objets d’art du Moyen Âge. Il me semble en effet, en forçant un peu le trait, que nous vivons avec dans l’esprit une opposition, plus ou moins consciente, entre les émaux limousins d’une part, dont la beauté tient au caractère narratif des œuvres et à la fantaisie des émailleurs qui, avec une grande liberté, ont semé leurs fonds de motifs toujours différents, et d’autre part les émaux rhéno-mosans au caractère plus abstrait, aux personnages éthérés, au contenu spirituel plus élaboré. Or, le paradoxe du ciboire de Maître Alpais est de réunir à la perfection les qualités de ces deux univers formels: sa forme représente la quintessence de l’émaillerie limousine, tout en étant l’expression d’une pensée abstraite très poussée.

Ces caractères ne se démentent pas lorsque l’on examine l’intérieur de l’œuvre; l’intérieur du couvercle comporte un médaillon gravé avec la main de Dieu bénissant, sur fond de
croix (Fig. 5), quant à l’intérieur de la coupe, il est orné d’un médaillon gravé d’un ange béniissant, entouré de la fameuse inscription ‘MAGI[S]TER G ALPAIS ME FECIT LEMOVICARUM’ (Fig. 5).

Dans son ébauche de 1965 sur les ciboires romans en forme de coupe a couvercle, P. Skubiszewski montra que la forme qu’emprunte le ciboire de Maître Alpais, et d’autre coupes célèbres telles le ciboire de Malmesbury ou le ciboire Balfour, celle d’une coupe à boire ou scyphe, fort répandue au Moyen Âge, dérivait de l’orfèvrerie persane.3 Dans le cas du ciboire de Maître Alpais, après avoir regardé l’objet de dessus, ainsi que l’intérieur de la coupe et du couvercle, il me semble qu’il faut ajouter un élément à sa démonstration: celui de l’influence de l’architecture islamique.

En effet, regardant le ciboire de dessus, ce qui faisait son utilisateur mais ce que nous ne pouvons faire quand il est présenté en vitrine, nous voyons, en miniature, une coupole richement décorée (Fig. 4). Quant à l’intérieur du ciboire, que voyait aussi son utilisateur (mais que nous ne voyons pas habituellement, puisque l’œuvre est toujours présentée fermée en vitrine), avec son jeu de prisms, il évoque l’intérieur d’une coupole à muqarnas, telle celle, contemporaine de notre ciboire, du tombeau de Sitt Zubaïda à Bagdad, c. 1193 (Fig. 6).1 Si les similitudes visuelles sont très frappantes, peut-on pour autant parler d’influence? On ne peut bien sûr mettre sur le même plan des coupes d’orfèvrerie orientale, objets précieux et de petites dimensions, qu’on transportait aisément en Occident où ils furent appréciés comme objets de luxe et purent servir de modèles à des artistes, et des coupoles, qui n’ont jamais voyagé jusqu’en Occident, telles des tapis volants! Si aucun orfèvre limousin de la fin du 12e siècle n’avait vraisemblablement vu de coupole à muqarnas, le commanditaire du ciboire, en revanche, aurait pu en voir s’il avait, tel Richard Cœur de Lion, participé à la troisième croisade (1189–92). La Syrie fut en effet le berceau du développement de la coupole à muqarnas, apparue au 10e siècle et utilisée en particulier du temps de Nur al-Din, dans de très nombreux édifices à Damas, à Alep ou à Jérusalem. Il s’agit d’édifices légèrement antérieurs au ciboire, que des croisés ont pu voir et admirer notamment le bimaristan ou hôpital que Nur al-Din fit édifier à Damas, c. 1154, qui faisait l’objet de l’admiration de tous les voyageurs (Fig. 7). Du point de vue de l’iconographie du ciboire, le rapprochement avec une coupole de mosquée, au symbolisme cosmique bien connu, est tout à fait éclairant, et rejoint le jeu sur le chiffre quatre, symbole de perfection cosmique, souligné précédemment.

Figure 5 Vue de l’intérieur du ciboire de MaîtreAlpais: coupe à gauche et couvercle à droite (© Cliché D. Bagault, C2RMF)

Figure 6 Coupole à muqarnas du tombeau de Sitt Zubaïda, Bagdad, vers 1193 (© Documentation du département des Objets d’art, musée du Louvre)

Figure 7 Coupole à muqarnas de l’hôpital de Nur al-Din, Damas, 1154 (© Annick Neveux-Leclerc)
L'iconographie: à la recherche des seize apôtres

Pour quitter l'Orient et revenir sur un terrain plus familier, je voudrais m'intéresser en détail à l'iconographie du ciboire de Maître Alpais, qui fut étrangement peu étudiée, à l'exception d'Élisabeth Taburet-Delahaye dans le catalogue de l'exposition L'Oeuvre de Limoges, et il y a beaucoup plus longtemps, d'Alfred Darcel, dans son étude sur le ciboire parue en 1854 dans les Annales Archéologiques. Pour les autres auteurs, tout semble couler de source. Pourtant, cette iconographie pose plusieurs problèmes: décrivant les personnages inscrits dans les grands losanges, la plupart des auteurs parlent d'apôtres, sans se rendre compte, ou sans vouloir se rendre compte qu'ils sont 16, ce qui est quatre de trop! D'autre part, parmi ces 16 personnages, ayant pour tout attribut un livre fermé, sans inscription aucune pour les identifier, l'un cependant se distingue, sur la coupe (Fig. 3), ce qui n'est, là aussi, pratiquement jamais remarqué par les innamorables auteurs qui ont décrit le ciboire.

Il ne tient pas de livre, est encadré de deux larges palmettes émaillées, dorées, rehaussées de rouge-décor plus riche que les petits fleurons encadrant les autres personnages- et surmonté, à droite, d'un ange avec un décor également particulier: deux croix grecques, alors que les autres anges sont entourés de petits ronds dorés. Il est donc désigné de manière particulière. Étant donné la rigueur mathématique de la composition d'ensemble, soulignée plus haut, il semble impossible que ces 16 figures soient de simples 'bouche-trous' placés là par hasard, et que ce personnage différencé des autres soit le résultat d'un moment d'inattention de Maître Alpais. Pour mieux comprendre qui sont ces 16 personnages, et essayer de trouver qui est l'homme sans livre, il faut reprendre l'analyse que fit Darcel en 1854, de loin la plus détaillée et la plus complète du ciboire. Sa lecture est très convaincante – à une exception près – car elle donne une interprétation d'ensemble de l'œuvre, fidèle à la conception rigoureuse et mathématique du ciboire. Sa lecture s'effectue du bas vers le haut: le pied, que nous n'avions pas encore évoqué, avec ses personnages dans des rinceaux, poursuivis par des créatures fantastiques, figure le niveau terrestre de l'homme luttant contre le péché, ou, pour citer Darcel: l'homme embarrassé dans les liens inextricables de la vie, laissé aux prises avec le péché. Avec la coupe et le couvercle, on atteint le domaine céleste, celui des saints et des anges. Les 32 anges sont pour Darcel les représentants de la hiérarchie angélique, figurée par quatre anges pour chaque chœur (reprenant ainsi la combinaison mathématique de 4 et 8): séraphins, chérubins, trônes, dominations, vertus, puissances, principautés, anges. Au sommet, sous la forme de quatre figures d'ange, toutes différentes, tenant une hostie sur le bouton, sont les quatre archanges. Quant aux 'saints', ils sont décrits par Darcel comme ceux

qui ont prophétisé la venue du Christ, et ceux qui furent les témoins vivants de sa mission… ils sont là comme garants de la vérité et pour attester aux fidèles de la réalité du mystère eucharistique contenu dans cette coupe.

Il distingue donc le collège apostolique, ceux qui furent les témoins vivants de la mission, des quatre autres saints, qu'il identifie avec quatre prophètes: Isaïe qui annonce la Nativité, Jérémie la Passion, Daniel le Jugement, et Ezechiel la Gloire du paradis. Et Darcel de conclure qu'il s'agit donc d'une représentation du ciel sur le ciboire,

resplendissant par Dieu, par ses anges, par ses prophètes, le ciel, but suprême de la terre, c'est-à-dire de l'homme qui se débat au-dessous contre ses passions et contre le mal.

Cette interprétation très cohérente me paraît bien rendre compte du sentiment de plénitude et de perfection que donne le ciboire, et je l'adopte très volontiers, à une exception près, celle des prophètes, pour laquelle il faut émettre deux réserves; Élisabeth Taburet-Delahaye a déjà fait remarquer avec pertinence que les prophètes tiennent généralement des phylactères et non des livres, d'autre part cette interprétation ne tient pas compte du fait que l'un des personnages est plus particulièrement mis en valeur, il reste donc à tenter de l'identifier.

Si l'on accepte le principe de 12 apôtres et quatre autres personnages, plusieurs hypothèses d'identification sont possibles. La première semble la plus évidente: il est tentant de compléter le collège apostolique avec les quatre évangélistes pour arriver à 16 personnages; mais en réalité, ici l'addition de 12 et quatre n'arrive qu'à 14. Il ne faut pas oublier, en effet, que Jean et Matthieu sont à la fois évangélistes et apôtres, et ne devraient donc pas être figurés deux fois.

Il faut donc envisager une deuxième hypothèse, en gardant seulement deux évangélistes sur les quatre, Marc et Luc, ce qui laisse encore deux places à pourvoir. L'une l'est facilement, avec saint Paul, très fréquemment intégré au collège apostolique au Moyen Âge, et dont le 'type' est répété trois fois sur la coupe. Quant à notre 'homme sans livre', il pourrait bien s'agir de saint Martial, 'l'apôtre du Limousin', qui apparaît sur le même plan que les apôtres dans des litanies ou sur des œuvres, notamment le devant d'autel de Grandmont, où il est figuré comme un apôtre, et non comme un évêque, parmi les apôtres, mais où, heureusement, l'orfèvre a eu la bonne idée d'identifier les personnages par des inscriptions, car ils n'ont aucun attribut, comme sur le ciboire.

Saint Martial ou saint Trophime, seizième apôtre?

Avec cette hypothèse comptant 12 apôtres, saint Marc, saint Luc, saint Paul et saint Martial, les 16 personnages sont identifiés d'une manière plausible. Cependant cette proposition ne me paraît pas entièrement convaincante: en effet, la figuration de saint Martial suppose plutôt un commanditaire limousin, ce qui me semble contradictoire avec la fameuse inscription 'MAGI[S]TER G ALPAIS ME FECIT LEMOVICARUM' (Maître G Alpais m'a fait à Limoges). A mes yeux, la mention du lieu de fabrication exclut un commanditaire limousin, pour lequel la précision aurait été inutile. La signification à donner à ces deux inscriptions, car ils n'ont aucun attribut, comme sur le ciboire.
montrer que lesorfèvres limousins ont tenu à affirmer leur art avec fierté vis-à-vis de l'étranger. Mais ce n'est pas le cas dans le troisième exemple, le plus tardif, celui du chef-reliquaire de St Ferréol, daté de 1346 et réalisé pour l'église de Nexon (Haute-Vienne). Il porte une longue inscription en latin au revers, ici traduite en français 'Le Seigneur Guy de Brugières, de la paroisse de Saint-Martin-le-Vieux, chapelain de l'église de Nexon, a fait faire cette tête à Limoges en l'honneur du saint évêque Ferréol; moi, Ayméric Chrétien, orfèvre du château de Limoges ai réalisé cette œuvre à Limoges, en l'année sainée de 1346 sur l'ordre de maître Guy de Brugières'.12 La provenance de Limoges est répétée trois fois, bien que le chef-reliquaire ait été réalisé pour une église qui ne doit pas se situer à plus d'une quarantaine de kilomètres de Limoges: fierté peut-être nécessaire à une époque où l'œuvre de Limoges était plutôt sur le déclin?

Dans le cas du ciboire de Maître Alpais, l'inscription pourrait être un argument pour étayer la provenance provençale donnée par le plus ancien propriétaire connu, le peintre Pierre Révoil (1776–1842), dont la collection fut acquise par le Louvre en 1828. Il nous faut examiner une dernière hypothèse, qui prenne en compte cette question de la provenance.

Dans une troisième et dernière hypothèse, l'on aurait: 12 apôtres, saint Marc, saint Luc, saint Paul, et le dernier homme qui, s'il n'est pas saint Martial, pourrait être son homologue provençal, saint Trophime. En effet, nous vivons sur l'attribution donnée par Révoil dans l'inventaire qu'il rédigea lui-même de sa collection, avant de la vendre au Louvre: ‘M. Révoil pense d'après quelques données que ce hanap aurait été fait pour les moines bénédictins de Montmajour près d'Arles’.

L'attribution de Révoil n'est pas donnée au hasard: quoique lyonnais d'origine, il vécut dans la région de Montmajour. Il habita de 1816 à 1823 à Aix-en-Provence, où il s'était marié et où naquirent ses deux fils. Révoil avait des attaches provençales par sa belle-famille: celle-ci possédait le château de Servanes, à moins de trente kilomètres de Montmajour, où il séjourna à de multiples reprises, et où il se retira à la fin de ses jours.13 Visiblement, Révoil s'intéressa à l'abbaye et la connaissait bien.14 Ainsi, il en fit le décor d'un tableau commandé par la duchesse de Berry en 1829: saint Louis se confessant à l'abbé de Montmajour avant de partir en croisade.15 L'abbaye avait été sécularisée par Louis XVI avant la Révolution, en 1786 et dès cette date, des biens mobiliers avaient été aliénés, peut-être déjà le ciboire? Puis l'abbaye fut vendue sous la Révolution comme bien national à une certaine Élisabeth Roux-Chatelard, qui, après avoir vendu meubles, boiseries, fer forgés, etc., se révéla insolvable. Elle fut donc dessaisie du bien, et une nouvelle acquisition fut organisée. L'abbaye fut vendue sous la Révolution en 1799 seulement, et entra aussi au Louvre avec sa collection. La différence de parcours entre cette crosse, à la provenance assurée, et le ciboire, peut-être passé par plusieurs mains, peut expliquer la prudence relative de Révoil dans son inventaire.

Quoi qu'il en soit, il me semble que nous pouvons lui accorder le bénéfice du doute.

Ainsi, si le ciboire de Maître Alpais fut commandé par un abbé de Montmajour, saint Trophime pourrait bien être notre ‘quatrième homme’. L'abbaye de Montmajour revendiquait en effet son patronage: selon la tradition, Trophime, premier évêque d'Arles, le fondateur de l'église arlésienne (qui avait des prétentions à être le premier des sièges épiscopaux de Gaule) se retirait pour méditer dans une grotte d'une colline voisine, sur laquelle fut fondée Montmajour.17 Comme souvent, au cours du Moyen Âge, on a fusionné un personnage légendaire plusieurs Trophime et plusieurs traditions. Selon la tradition la plus ancienne, remontant au 5e siècle, Trophime, envoyé par saint Pierre lui-même en 46 (d'où l'assimilation aux apôtres), évangélisa la région d'Arles et devint évêque. Selon Grégoire de Tours, il fut envoyé plus tardivement, en 250, du temps de l'empereur Dèce, avec six autres 'missionnaires' en Gaule qui devinrent évêques: Gatien (à Tours), Paul (à Narbonne), Saturnin (à Toulouse), Denis (à Paris), Austremoine (en Auvergne), Martial (à Limoges). Il se trouve alors sur le même plan que saint Martial, que les émailleurs limousins firent généralement comme un apôtre, et non mitré. A partir du 9 e siècle, l'évêque saint Trophime d'Arles fut assimilé au Trophime disciple de Paul mentionné dans les Épitres et les Actes des Apôtres qui, selon la tradition, était à la fois un cousin de Paul et d'Étienne. Ainsi, en Provence, à la fin du 12e siècle, époque où la légende a atteint son élaboration la plus complexe, et le culte de saint Trophime son apogée après la translation de ses reliques en 1152, saint Trophime, en sa double qualité de disciple de Pierre et de Paul, était un personnage éminemment apostolique, que l'on a pu faire figurer dans un collège apostolique ‘élargi’.18 Avec saint Trophime, nous avons peut-être la clé du mystère des 16 apôtres et de la composition du ciboire de Maître Alpais.

Conclusion
Chef d'œuvre de l'orfèvrerie limousine, le ciboire de Maître Alpais offre aux regards la forme en réduction d'une coupole symbolisant la voûte céleste occupée par les saints et les anges. Sa structure, mathématiquement composée, évoque celle d'une coupole à muqarnas. Un des saints y est particulièrement mis en valeur, vraisemblablement le saint patron de l'établissement qui commanda le ciboire; si celui-ci provient bien de Montmajour, comme l'indiquait le collectionneur Révoil, saint Trophime, fondateur de l'église d'Arles, paraît le candidat le plus vraisemblable: son culte atteignit son apogée à la fin du 12e siècle (après la translation de ses reliques et le couronnement de Frédéric Barberousse en 1178 à Saint-Trophime d'Arles), au moment de l'achèvement du portail de Saint-Trophime où il se trouve représenté avec les apôtres, ce qui correspond à la datation stylistique attribuée au ciboire.

Remerciements
Je remercie tout particulièrement Eberhard König et Pierre-Yves Le Pogam pour leurs encouragements et leurs lectures avisées, ainsi que Marie-Cécile Bardoz et Carole Treton au département des Objets d'art, Hélène Bendejacq, Gwenaëlle Fellinger et Annick Neveux-Leclerc au département des Arts de l'Islam, musée du Louvre, pour leur aide efficace.
Notes

5. Darcel, 1854, p. 5–16.
6. À la différence du frontal de la cathédrale d’Orense, également orné d’un collège apostolique élargi à 16 personnages, mais où les orfèvres limousins ont indiqué par des inscriptions l’identité des personnages supplémentaires (saint Martial, saint Martin, saint Tiris ou Quirico, saint Vincent).
13. Révoil est enterré dans la commune voisine du château, à Mouriès.

17. L’église souterraine Saint-Pierre passait dans la tradition pour l’oratoire ou le ‘confessionnal de saint Trophême’.

Bibliographie


The Maître Alpais ciborium is one of the most important works of Limousin enamellers. It is famous for its technical perfection and for the inscription engraved at the centre of the lower cup, surrounding a blessing angel: ‘Master Alpais from Limoges made me’. At the peak of their artistic abilities, the Limousin artists made an object of incomparable quality (Fig. 1). The ciborium was examined twice in the laboratory of the C2RMF: firstly, to study the metalwork in the context of the exhibition, ‘Enamels of Limoges 1100–1350’, which took place in Paris in the Louvre Museum and then in New York in the Metropolitan Museum of Art in 1995–96. Secondly, to analyse the cabochons and the enamels as part of a study of the imitation of precious stones with coloured glass, through the study of a medieval manuscript, the Trésorier de Jean d’Outremeuse.

All the scientific results of these studies of the ciborium are presented in this paper. For Limoges champlevé enamels, a technical and a glass chemical composition database with entries for approximately 200 plaques and medallions (about 100 objects) has been created in the C2RMF. Other laboratory studies have been carried out by Dandridge and Wypyski, and Freestone.

Experimental methods
In order to investigate the manufacturing techniques, the object was studied using a binocular microscope and was X-rayed to examine details which are invisible to the naked eye. Radiographs were taken at exposures ranging from 100 mA minutes at 50 kV and at 0.5 m to 60 mA minutes at 380 kV and at 2.1 metres, depending on the size and the density of the part of the ciborium studied. Radiography was used to look for hammermarks underneath the enamel, and its method of construction. A 2mm thick lead filter was used to sharpen the image of the ‘arrow-pointed’ rivet, see below.

The analysis of the surface of the glass was undertaken directly on the object, with no sample being removed, using a proton beam of 2.95 MeV extracted in air, produced by the laboratory’s AGLAE accelerator, in PIXE and PIGME modes (respectively particle-induced X-ray and gamma ray emission).

The metalwork
The ciborium comprises a bowl and cover resting on a truncated conical foot. The cover is surmounted by a knop, with small applied heads and figures riveted to it (Fig. 1). Radiography assists in the understanding of the metalwork and shows the sophisticated assembly of the ciborium (Figs 2–6). The metalworking is of exceptional quality, both in the individual components and the different methods of joining and decoration.

It is highly probable that both the bowl and cover were formed by hammering from a copper sheet, which is the traditional method of Limoges enamel workmanship. No casting porosity can be seen on the radiographs. Hammer work created the lozenge pattern, which appears in negative on the reverse, within which the half-length figures of angels and the foliage are engraved (Figs 1 and 4). Unfortunately no metal analyses or metallographic samples were available to confirm the hypothesis of hammering. Furthermore, hammer impressions are very difficult to identify on the radiographic images because the engraving and enamels covering the...
Figure 2 Diagram of the metal construction as interpreted from the radiographs and observations of the ciborium of Maitre Alpais (© C2RMF Th. Borel)

Figure 3 Radiographic image of the bowl and cover of the ciborium (© C2RMF Th. Borel)

Figure 4 Detail of the radiographic image of the bowl of the ciborium showing the lozenge patterns in the metalwork, the champlevé and the engraving. Note the rivets securing the angels’ heads (© C2RMF Th. Borel)

Figure 5 Radiographic image of the bottom of the ciborium showing the construction of the foot and the junction with the bowl (© C2RMF Th. Borel)
surface obscure any tool marks. The thickness of the metal is 2–2.3mm at the mid-point of the bowl and cover, and around 4mm at the bottom. The cover is fitted to the bowl with a strip of metal soldered to the rim and a section of this strip still survives (Fig. 1).

The foot is made in three parts: two are in the shape of truncated cones (Figs 1 and 5). Each of these cones are made from one piece and are closed at the top - no junction can be seen on the radiograph. The inner cone, made of plain sheet metal of around 1mm thickness, forms a liner inside the outer cone and is fixed to it with three rivets at the bottom. The outer cone is thicker, about 2mm at the top and 2–2.5mm on the sides. It is pierced and decorated with figures and animals worked in repoussé and further embellished with engraving. The outer, openwork, foot is tightly held by an arrow-headed rivet through a circular hole, 1mm deep, in the centre of the bowl. The head of the rivet is hidden by the liner of the foot but can be seen on the radiograph (Fig. 5). A metal strip forming a ring around the top of the foot hides the junction between the cup and the foot, which would be expected to have been secured with solder but none was visible.

The ovoid knop on the top of the cover is made of three main parts: the ovoid form is made of two domes of plain sheet copper, the upper one is inserted into the lower one (Figs 6 and 7). The upper dome is encased by a third dome of openwork, which was hammered and worked in repoussé and engraved to form figures. Four applied figures of angels are riveted around the knop: the heads are in high relief while the bodies are rather flatter. The figures could have been made by lost-wax casting or by hammering. The three domes are joined to each other and to the cup by a decorated rod. The upper end of this rod is acorn-shaped and surrounded with floral decoration in two independent parts, while the other end is riveted through a thick washer inside the conical part. The knop is attached to the top of the cover of the ciborium by three rivets.

The ciborium is decorated with 48 small applied heads arranged in three rows of eight on both bowl and cover (Fig. 1 and Antoine, this volume, Figs 1–4). They are of two sizes: the largest ones are fixed around the centre of the cup and cover and correspond to the stronger, individualized faces (Figs 8–9). The heads were made of thick metal, probably stamped. Different matrices were used to stamp the heads: three for the heads of the middle section of the bowl and two for the middle section of the cover (Figs 8–9). Within each group of matrices, the heads are not exactly identical because they required reworking with a graver or a scorper to remove the traces of the riveting after fixing (Fig. 4). The rivets are visible inside the cover and the bowl. Moreover, microscopic examination of the heads indicates that details in the hair, beards and eyes were often retouched or emphasized by engraving and chasing (Figs 8, 10). The champlevé work is engraved over the whole surface of the ciborium.
The glass compositions; the enamels
The ciborium is decorated with eight opaque enamel colours: dark blue, lapis blue, light blue, white, red, yellow, light green and turquoise. The enamels used for the bowl and cover are similar except for one colour; the clear blue used for the cloud decoration on the bowl is replaced by a turquoise on the cover (Figs 11–12). As is usual for Limoges work, all the enamels are a mixture of opaque and translucent glass powders with individual particles no greater than 0.5mm in diameter (Figs 11–12).

The ground is alternately enamelled: in the small lozenges with lapis blue, which is relatively opaque, in the large lozenges with dark blue, which is more translucent. Both blues were analyzed (Table 1). These opaque glasses are soda-lime-silicates from a mineral sodium source like natron, being low in magnesium and potassium oxides. They are both coloured by cobalt oxides (0.30 to 0.35 wt%) and opacified by the presence of small crystals of calcium antimonate dispersed in a vitreous matrix.

It has been already shown that Limoges enamels underwent a chronological evolution in glass composition. As expected, the two blue enamel compositions of the ciborium of Maitre Alpais are typical of the first period ranging from the 12th century up to the beginning of the 13th century.

The glass compositions; the cabochons
The ciborium was originally decorated with 62 cabochons, of which three are missing today. Fourteen were located on the knop in one row of four and one row of 10 cabochons, of which two are missing. There are 24 cabochons set on the bowl and 24 on the cover, which are arranged in three rows of eight, as with the small applied heads (one cabochon is missing). The majority of the cabochons are coloured and translucent, but eight smaller beads are made of opaque turquoise-coloured glass. All the cabochons are set in deep recesses (Figs 1, 4, 6).

Seventeen cabochons have been analyzed (Table 1), all of them are artificial gems made from translucent and coloured glasses and believed to be original. The same types of glass compositions were used for the enamels as for the cabochons. The cabochons are mainly made from sodium-lime-silicates using a mineral sodium. Only for two (one green and one yellow) the sodium source could have been a plant ash.

Table 1 (this page and next): Glass chemical composition of the translucent and coloured cabochons and opaque enamels of the Maitre Alpais ciborium cover, obtained by ion beam analyses at the C2RMF, expressed as weight % of oxides

<table>
<thead>
<tr>
<th>No.</th>
<th>Position</th>
<th>Shape of the cabochons</th>
<th>Colours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>cover</td>
<td>ovoid base round form</td>
<td>translucent amber yellow</td>
</tr>
<tr>
<td>2</td>
<td>cover</td>
<td>rectangular base round form</td>
<td>translucent amber yellow</td>
</tr>
<tr>
<td>3</td>
<td>knop</td>
<td>ovoid base round form</td>
<td>translucent amber yellow</td>
</tr>
<tr>
<td>4</td>
<td>knop</td>
<td>circular base round form</td>
<td>translucent amber yellow</td>
</tr>
<tr>
<td>5</td>
<td>cover</td>
<td>ovoid base round form</td>
<td>translucent yellow-green</td>
</tr>
<tr>
<td>6</td>
<td>cover</td>
<td>ovoid base round form</td>
<td>translucent yellow-green</td>
</tr>
<tr>
<td>7</td>
<td>cover</td>
<td>ovoid base round form</td>
<td>translucent amber orange</td>
</tr>
<tr>
<td>8</td>
<td>cover</td>
<td>ovoid base round form</td>
<td>translucent amber orange</td>
</tr>
<tr>
<td>9</td>
<td>cover</td>
<td>rectangular base cut form</td>
<td>translucent amber-brown</td>
</tr>
<tr>
<td>10</td>
<td>cover</td>
<td>ovoid base round form</td>
<td>translucent dark green</td>
</tr>
<tr>
<td>11</td>
<td>cover</td>
<td>circular base round form</td>
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<tr>
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<tr>
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<td>circular base round form</td>
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<td>rectangular base round form</td>
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<tr>
<td>19</td>
<td>enamel ground of cover</td>
<td>opaque lapis blue</td>
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<td>Average Values of the Different Points of Analysis</td>
<td>Sigma Values</td>
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<td>15.21 14.38 13.73 12.32 12.00 11.96 11.71 11.67 11.32 11.31 11.31 11.42 11.53</td>
<td>0.62 0.50 0.48 0.46 0.46 0.46 0.46 0.46 0.46 0.46 0.46 0.46 0.46</td>
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Table 1 cont.: Glass chemical composition of the translucent and coloured cabochons and opaque enamels of the Maître Alpais ciborium cover, obtained by ion beam analyses at the C2RMF, expressed as weight % of oxides.
(the magnesium and potassium oxides levels are higher, close to 2 wt %) – this glass composition is typical of the second period—from the beginning of the 13th to the 14th century. Two cabochons are potash-lime-silicates (one dark green and one red-brown). The potassium is derived from wood ash, with high levels of calcium, potassium, magnesium and phosphorus. The use of potassium glasses for the Limoges enamels was very exceptional. Limoges enamellers did not follow specific recipes to produce more brilliant glasses for their glass gems. They simply employed the available materials.

The translucent color most frequently used for the cabochons of the ciborium is green (14 dark green, 3 yellow-green, 2 pale green, 1 turquoise green), followed by red (6 brown-red, 5 red, 5 red-pink), amber (8 orange, 5 yellow) and blue (2). Only 8 opaque turquoise glass gems are employed to decorate the less visible part of the ciborium at the bottom of the lower cup (Fig. 1). Translucent glass gems appear to have been more valued than the opaque ones by Maître Alpais and were more commonly employed during the medieval period.

All the transparent colours have been analyzed (Table 1). The colorants used for the cabochons of the ciborium are common for all types of glass production during the medieval period: cobalt for the blue; copper for the green (coming here from bronze alloy and associated with tin, lead and manganese); manganese (with iron) for the red-brown; iron (with sulphur) for the ambers, yellows and green-yellows, and for only for one amber gem, iron and manganese.

The glass gems of the ciborium have mainly ovoid bases and round forms (30 of all colours). Others have circular bases and round forms (17 of all colours), or rectangular bases, cut or flat (8 of all colours) or ovoid bases with flat forms (4 red-brown). All the forms have been analyzed (Table 1). Evidently there is no relation between the shape (base, cut or not) and the colour of the cabochons, nor between the colour and the basic glass composition. But, there may be a relation between the shape and the location; gems cut like precious stones with rectangular forms appear to have been more valued by Maître Alpais as they all are located in prominent parts of the ciborium; the bottom of the cover and the upper part of the knob (Figs 1 and 6).

Notes
1 Taburet-Delahaye, 1995–96; Antoine, 2008.
2 Antoine, this volume, Figs 1–5.
4 Canella, 2006; Biron and Canella, 2002, 2005; Biron and Bagault, 2002.
5 Biron et al., 1995–96, 2001 and Biron chemical analysis at the C2RMF unpublished results.
6 Dandridge and Wypyski, 1992.
7 Freestone, 1993.
8 For more details of the experimental set-up, see Biron and Beauchoux, 2003; Calligaro et al., 1996.
9 Biron et al., 1995–96.
10 Antoine, this volume, Fig. 3.
11 Biron et al., 1995–96.
12 One matrix has a slim face with a beard and no hair (2 heads), another has a round face with beard and hair (4 heads), the third has a round face with hair and without a beard (2 heads).
13 Dandridge and Wypyski, 1992; Biron et al., 1995; Biron et al., 1998.
14 They are the accessible ones for the ion beam experimental set-up; the curvature of the ciborium does not allow to access to all areas for analysis.
15 Biron et al., 1995–96.
18 The turquoise coloured opaque beads were not accessible for the analysis, see Antoine, this volume.

Bibliography
Cannella, A.F. 2006. Gems, verre coloré, fausses pierres précieuses au Moyen Âge – le quatrième livre du Trésorier de Philosophie naturelle des pierres précieuses de Jean d’Outremeuze. (PhD manuscript) Bibliothèque de la faculté de Philosophie et Lettres de L’université de Liège, Belgium.
A Christofle Electrotype of the Medieval Maître Alpais Ciborium

Bet McLeod, Marian Campbell and Odile Nouvel

As might be expected, the Maître Alpais electrotype ciborium in the Victoria and Albert Museum (reg. no. REPRO 1888-450, Fig. 1), is at first glance, a close copy of the medieval Maître Alpais ciborium. This electrotype was purchased by the Department of Science and Art of the Museum in 1888 directly from MM Christofle et Cie for the sum of £10 [pounds sterling] 10 s [shillings].

As with all electrotypes of original objects, the principal mechanical differences are those of the method of fabrication and the materials used in the decoration. The most striking visual difference between the electrotype ciborium and the medieval Maître Alpais ciborium is the heads of the angels: the heads on the electrotype example are an integral part of the structure of the ciborium (Fig. 2), rather than being cast separately and applied, as on the medieval original. Another aesthetic difference is in the quality of the engraved detail; that on the electrotype is of a considerably lesser standard. While the glass cabochons on the medieval Maître Alpais ciborium are green, red, brown and blue in colour, those on the electrotype are limited to a palette of green, red and yellow.

In terms of dimensions, the medieval Maître Alpais ciborium stands 301mm high; the MM Christofle et Cie catalogue of 1888 (Fig. 3) states the height of the electrotype copy to be 304mm, but one electrotype example at the Victoria and Albert Museum (REPRO 1888-450) is 297mm high, and all other known examples vary slightly in their height. These differences in height may be explained by the losses in dimensions commonly caused when taking a plaster mould from an original, and subsequently taking a gutta-percha ‘secondary’ mould from that ‘master’ model.

The hemispherical cover contains an inner lining that, although it has not been examined technically, is believed to have been soldered in place. The hemispherical bowl also contains an inner lining, which X-radiography has confirmed as being soldered in place (Fig. 4). The foot is fitted with an inner sleeve and is attached to the bowl by a screw, visible on the underside (Fig. 5). Based on a physical examination of the two Maître Alpais electrotype ciboria in the collection of the Musée des Arts Décoratifs, Paris, it is assumed that the globular finial is attached to the cover by a screw. The inner linings of bowl, cover and foot appear to have been spun, as there is a central marker point and circular marks consistent with spinning.

Neither the inner lining of the bowl nor that of the cover of the electrotype are decorated with the engravings found on the medieval original; the inner lining of the bowl does not bear the famous inscription ‘magis[...]ter g alpais me fecit lemovicarum’, and the inner lining of the cover does not bear the medallion depicting the hand of God blessing. These omissions are common to all the Maître Alpais electrotype
The ciborium is of electroformed copper (see Rohrs et al. Appendix below), and the decoration is carried out in electrogilding, translucent and opaque glass and a coloured wax material. For ease and consistency of terminology, ‘beads’ shall denote the turquoise-coloured opaque glass decoration, ‘cabochons’ the rectangular- and oval-shaped translucent glass decoration, and ‘wax’ shall be used for the coloured opaque decoration. Although the reasoning behind the use of wax for the ground decoration rather than champlevé enamel is not recorded, it is thought that the wax material was used since it did not need to be fired: enamel would have required a firing temperature which would have damaged the electrogilded surface and the solder used to affix the inner linings. Although not tested, the inner linings of the bowl, cover and foot are probably of copper; spun copper linings were cheaper and easier to manufacture than making electrotype linings without any decoration.

**Description**

The globular finial to the cover rises from a tall conical foot decorated with a stylized floriate motif. It is decorated with, on the underside, cabochons within a decorated circular frame (one cabochon now missing), the central flat band decorated with hatching and inset with eight differently shaped and ciboria known to the authors. As there are no records surviving in the archives of the Musée du Louvre and MM Christofle et Cie, it cannot be determined why the engraved details on the interiors of the medieval original are not replicated on the electrotype examples, and one can only presume that moulds were not taken of the interiors of the medieval original, or if taken, were not used. There are many examples of electrotypes where the interiors of vessels or the backs of two dimensional objects are not reproduced: this may perhaps be due to the expense of reproducing areas that would not be visible, or perhaps to a technical issue.

Electroforming is the electrical equivalent of casting: an up-to-date commentary on the modern process of making replicas is also published in this volume. Although no records exist in the Christofle archives to describe the processes used in the 19th century, it is thought by their 21st-century colleagues that electrotypes were made by taking an initial mould in plaster from the object to be reproduced: the original object was probably prepared with a material such as an oil for ease of application and removal of the plaster mould. This initial plaster mould would have been used to cast a ‘master’ model, which would subsequently have been worked on by carvers and engravers to remove the areas designed to receive the wax (in imitation of enamel), the applied glass cabochons and beads, and to sharpen details of the surface decoration, such as the heads and script. A number of gutta-percha copies were then taken from the improved ‘master’ model, and it is these ‘secondary’ copies that were then placed in the plating vat to receive the copper deposition. It is thought that the openwork foot may have been produced by the ‘lost-wax’ method prior to being plated.

The resulting electrotype model would have been worked upon again, to solder the different elements together and to sharpen the details before being gilded to imitate the appearance of the original. The final procedure was the fitting of the applied decoration of glass and wax. As can be seen in the catalogue MM Christofle et Cie offered two different versions of the Maître Alpais electrotype ciborium (Fig. 3): one decorated only with wax, at a price of 265 francs, the other decorated with wax and with glass, at a price of 300 francs. This would suggest that there would have been another ‘master’ model that was only improved to the degree sufficient to receive the wax decoration. The authors are not aware of any examples of the Maître Alpais electrotype ciborium decorated only with wax.

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coloured cabochons (two large oval cabochons now missing), and above, with four openwork figures of angels in half relief within architectonic niches over a solid globe, crowned by a foliate cone.

The body of the cover is decorated in a lozenge pattern outlined by gilt bands, each band with lines at the edge, and decorated with a zigzag motif on either side of a rectangular panel inset with red wax. The bands are punctuated at the interstices with differently-shaped and -coloured glass cabochons. One oval cabochon on the lowest register is now missing. The lozenge pattern around the central body of the bowl is framed by a narrow triangular lozenge in the uppermost register immediately below the finial, and a wide triangular lozenge in the lowest register immediately above a rim engraved with cross hatching. Within the upper and lower lozenges are reserved and engraved half-length figures of angels with integral heads. Each of the lozenges in the middle register also contains a half-length figure of an apostle with an integral head. All these figures carry a book in the right hand, with the left hand raised.

The wax ground is of a single dark blue colour; the angel figures rise from a calyx of white, medium blue and red accents, the apostle figures rise from a calyx of yellow, green, white and red accents. The calyx in the uppermost register is not filled with coloured wax, but is thickly gilded. The single figure is framed with foliated rinceaux of yellow, green, medium blue and white. The reserved and gilded decoration comprises dots in the upper and lower register, stylized scrolling rinceaux in the lowest register, and in the middle register, a sophisticated design of scrolling and floriate rinceaux framing the figure, with a dot underneath the figure.

The foot
The foot consists of openwork foliage inhabited with alternating four mythical monsters and four relief figures in short tunics, the figures with integral heads. The figures do not have glass eyes. The inner lining to the foot bears the applied oval medallion of the Union Centrale Des Arts Décoratifs (UCAD) and the number 131 (Fig. 5).

Examples of the Alpais electrotype ciborium known to the authors
1 Victoria and Albert Museum, London: reg. no. REPRO 1888-450, UCAD medallion and no. 131; ht 297mm, acquired 1888.
2 Victoria and Albert Museum, London: reg. no. Circ. 1913-566, UCAD medallion and no. 965; ht 299mm, acquired 1913.

The Heritage of ‘Maître Alpais’ | 35
The acquisition of electrotypes by the South Kensington Museum in the 19th century

The brilliance and permanency of colour of enamel fascinated 19th-century commentators, drawn to what the great goldsmith and enameller Lucien Falize called their ‘couleur éclatante’.[3] In the 19th century the nascent Victoria and Albert Museum, then called the South Kensington Museum, played a leading role in raising the public awareness of artists, craftsmen, manufacturers and collectors to the artistic possibilities of enamelling.[4] From its very beginnings the museum collected enamels of all kinds and all dates. Its earliest acquisitions of ‘modern’ enamels date from the 1850s and 1860s. Amongst them were a chalice (reg. no. 1329-1852) of silver enamelled in champlevé, inspired by medieval examples, dating from 1851 and made by Francis Skidmore of Coventry; a cross (reg. no. 2648-1856) of copper and champlevé enamel, clearly modelled on medieval examples from Limoges, and made by the Paris firm of Dotin in 1855.[5] The small copper cross, dated 1867 (reg. no. 1325-1871), enamelled in cloisonné and signed by Tard, was made by MM Christofle et Cie, and shown at the international Paris exhibition of that year, before being acquired by the museum.

Under the direction of its head, Henry Cole, in 1874 the South Kensington Museum staged an ambitious exhibition on ‘Enamels of all dates and from all over the world’. The catalogue, with an introduction on enamels by J. Hungerford Pollen, lists 1168 pieces and includes items drawn from distinguished collections such as those of J. Beresford Hope and Sir Richard Wallace, as well as from those of the museum itself.[6] By this time the museum had already acquired important medieval European enamels, notably from the Soltikoff collection, as well as from the dealer John Webb. Medieval Limoges enamels in its collection included crosiers, book covers, gemellions and pyxes, one of the earliest acquisitions being a fine crosier with the Annunciation (reg. no. 2100-1855). In 1887 the energetic Henry Cole had initiated the important international agreement concerning reproductions, designed to further the appreciation and understanding of works of art, both by students, craftsmen and the public. This convention, signed by 14 European princes, had all the countries involved agree to exchange with each other reproductions of their works of art, in the form either of plaster casts or of electrotype copies.[7] By the later 19th century, electrotype copies of metalwork, especially goldsmiths’ work, made up a significant part of the museum’s growing collection of reproductions, and complemented the plaster casts and the photographs of original works of art. With the emphasis today so much upon the unique qualities of a work of art, it is easy to overlook the importance of copies in the relatively recent past as a way of spreading the knowledge of art. The 19th century was a time when few people travelled, except for the very wealthy, and much art was privately owned, shut away and inaccessible.[8]

The Maître Alpais medieval ciborium was an iconic enamel in the 19th century, not just because it was an intriguing cross-cultural work of medieval craftsmanship, but also because it was regarded as a model of excellence and one that could inspire contemporary craftsmen.[9] In 1887 MM Christofle et Cie made numerous electrotype copies of medieval enamels in France, including pieces in the Musée du Louvre, notably the Maître Alpais ciborium. Five of these examples from French collections were acquired by the South Kensington Museum in 1888.[10]

Historique de la reproduction du ciboire de Maître Alpais aux Musée des Arts Décoratifs

La reproduction galvanoplastique du ciboire de Maître Alpais a été acquise en mai 1887 par l’Union Centrale des Arts Décoratifs (UCAD),[11] en même temps que les reproductions de 51 autres œuvres, conservées majoritairement au Musée du Louvre, mais aussi à Château de Versailles ou dans des collections privées. Cet achat massif, affecté à la classe ‘Moulages’ des collections de l’UCAD, s’est inscrit dans le contexte de l’étroite collaboration nouée entre la manufacture Christofle et l’UCAD, grâce à la personnalité d’Henri Bouilhet qui était à la fois directeur de la manufacture Christofle et vice-président de l’UCAD dès 1873. Son active participation aux expositions consacrées aux Arts du Métal en 1880, du Bois, du Papier et du Textile en 1882, et de la Terre et du Verre en 1884, s’est intensifiée lorsqu’en 1887 le conseil d’administration décide d’organiser une quatrième exposition dite ‘récapitulative’. Cette exposition était conçue comme une vision de synthèse sur ‘tous les arts de l’ornement quelles que soient les matières [pour] prouver que si nos arts décoratifs étaient, comme quelques uns qui le craignent, menacés par des rivalités...
voisines, le génie de la France serait encore de taille, non seulement à se défendre, mais à triompher.18

L’angle d’attaque est alors explicitement nationaliste. Ce n’est pas un hasard si le premier fascicule du ‘Catalogue spécial des reproductions galvanoplastiques des objets d’art destinés au Musée des Arts décoratifs’, édité conjointement par l’UCAD et la manufacture Christofle paraît précisément en 1887. On y trouve la liste des œuvres reproduites: 31 œuvres du Musée du Louvre, dont le ciboire de Maître Alpais,19 les pièces du ‘Trésor de Hildesheim’ où Christofle est allé faire les moulages, les pièces du ‘Trésor de Bernay’ découvert en 1830 et conservé à la Bibliothèque Nationale, des œuvres conservées à Château de Versailles, d’autres provenant de collections privées ou appartenant à des lieux de cultes. A l’exception du ‘Trésor de Hildesheim’, toutes les œuvres proviennent de France. Cette liste d’œuvres est précédée d’un avant-propos qui permet de comprendre la complexité de la démarche. Il y est rappelé que ‘le but principal [de l’UCAD] est de vulgariser par tous les procédés de reproduction, les types anciens ou modernes pouvant servir à guider l’artiste et former le goût du public’.20 La sélection des œuvres a été confiée à ‘une commission spéciale, prise dans le sein du conseil d’administration’. L’avant-propos donne ensuite un large extrait d’une conférence donnée par Henri Bouilhet sur les avantages de la galvanoplastique qui peut donner toutes les sensations extérieures d’un original, fût-il en or, en argent en bronze, en fer ou en étain […] et réaliser, à moins de frais et avec une rare perfection, tout ce que les artistes du passé ont laissé de plus parfait et de plus précieux.21

Or dès mars 1885, le conseil d’administration de l’UCAD avait décidé de créer le Musée des Moulages et Reproductions qui est la partie la plus importante de notre œuvre d’Enseignement et de vulgarisation, celle qui doit rendre le plus de services à nos Industries d’Art, car nul d’entre nous n’a […] la prétention de refaire le Louvre ou Cluny.22

Un mois plus tard, en avril, la Commission des Reproductions avait été chargée de choisir dans les collections du Musée du Louvre des œuvres d’orfèvrerie susceptibles d’être reproduites par la galvanoplastie.23 Les membres de cette commission, dont le rapporteur était le célèbre orfèvre Lucien Falize ont alors décidé de passer commande à Christofle de deux types de galvanoplasties: les copies ‘simples’ en galvanoplastie dorée, ajustée ou patinée et les ‘fac-similé capables de produire une illusion complète’.24

Christofle ayant donné une réponse positive à la demande de l’UCAD, le projet avait fait l’objet dès 1885 d’un protocole et d’un contrat entre les deux partenaires: les frais de moulages des 43 pièces du Louvre seraient à la charge de l’UCAD, soit 688 frs. [francs], les modèles restant sa propriété. Ces ‘moulages-étalons’ serviraient à réaliser les épreuves des futures pièces du Musée des Arts Décoratifs. Le coût des copies simples s’élèverait à 3453 frs., celui des facsimile à 4395 frs. Enfin, il était prévu que l’UCAD percevrait ‘un droit de 16% sur le prix fort de toutes les épreuves vendues à un tiers, escomptant ainsi un revenu important de ces ventes’. Le conseil d’administration concluait ainsi: ‘Nous insistons pour que vous désigniez dès à présent une commission chargée de déterminer les types et le mode de poinçonnage et le contrôle prévus par le contrat’.25

L’UCAD se portait garante de la qualité irréprochable des pièces reproduites par Christofle, tant sur le plan des choix scientifiques, que sur leur exécution.

Lorsque le projet de ‘l’Exposition récapitulative’ de 1887 prend forme, le président de l’UCAD, Antonin Proust rappelle le point de vue qu’il a toujours défendu sur une politique de reproductions galvanoplastiques:

[…]. Le musée national des Arts décoratifs doit être formé, toutes les fois que cela est possible, d’objets reproduits. […] il vaut mieux posséder la reproduction d’une œuvre irréprochable que l’on peut rééditer et répandre sans crainte, que de se rendre acquéreur d’une œuvre parfois incomplète, souvent complétée, et qui est pour ces motifs peu recommandable. Si l’on voulait, au reste, composer le musée national des Arts décoratifs d’objets originaux, donnant une expression exacte de toutes les manifestations de l’art, on y perdrait son temps, sa peine et son argent. […] En créant le musée national des Arts décoratifs, l’Union centrale veut avant tout contribuer à l’enseignement de l’art à tous ses degrés et dans toutes ses applications et y contribuer non seulement par l’exposition des chefs d’œuvre, mais encore par la facilité de s’en procurer des exemplaires.26

En mai 1887, toujours en prévision de l’‘Exposition récapitulative’, les 51 reproductions exécutées par Christofle, dont le ciboire de Maître Alpais, sont acquises par l’UCAD. En juillet 1887, le conseil d’administration de l’UCAD fait le point sur les préparatifs:

La Commission de l’Exposition ayant décidé de donner une grande place dans cette exposition aux reproductions d’objets d’art par la galvanoplastie et le moulage, diverses demandes ont été faites auprès des Musées étrangers pour les inciter à nous prêter à cette occasion leurs collections de reproductions. C’est ainsi que MM. Christofle et Cie ont obtenu l’adhésion en principe de MM. Elkington de Londres et M. de Ganay celle du Musée de Vienne à la condition que la Société prendrait dans les galvanos [sic] envoyés à cette Exposition un nombre de pièces à son choix, correspondant à une valeur marchande de 7000 frs pour M. Elkington et de 2000 frs pour Vienne.27

Enfin après la fermeture de ‘l’Exposition récapitulative’, il est décidé de ‘faire un choix parmi les reproductions par la galvanoplastie, le moulage ou la photographie des pièces figurant à l’exposition et qui pourraient être conservées pour le Musée’.28

Si cette politique de reproduction, toute nouvelle à Paris, s’inspire directement de celle déjà initiée au South Kensington Museum de Londres, mais aussi à Vienne, Berlin, Munich et Nuremberg, l’UCAD tient à marquer sa différence en exigeant ‘que les pièces qu’elle mettrait dans ses collections fussent les plus parfaites et les plus sincères, et que la confusion entre l’original et la copie fut, sinon possible, du moins si près d’exister, qu’il faudrait un œil exercé pour en découvrir la différence’.29

**Acknowledgments**

The authors are grateful to Mme Anne Gros at the Musée Bouilhet-Christofle, M. Jean-Claude Bourbon of Orfeverie Christofle, Mme Nathalie Dupuis at the Musée des Arts Décoratifs, Paul Williamson, Eric Turner, Angus Patterson and Louise Hofman at the Victoria and Albert Museum.
Appendix

Scientific investigations into an electrotype copy of the Maître Alpais ciborium

Stefan Röhrs, Sophy Wills, Marei Hacke

In the 19th century, electrotypes of significant examples of medieval and later works of art were produced in order to make the originals known to a wider public. These electroformed copies resembled the originals in shape, design and colour, but were produced with different techniques and usually different materials. To better understand how these copies were made, an electrotype reproduction of the medieval Maître Alpais ciborium, produced by MM Christofle et Cie and in the collections of the Victoria and Albert Museum (REPRO. 1888-450), was chosen for technical investigation and analysis by X-radiography, X-ray fluorescence (XRF) and Fourier transform infrared spectroscopy (FTIR).

A close look at the original and its electroformed copy quickly revealed significant differences: in the electrotype version, the metal areas of patterns and figures are slightly raised compared to the ‘enamel’ surface, as seen in the foliate decoration (Fig. 6a), whereas in the original Maître Alpais ciborium and medieval Limoges champlevé work in general the metal areas are flush with the enamel surface, and chased designs for details such as robes or halos (Fig. 6b). The only relief metal features in the Maître Alpais ciborium are the collets which hold the cabochons and the applied heads of the figures.

This observation leads to the immediate conclusion that the surface of the electrotype is not an accurate copy of the original surface. Electroforming enables detailed surface structures of an original to be replicated. Differences in detail such as those noted above suggest that the mould used to make this electrotype was not taken directly from the original but from a ‘master’, i.e. a copy at one remove, of the Maître Alpais medieval ciborium. This ‘master’ model would be a representation of the ciborium without the cabochons and enamels, so that the electrotypes which were subsequently made from it incorporated finished, but void, metal shapes into which the applied decorations could be set.

X-radiography revealed that the bowl of the ciborium is made from four metal parts held together by a screw: the decorated outer bowl, its inner lining, the foot and its inner sleeve (Figs 4, 5, 7). The screw holds the inner sleeve of the foot and the inner lining of the bowl together and thereby fixes all four parts together. Additionally, the inner lining and the bowl are soldered together at the upper rim. The radiograph shows the solder running diagonally and irregularly from the rim into the void between the inner and the outer bowl. The join between the lining and the outer cup is not visible to the naked eye, as it appears to be hidden by the gilding layer. The inner sleeve of the foot joins the foot tightly at the base.

The outer metal bowl was electroformed. The applied heads, which on the Maître Alpais ciborium are attached to the bowl by metal posts protruding from their back surface, are made as one with the bowl during the electroforming process. The radiograph does not show a contrast in the material between the areas of pattern and the figures’ bodies or heads, confirming that the heads are of the same thickness as the rest of the bowl and are, therefore, not applied later. All parts of the ciborium were gilded: in some areas the gilding has been deliberately worn off (Fig. 6a). Fire gilding, or mercury gilding, which was the medieval gilding technique, was not used in this example, as no mercury was found by XRF. Electrogilding would have been used instead for the electrotypes. In some areas the gilding is visible behind the beads and cabochons indicating that the gilding was applied before the glass stones were set. Both beads and cabochons were set into the surface with a collet holding them in place.

Figures 6a and 6b Detailed views of the Maître Alpais electrotype ciborium (left) and the original Maître Alpais ciborium (right (6a © Victoria and Albert Museum, 6b © Musée du Louvre)

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XRF analysis demonstrated the absence of elements typically found in copper alloys, such as lead, tin or zinc. Only copper was detectable through the gilding. The electrotype, therefore, is probably made from pure copper and not from an alloy.

Analysis of the cabochons and the beads by XRF showed that different glass materials were used on the object. The turquoise-coloured beads are high in lead and contain arsenic and copper to render them opaque turquoise. The cabochons are of various compositions: high lead glass was found for those coloured green and red, while soda-lime-silicate glass was used for the yellow cabochons. The green contained chromium, but no colourant was identified for the red, suggesting that possibly a gold- or copper-ruby glass was used, with a very low content of the colouring element(s). The high iron content of the yellow glass may be responsible for its colour. By comparison to the original Maître Alpais ciborium, fewer and different colours were chosen for the glass cabochons.

Wax was used on the electrotype to imitate the medieval champlevé enamelling of the original ciborium. Areas of white, blue and red wax were analyzed by FTIR. An ester-containing wax, possibly beeswax, was identified as the main component. The blue infill appeared to contain the pigment ultramarine as well as calcium carbonate and fatty acid salts with zinc and lead cations. The white infill may be pigmented by a carbonate-based pigment. XRF analysis of the red areas confirmed the presence of mercury. This suggests that vermillion was used.

Acknowledgements

Thanks are due to Paul Robins (Victoria and Albert Museum) for the radiograph and to Antony Simpson (the British Museum) for the illustration of its interpretation.

Notes

1 Neilson, this volume.
2 Our thanks to our colleague Jean-Claude Bourbon for this and the following suggestions relating to the manufacture of electrotypes by MM Christofle et Cie in the 19th century.
3 Grateful thanks are due to our colleagues Jean-Claude Bourbon and Anne Gros.
4 The second Maître Alpais electrotype ciborium in the Victoria and Albert Museum (reg. no. Circ. 1913-566) was purchased by the Circulation Department, again directly from the manufacturer, in 1913, for 300 francs. The Circulation Department’s remit was to acquire and assemble works of art that could be sent to regional museums and art schools in a series of travelling exhibitions, for the public and students in the regions to see works of art at first hand, without the need to travel to London. The Department purchased or commissioned many electrotypes for this purpose. All information regarding the purchase by the Victoria and Albert Museum of electrotypes from MM Christofle et Cie is taken from the Registered Papers of the Museum, held in the V&A archives.
7 Wainwright, 2002, p. 25–44, fig. 3.
9 London, 1875.
11 Gibbs Smith, 1981, p. 75, fig. 78.
12 Campbell, 1998.
15 Darcel, 1854, p. 5–11.
20 Catalogue galvanoplastiques, 1887, p. III.
21 Catalogue galvanoplastiques, 1887, p. V.
22 Archives de l’UCAD, Bibliothèque des Arts décoratifs, Conseil d’Administration, 14 mars 1885, p. 5.
23 Ibid., 29 avril 1885, p. 30.
24 Ibid., 29 avril 1885, p. 30.
25 Ibid., 29 avril 1885, p. 33.
26 Anonymous, 1887, p. 354.
27 Archives de l’UCAD, Bibliothèque des Arts décoratifs, Conseil d’Administration 8 juillet 1887, p. 244.
28 Ibid., 19 octobre 1887, p. 254.
29 Catalogue galvanoplastiques 1887, p. VI.
30 McLeod et al., this volume.
32 Biron et al., this volume.
33 Neilson, this volume.
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35 Oddy, La Niece and Stratford, 1986.

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The Heritage of ‘Maître Alpais’

Electroforming
The Replication of Ancient Objects by Electrodeposition

Mike Neilson

The British Museum has made electrotypes and casts of objects from its collection for over a century. These replicas have included the treasures of Mildenhall, Thetford and Sutton Hoo. These copies were not made to deceive, but for educational purposes and to provide display material for the museums located in the area of a major archaeological find.

At its simplest, electroforming is a technique of making a copy of an object by taking an impression of its surface with a mould-making material. Metal is deposited onto the mould by an electrical current passing through a solution of metal ions. The resulting metal shell replicates all the surface details of decoration, the tool marks and even defects seen on the original. Electroforming is an extension of the standard electroplating process which is used to deposit much thinner layers of one metal onto another.

The method was developed in the mid-1830s, and during the Victorian era the process was applied to produce types for the newspaper industry of the day, hence the term ‘electrotype’ is sometimes used in preference to ‘electroform’ to describe the products. The method soon began to be used to produce copies of coins, small artefacts and even large statuary, to meet demand from museums and art schools for exhibition, display and as reference models in the study of art, architecture and design.

Initially there were few flexible and lightweight materials available for the moulds; amongst the materials commonly used were casting plaster, latex, gutta-percha and thermosetting plastics. Complex forms with undercuts created major difficulties for moulding with such materials and skilfully made plaster piece-moulds and natural rubber were used to overcome these problems. However, the reuse of such moulds quickly resulted in their deterioration and subsequent loss of detail. The manufacture of room temperature vulcanizing (RTV) silicone rubber by the electrical industries superseded the traditional mould-making products and modern techniques and materials have broadened the scope for electroforming, now making it an efficient manufacturing process for industry as well as a method for making replicas of historic artefacts.

As a rule of thumb, the greater the complexity of an object’s form, the greater the number of mould pieces it will need to copy it. Objects of low relief, such as coins, medals and inscriptions, rarely require more than a two-piece mould, whereas life-size statuary and three-dimensional objects such as a ciborium require multiple part moulds.

Moulding museum objects
Historic artefacts are often fragile and the moulding process can potentially cause damage or remove traces of original materials, for example pigments or food residues. The condition of the object to be copied must be assessed and the surface thoroughly checked for any such remains before it can be considered suitable for moulding. Seldom can objects be moulded without some form of protective coating. The application of oily lubricants are to be avoided, but today the reversible application of a lacquer or plastic film is effective in preventing damage by chemical staining from the mould-making materials.

Making an electroform of a bowl
The following illustrations describe a method which can be used today for making a copper electroform of a Roman silver bowl with a foot-ring (Fig. 1).

Figure 1 Side and plan view of original silver bowl with low-relief design

The mould has to be made in three parts to allow the bowl to be released: 1) upper surface, 2) underside of bowl/outside of foot, and 3) inside of foot (Fig. 2). Modelling material is used to serve as partitions to divide the mould into these three parts.

Figure 2 A sectional view, showing the three part silicone rubber mould enveloping the object. The outer layer is the rigid supporting shell.
RTV liquid silicone rubber is applied by brush in layers directly onto the protected surface of the first part of the object to be moulded and its dividing walls until a thickness of several millimetres has been achieved. Following the completion of the mould part, fibreglass matting and liquid polyester resin is stippled over the back of it, which when cured makes a rigid and waterproof carapace to support the flexible silicone rubber. The modelling material divisions are removed and the exposed silicone is sealed to prevent it bonding with the silicone used during the making of the next mould part. The process of division is repeated as necessary until the object is enveloped in mould parts.

The three parts of the piece-mould are disassembled to remove the bowl. The face of each part is coated with a fine metallic powder, making it conductive, and brought into contact with an electrical connection that is threaded through the mould.

The parts of the mould are immersed in a tank of liquid electrolyte of copper sulphate solution and dilute sulphuric acid, and connected to an electrical circuit (Fig. 3). Copper is deposited onto the conducting face of the mould. The arrows indicate the direction in which the copper ions migrate from the pure copper bar (anode), through the electrolyte and onto the surface of the mould (cathode) when a low direct current (DC) is applied. Once a sufficient thickness of copper has been deposited, the mould is removed from the tank, the support cases are removed and the silicone rubber is peeled from the copper shells. The electroformed shells are rinsed, dried and the excess metal around their edges trimmed off and the backs are filed and sanded to make accurate joins between each connecting shell (Fig. 4).

Electroforms are mere shells of the original object, usually formed in sections, in a metal that bears little resemblance in colour or weight to that of the original artefact. Electroformed parts are sometimes ‘backed-up’ with soft solder to strengthen and thicken the copper shells. Epoxy resin filled with a heavy metal powder can also be used to strengthen the shells, while also offering the comparable sensation of weight to that of the original. Soldered seam lines are removed by filing, sanding and polishing.

Electro-plating and also the use of dry pigment powders suspended in a shellac/methylated spirit (IMS) medium have been traditionally but not exclusively used to colour-match the replica to the surface of the original artefact. Inlay such as enamel on the ciborium, which is polished flush with the surface of the artefact, is usually only faintly picked up by a mould. A method of overcoming this problem is to cast a resin or plaster model in moulds taken of the original and on this master model cut the fields for the materials imitating enamel and for settings for the cabochons and beads. The moulds for the electroforming process would then be taken from this master, not from the original object. MM Christofle would have made a model of the Maître Alpais ciborium before taking further moulds of gutta percha from that master model to make the copies.

The processes used in the 21st century differs in some specific details from those used by MM Christofle to make the copies of the Maître Alpais ciborium, in particular the materials used for moulding, but the general principles have not changed. As a technique, electroforming is a complex process but it still remains the most accurate method of reproducing historical artefacts.

Acknowledgement
Thanks are due to Antony Simpson for creating digital images from the author’s drawings.

Notes
1 Spiro, 1968; Canning, 1944.
3 A rectifier supplies an electrical current to move the copper ions from the anode to the cathode via the electrolyte. This is done by reducing the current supply of 240 volts of alternating current (AC) to a direct current (DC) of a potential between 10–150 amps.
4 McLeod et al., this volume.

Bibliography
The Royal Scottish Museum was created soon after the 1851 Great Exhibition to perform for Scotland the combined functions of the Victoria and Albert Museum, the Science Museum, the former Geological Museum and the Museum of Natural History in South Kensington. Thomas Archer, its second director, worked closely with Sir Henry Cole gleaning valuable advice about acquisitions, important foreign exhibitions and much else. By 1966, when the ciborium was acquired, the situation had not greatly changed and today the institution still exchanges opinions and information with its London colleagues. In 1985 it was merged with the former National Museum of Antiquities of Scotland. Both are now part of National Museums Scotland, in Chambers Street, Edinburgh.

The acquisition
The four Limoges enamels already in the Royal Scottish Museum were bought from antiquarian collectors, dealers or at auction between 1870 and 1893. Examples came from the Castellani, Bateman, Jean van Hal and Soltikoff Collections. It was to enhance this group that the ciborium was purchased in 1966 by the then keeper of art, Cyril Aldred. His art historical advisor was John Forrest Hayward at the Victoria and Albert Museum, curator in the Departments of Metalwork and subsequently Furniture and Woodwork, who was introduced to the ciborium by the London antique dealer Ronald A. Lee (Fig 1). Elizabeth Goring, the curator of the NMS Egyptian collections, wrote in the festschrift which was published just after Aldred’s death in 1991:

Figure 1 The Royal Scottish Museum ciborium, NMS A1966.452, copper alloy, gilding and enamel, purchased as 13th century; ht 140mm, diam. 148mm (rim), 160mm (max.)(© National Museums Scotland)
I have had cause to be grateful to him on an almost daily basis; for his many years in the museum left a precious and lasting legacy. He added enormously to the range and quality of the collections, he recorded and documented the objects with meticulous care and consummate expertise and he devised an Egyptian Gallery which has given pleasure and enlightenment to thousands of children and adults.7

John Hayward was at the Victoria and Albert Museum from 1951 until 1966. Furniture History published a bibliography of his books and articles in 1984, running to 13 pages of small print.1 In addition to his writing on furniture, there are sections on arms and armour, books and bookbinding, ceramics, horology, jewellery, metalwork and ‘miscellaneous’. His only contributions to the study of medieval orfèvrerie, both in the Connoisseur, were ‘Art treasures from the Meuse Valley exhibited in Paris, April 1952’ and ‘A newly discovered Limoges Ciborium’. The latter was, of course, the ciborium under scrutiny.

Ronald Lee was the leading horological dealer in Britain and a major authority on the subject. He was also enormously knowledgeable about furniture, porcelain and works of art in general. To trade and museum contacts, he was famous for his unerring instincts and his ‘eye’.

With the guidance of these three experts, the Royal Scottish Museum made probably its most costly purchase by that date. It must have been the subject of much careful consideration, but in 1960s Edinburgh, none of the curators in the Royal Scottish Museum would have had much experience or specialist expertise which would have helped to evaluate an item of late 12th century French metalwork. The Director took a gentlemanly interest in silver on which he published a large popular book primarily of use to the non-academic private collector.1 All curators covered wide fields, which represented extensive sections of the collections. The ciborium was a suitable size to complement the pieces in the existing collection, but a different type and shape of vessel. No evidence had been uncovered of original provenance or pre-19th century ownership for any of those enamels, which is still not unusual for medieval artefacts. The tenuous association with the Maître Alpais ciborium gave the Royal Scottish Museum’s new acquisition a status otherwise lacking in the four pieces of Limoges it already owned.

The foot and the bowl (Fig. 2) were acquired by Lee at separate Sotheby’s sales in 1962 and 1965: to his delight Lee had noticed that they fitted together.4 Like Hayward, he assumed that this proved they originally came from the same vessel. In Hayward’s brief Connoisseur article, he argues that as medieval orfèvres could not solder copper surfaces together, the separation of these two parts of the ciborium could be ‘readily understood’. In fact, this is not strictly true. For example, solder was used to attach the tails to eucharistic doves,5 and it can also be clearly seen on an X-radiograph of the St Michael crozier exhibited in Paris, April 1952 and ‘A newly discovered Limoges Ciborium’. The latter was, of course, the ciborium under scrutiny.

Although R.B.K. Stevenson, Director of the National Museum of Antiquities of Scotland, was to some extent a medievalist, his specialist interest was in coins and earlier archaeological finds.6 He did not publish any of the four Limoges enamels already in their collection by 1966.6 The two museums were only about 1.5km apart, but there seems to have been very little academic interaction. So Aldred, a Londoner himself, assumed he was getting the best expert advice available and perhaps stealing a march on his less adventurous colleagues in Scotland. In addition he had every right to feel confident about his judgement. He mingled with the leading scholars in his own field and had disappointed the Metropolitan Museum in New York by turning down an invitation to join their permanent staff. He was also a skilled silversmith, whose hand-wrought reproductions of the vulture pectoral of Tutankhamen and other ancient jewellery are normally displayed in the Royal museum’s primary gallery. Nor was he a narrow Egyptologist. His original academic training was in European art history at the Courtauld Institute where, in 1937, he was one of the earliest graduates. In 1968 he proudly chose his expensive new acquisition to feature in a double spread in a popular guide book giving it a much larger colour illustration than any of the other items.7

The ciborium
A catalogue is at present being prepared of all the medieval enamels in Scottish collections, to be published by the Society of Antiquaries of Scotland.8 Consequently, for this volume, and

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also as a result of investigations into the British Museum ciborium, the National Museums Scotland object was carefully re-examined in 2008. It obviously does not compare stylistically with more distinguished examples of the genre.

The National Museums Scotland ciborium is a sketchy version of the lower half of the Maître Alpais ciborium, the enamels in particular very roughly executed. At the top there is a vertical band below a plain round moulded rim. On the band is a partially erased ‘Kufic’ inscription. Below the rim, the bowl curves outward and then slopes inwards to a slightly concave moulding holding the foot. The bowl is decorated with champlevé enamels forming a diagonal lattice of eight large diamond shaped panels, a frieze of triangles above and another of smaller quadrangular shapes below. Each diamond contains a half-length figure reserved in gilt with a halo. Their gestures vary – book in hand, right hand held forwards; book held upwards to left shoulder in both hands; book held in front of chest in both hands; open book in left hand, right hand raised and draped; figure turned slightly to left, book closed (?) in left hand; right hand raised, palm outwards; both hands out of sight below. Flanking each figure are curling tendrils with large trilobite leaves; below are schematized clouds in green and dark blue above a red triangle. Each triangle at the top of the lattice contains a bust of an angel with upward spreading wings, in some cases cross hatched. In the quadrangles below, the haloed heads and shoulders of angels have long curving wings, which criss-cross above them. There are a few engraved lines on the wings. All these figures have applied heads in fairly high relief. These heads, which are not identical, are in contrast to the flat enamel and gilt decoration of the rest of the panels. They are badly rubbed and squashed with thick, jaw-length hair; at least two are bearded, one also bald on top. Neck bands and draperies, also varied, are indicated by a few sketchy lines. The trellis which separates the figures is a concave channel slightly sunk into the bulge of the bowl. It is plain gilt, with a line border and a short rectangle of green or blue half way along each strip. The intersections are marked by oval fictive cabochon gems, possibly glass, in shallow moulded settings. The interior of the bowl is lined with a plain sheet of copper, gilding remaining in the centre with five irregularly spaced holes near the upper edge, which originally coincided with holes in the rim of the bowl itself but are now displaced.

The foot of the Edinburgh ciborium is much more competent than the bowl. There is now little, if any, evidence visible of chasing or engraving to refine the details. Although the design is clearly based on that of the Maître Alpais ciborium, it is simplified and lacks the fine details of the costumes, faces, feathered wings and leaves. The foot is girt, with a plain truncated cone above, which fits into the bottom of the cup. It has a reeded rim below a cast openwork frieze of three running men alternating with winged monsters amongst scrolling foliage. Its general appearance is much crisper and more competent than that of the bowl. The men wear short draped tunics and have bobbed hairstyles. One reaches out to grasp the tendrils at the sides of his body, one the foliage by his ears and one to catch the monster to his left with both hands. All are moving from left to right, their legs sometimes over, sometimes under the plant forms. They are similar, but carefully differentiated. The beasts have small reptilian heads, long necks and wings which spread either upwards or downwards behind them, or in one case one downwards behind and one upwards in front. All have the same stance, with the furthermost leg and claw foot raised horizontally. The differentiated heads look forward, droop over the top of the foliage or look sideways at the viewer. The foliage consists mainly of plain stems forming circular scrolls around the figures, terminating in curling leaves and fruits, above and below and three small plain round bosses at the lower rim.

Shortly after its purchase, the unsightly rivets which were visible on the rim of the bowl were removed by the museum conservation department. Presumably, this is when the holes in the lining became misaligned with those in the rim of the bowl but no detailed record of the work could be found in National Museums Scotland archives.

A disquieting feature is the strangely inadequate rendering of the pseudo-Kufic inscription. The letter forms are indistinct dotted lines apparently worked before the gilding was applied, so their poor definition cannot be attributed to wear. The contrast with the crisp motifs of the Maître Alpais ciborium inscription is very notable. Even the surviving electrotypes are rather more precise. The definition of the figures on the bowl is very blurred and the heads in relief almost featureless, although this may be due to the apparent wear which has also partly removed their gilding. The treatment of the three dimensional heads on the Edinburgh bowl appears to be different from the Maître Alpais ciborium where they are made separately and riveted to the body of the vessel. In the 1905 catalogue of the exhibition L’Œuvre de Limoges that technique is described in detail and said to be the method of attachment for ‘la plupart des têtes appliquées’ on medieval Limoges enamel objects. However, the heads on the Edinburgh bowl appear to be made in one with the bowl. Even if the techniques employed could represent a very provincial medieval workshop, the materials of the ciborium, recently analyzed at National Museums Scotland and the British Museum, are more consistent with a date in the 19th century or later. However, in 1966, basing their judgement on stylistic grounds alone, those involved with the purchase could understandably have believed the ciborium was a simplified version of the design on the Maître Alpais ciborium rather crudely carried out, but even so, medieval as argued by Hayward.

Soon after the larger acquisition of the ciborium, Cyril Aldred also bought a small openwork panel from Ronald Lee, which is strikingly similar in style and technique to the ciborium foot (Fig 3). As part of their research for this volume.

**Figure 2** The bowl of the Royal Scottish Museum ciborium as sold at Sotheby’s, London, April 1965, lot 57 (© Sotheby’s)
National Museums Scotland, Department of Conservation and Analytical Research also tested that. Their results were very similar to those for the ciborium. It might have aroused suspicions that a supply of such material had been produced by a modern workshop, but the charitable view is perhaps that both curators and dealers can be dangerously optimistic. The gilt bronze ciborium measures 97 by 42mm and has a plain flat frame with central line of small punched circles. There is a hole pierced in each corner for a nail, stud or other means of attachment. Within the frame is an openwork design consisting of two winged monsters in fairly high relief, stalking from right to left, among flatter scrolling foliage. They both have two legs with clawed feet, scaly bird like bodies with long necks and small heads, turning backwards. The left head is indecipherable, that to the right is dog like, with drooping ears. There is a general resemblance between the monsters on the foot of the Edinburgh ciborium and the two on the panel, but the latter is rather coarser, heavier in execution and more three dimensional. Some of the gilding is missing from the top of the right hand corner and the bodies of the monsters. The reverse of the piercing of both items has a sharp and slightly mechanical appearance, which would be rather unexpected if they were genuinely medieval.

Conclusions
Medieval enamels have been avidly collected since the 18th century particularly in France itself, but also in England, where at least seven examples are recorded in private collections between 1747 and 1795. Naturally, this led to acknowledged reproductions such as electrotype being made and also copies intended to deceive. The guiding principle for both collectors and museum curators in the mid-20th century was frequently ‘taste’ or ‘connoisseurship’. Tellingly, Aldred is lauded as ‘an outstanding connoisseur’ in his festschrift was frequently ‘taste’ or ‘connoisseurship’. Tellingly, Aldred is both collectors and museum curators in the mid-20th century fellow curator in the Museum of Fine Arts in Boston. Hayward died prematurely in 1983, but by 1981 was considered a sufficient authority on dubious medieval antiquities to be commissioned to catalogue the personal collection of Louis Marcy (1869–c. 1932) in Reggio Emilia, who famously sold fake enamels made in his studios to the British Museum, the Victoria and Albert Museum and numerous other antique dealers. By 1965, surely he was already aware that fake Limoges enamels existed in some quantity.

In the early 1960s, the scholarly literature on medieval champlevé Limoges enamels was mostly still in the 19th century antiquarian tradition, although the Maître Alpais ciborium itself had been published at least 40 times since 1841, in almost every case with an illustration. The most recent account of it had appeared in Marie-Madeleine Gauthier’s first book. Gauthier revived the study of medieval enamels and took an approach of which an obituarist wrote ‘never previously had the study of Limoges enamels moved so radically from its local and antiquarian roots and taken wing on the European stage’. She went on to found the Corpus des Émaux méridionaux in Paris and by 1983 a preliminary handbook had been compiled by a team of young research assistants under her guidance. Unfortunately, it did not include the Royal Scottish Museum collection. In due course, these studies developed under the influence of Élisabeth Taburet-Delahaye and Danielle Gaborit-Chopin at the Louvre and were taken up by art historians and curators across Europe and in the U.S.A., culminating in the definitive exhibition shown in New York and Paris in 1995.

In our present climate of knowledge, therefore, it is nowadays a temptation to dismiss our forebears of four or five decades ago as lazy or ignorant.

In Britain there have been influential changes in museum organization since 1966, which have had a considerable effect on the procedures for major acquisitions. Among national museums, most now have trustees whose approval must be sought for significant expenditure and who normally require the curators concerned to present a well researched and cogently argued case for any important purchase. Another motivation for change was the new role given to the National Art Collections Fund, founded in 1903, and the National Heritage Memorial Fund set up in its present form by the 1980 National Heritage Act. Again a properly researched written application was now required. The National Heritage Memorial Fund in particular demanded evidence of the historic importance of the object in question, of its provenance, its quality of workmanship and design, plus comparable recent prices for similar objects, if obtainable. There was always stiff competition for the money, so personal taste and a discerning eye were no longer enough.

We should, however, resist the temptations of an enjoyable moment of schadenfreude brought on by the sorry tale of the great, the grand and the Edinburgh ciborium. In spite of the advances in scientific and historical research made since its purchase, like the ‘experts’ of 1966 there are probably remaining pitfalls awaiting the present generation too. As their successors discover new techniques of analysis and art history progresses with added discoveries supported by easily obtained images, routine travel, huge scholarly exhibitions and streams of publications, even the most penetrating of early 21st century art historians and scientists will probably be revealed as having made their own, if different, mistakes.

Acknowledgements
Many insights into curatorial practices were provided by the following members of RSM Art Department, who served under Cyril Aldred; Pat Atkins, Dale Idiens, Kay Moodie, Revel Oddy and Priscilla Ramsey, all of whom the author would like to thank very sincerely. She herself enjoyed much hospitality from Mr and Mrs Aldred, when on the junior staff of the department from 1961–65. The author would also like to thank Christopher Mason, European Sculpture and Art, Sotheby’s, for his help.

Notes
1 Swinney, 2006, p. 130–3.
2 Goring, Reeves and Ruffle, 1997, p. 3.
3 Trueblood, 1984, p. 62–76.
5 Finlay, 1956, passim.
6 No references to these acquisitions could be found in the Ronald A. Lee archive, now deposited at West Dean College. Jon Privett generously investigated this material for the present paper.
7 Taburet-Delahaye and Boehm, 1995, p. 53.
9 Hayward, 1965, p. 240.
11 Goring, Reeves and Ruffle, 1997, p. 3.
16 Glenn forthcoming.
17 Troalen et al., this volume, Fig. 8a.
18 Biron et al., 1995, p. 53
19 Troalen et al., this volume.
26 Gauthier, 1950, passim.
28 Gauthier, 1983.
29 Taburet-Delahaye and Boehm, 1995.

Bibliography
Trueblood, N. 1984. A bibliography of the printed works of the late John Forrest Hayward, m.a., D.LITT. (Oxon.) F.S.A. Furniture History 20, 62–76.
This paper discusses technological aspects of the construction of the National Museums Scotland ciborium (A.1966.452) to compare it particularly with the Maître Alpais ciborium, the ciborium in the British Museum and with known techniques of Limoges enamelling.1 It does not deal with the art historical description of the piece, or a full description of the circumstances of its acquisition.2

The ciborium was registered as ‘probably from Magister Alpais’ but over the years some doubts about its authenticity have been expressed. The metal composition was analyzed in the late 1960s but no technological study has previously been undertaken. Our aim was to establish through the use of scientific analytical techniques whether it is medieval or modern. Unlike the Maître Alpais ciborium, it lacks an inner lining to the foot and has an inner skin to the bowl. Although the shape and form of the designs are similar, the detail is less sharp on the National Museums Scotland ciborium. Also the enamels and inset gems, while in similar positions, are differently coloured. The full scientific study of the enamels and gems is described in the appendix to this paper.3

Analytical methods
The ciborium was examined at National Museums Scotland using a stereo-microscope (Olympus SZX12 x 7-90) coupled with an optical camera (Olympus DP70) and its construction was investigated by radiography using a 300kV Pantak X-ray set. It was also taken to the British Museum for comparison with the British Museum ciborium and two electroformed ciboria belonging to the Victoria and Albert Museum. The elemental composition of the copper alloys and gilding areas (see Table 1) were analyzed using an Oxford Instruments ED 2000SW air-path X-ray fluorescence (XRF), with rhodium target X-ray tube collimated to an area of about 2mm x 1.5mm, coupled to Si(Li) detector using the Oxford XpertEase software.

Two small metal samples, cut from the rim and the foot of the ciborium, were mounted in resin in cross-section. They were polished and etched with alcoholic ferric chloride and examined at magnifications of up to x500 with an inverted stage metallographic microscope (Zeiss Axiovert 100) to investigate their microstructures.

Technical description
The National Museums Scotland ciborium is composed of a double-skinned bowl and associated openwork foot made of copper alloy. Its surface is gilt and enamelled, with opaque and translucent glass imitating cabochon stones in red, turquoise, yellow and orange. The enamel is blue, dark blue, green, yellow and red.4 The bowl is heavy whereas the foot by comparison is very light, the majority of the weight is clearly in the outer skin of the bowl. The decoration of the bowl is not finely finished, with a lack of detail to the figures (Fig. 1), the gilding is uneven, appearing rather unnaturally worn, and several of the cabochons are broken. There are no visible joins around the relief heads or evidence of a method of attachment. The inner skin is a plain, nearly hemispherical bowl rising to just beneath the rim of the outer bowl.

XRF analysis revealed similar alloy compositions for the different parts of the object: it is copper containing 1.6 to 2.1 wt% of zinc, 0.1 to 0.5 wt% of lead and 0.9 to 1.4 wt% tin and no detectable impurities of silver, iron or arsenic (Table 1). These results compare well with those obtained by atomic absorption analysis in 1968 before the foot and the bowl were reunited at the Royal Scottish Museum.5 XRF analysis of the enamels and cabochons revealed high levels of lead as well as the presence of chromium and uranium as colorants. These elements were confirmed by further XRF analysis at the British Museum.6

The ciborium is gilded. The gilding appears very thick on the outer skin of the bowl, obscuring the already weak details on the relief heads and decoration of the metal surface. It is particularly thick on the rim. XRF analysis of the surface showed the presence of gold, mercury and traces of silver, confirming the use of fire gilding on the outer bowl and the foot (Table 1). The inner bowl also has some gilding, which under magnification is thin and has a spotted appearance, similar to electrolytic gilding. XRF investigation of the inner bowl identified the metal as copper, with little or no zinc, and the presence of gold. No mercury was found, confirming that it is most likely to have been gilded by the electrolytic method. The inner bowl has been heavily marked by many linear scratches running in various directions. These lines are not consistent with manufacture, but seem likely to be an attempt to add artificial wear to age the surface. The gilding is worn away entirely round the upper edge (Fig. 2).

Figure 1 Detail of the National Museums Scotland ciborium showing some of the ‘inscription’ around the rim, blue enamel, gems and relief heads (© National Museums Scotland)
Troalen, La Niece, Lees and Tate

Table 1: Metal compositions in wt\% by atomic absorption analysis and X-ray fluorescence analysis

<table>
<thead>
<tr>
<th>Atomic Absorption and Colorimetric Analysis (1968)</th>
<th>Cu</th>
<th>Sn</th>
<th>Zn</th>
<th>Pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab. ref. 083/68 R.S.M. ciborium 1966.452</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample 88 Gem setting near top rim</td>
<td>97.0</td>
<td>0.7</td>
<td>2.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Sample 89 Base of foot</td>
<td>97.0</td>
<td>0.8</td>
<td>2.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Sample 90 Inside and top of foot</td>
<td>97.0</td>
<td>0.9</td>
<td>1.9</td>
<td>0.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X-Ray Fluorescence Analysis Cu Alloy 2008 Method</th>
<th>Cu</th>
<th>Sn</th>
<th>Zn</th>
<th>Pb</th>
<th>Fe</th>
<th>Ni</th>
<th>As</th>
<th>Ag</th>
<th>Sb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper alloy Ciborium A.1966.452</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rim (Cu exposed) detection limit = &lt;0.1%</td>
<td>96.8</td>
<td>0.9</td>
<td>2.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.2</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Head of figure detection limit = &lt;0.1%</td>
<td>96.2</td>
<td>1.0</td>
<td>2.1</td>
<td>0.5</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.7</td>
<td>0.1</td>
<td>0.1</td>
<td>0.4</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Foot (Cu exposed) detection limit = &lt;0.1%</td>
<td>96.5</td>
<td>1.4</td>
<td>1.6</td>
<td>0.3</td>
<td>0.1</td>
<td>0.0</td>
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<tr>
<td>Standard deviation</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.7</td>
<td>0.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

| X-Ray Fluorescence Analysis Qualitative Method   |     |     |     |     |     |     |     |     |     |
| Copper Gilding                                   |     |     |     |     |     |     |     |     |     |
| Inner bowl                                       |     |     |     |     |     |     |     |     |     |
| Rim                                              | Cu  | Au, Hg, traces Ag |
| Bowl                                             | Cu  | Au, Hg, traces Ag |
| Foot                                             | Cu  | Au, Hg, traces Ag |
| Inside rivet holes                               | Cu, Zn, Ti, Ca |
| Brown Patina                                     |     | As, Fe, traces Ca, Mn, Cr |

<table>
<thead>
<tr>
<th>X-Ray Fluorescence Analysis Cu Alloy 2008 Method</th>
<th>Cu</th>
<th>Sn</th>
<th>Zn</th>
<th>Pb</th>
<th>Fe</th>
<th>Ni</th>
<th>As</th>
<th>Ag</th>
<th>Sb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper alloy NMS standard GM8B detection limit = &lt;0.1% Average</td>
<td>81.9</td>
<td>3.8</td>
<td>7.2</td>
<td>6.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.0</td>
<td>0.2</td>
<td>0.0</td>
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<tr>
<td>Theoretical value</td>
<td>82.1</td>
<td>3.5</td>
<td>7.9</td>
<td>5.7</td>
<td>0.3</td>
<td>0.3</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.1</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

X-radiography of the ciborium exposed its unusual construction (Fig. 3). The hemispherical inner bowl is shown to be clearly separate from the outer bowl, only joining beneath the rim. No solder can be convincingly identified either at the joint between the foot and the bowl, or between the outer bowl and inner bowl. There is no evidence of rivets attaching the relief heads to the bowl, confirming the optical microscopy observation that they are all of a piece with the outer bowl. There are several cracks, which are seen in the radiographic images, most noticeably a large crack to the base of the outer bowl where the foot is joined, which could have occurred during the manufacture of the bowl or possibly at the time of reattaching the foot to the bowl. Another feature that is clear in the X-radiographs is the random distribution of numerous round spots of low density (appearing dark in the image) which are interpreted as air bubbles in the metal, that is, casting porosity. These bubbles occur even in the rim of the bowl where there is no enamel, confirming that they are in the metal rather than in the enamel. Since the bubbles are not distorted or flattened it is apparent there has been no subsequent working of the metal and the slightly pitted surface of the inside of the rim, where it is not covered by the inner bowl, shows that there was no serious attempt to smooth the metal surface.

The black circular features shown in the radiograph beneath the rim correspond to the series of five holes which are located at uneven intervals around the edge of the rim of the outer and the inner bowl. These holes are clearly visible without radiography but, for some reason, the two parts of the bowl are no longer positioned so that the holes in the inner and outer bowl line up.
As noted above, the construction of the outer bowl is crude in comparison with known Limoges ciboria. Evidence of this can be seen when the radiographs are compared with radiographs of the ciborium in the British Museum. The low variation of density between the enamel and the copper observed on the radiograph of the National Museums Scotland piece (Fig. 4a) clearly differs from the sharp contrast seen in the true Limoges object (Fig. 4b). Comparison of the radiographs also shows that the British Museum ciborium has no porosity (bubbles) in the metal structure.
The interpretation of the bubbles as casting porosity was confirmed by the examination of a small sample from the rim of the outer bowl, mounted in resin and polished (Fig. 5). A second metal sample taken from within the openwork of the foot was similarly prepared and etched. This sample also showed a cast structure with some recrystallization at the surface, indicative of very limited hot work (Fig. 6).

The inside surface of the openwork of the foot has a rough appearance and the figures on the foot have slightly indented inner surfaces. Examination shows areas where there has been some post-casting work to the metal (Fig. 7), possibly giving rise to the evidence of hot work seen in the metallographic section. The rough inner surface of the foot is covered with an artificial thick brown ‘patina’ containing arsenic, iron and traces of calcium, manganese and chromium (Table 1), which obscures the details of manufacture.

As noted previously, no evidence of solder joins can be found anywhere on the bowl, either in the X-radiograph or from visual examination, nor is there an indication of any mechanical means of securing the bowl to the foot. It was usual for Limousin metalworkers to use mechanical joins to assemble separate elements, but on the National Museums Scotland ciborium the foot appears only to be gripped by being forced into a collar at the base of the bowl; there is no rivet like those found on both the British Museum ciborium and the Maître Alpais ciborium. Similarly, it is normal for relief figures on Limoges artefacts to be attached with rivets. This technique can be found on the Maître Alpais ciborium, where the heads which were made separately have been riveted onto the bowl. On the National Museums Scotland ciborium the relief heads appear to have been cast as one with the bowl, and no rivets or filled rivet holes can be seen microscopically or in the X-radiographs. On the British Museum ciborium there are no relief heads.

The National Museums Scotland ciborium does however have rivet holes around the rim. These holes certainly once contained rivets, as can be observed on a picture of the object taken in 1968 (Fig. 8a). The rivets were then believed not to be original and were subsequently removed by the museum, the remaining holes filled in with Epophen and covered with ‘gold looking’ leaf (Fig. 8b). XRF analysis of this area confirmed the presence of modern brass paint with titanium and calcium used as the filler (Table 1). This probably explains why the gilding in this area is particularly thick.

Discussion

The collective evidence shows that the outer bowl of the National Museums Scotland ciborium is different from the British Museum and the Maître Alpais ciboria. It was made by casting, its metal composition is different, as are the methods of assembly of its parts.

Limousin enamellers formed the copper substrate by hammering and incising, rather than by casting, and with a few exceptions, enamelling was executed on copper between 2mm and 5mm thick. Though many Limoges enamels are plaques or composed of flat parts, the few vessels examined, such as the British Museum ciborium bowl are also thought to have been formed by hammering and incising. The National Museums Scotland ciborium does not follow this model; to have made the entire bowl and its relief ornament by casting is quite different to the accepted tradition of Limoges workshop practice.

A casting requires the existence of a model: the visual appearance of the National Museums Scotland ciborium – apart from the colours of the cabochons, is extremely close to the Victoria and Albert museum’s electrotype on which the details are also less sharp than the Maître Alpais ciborium. However, they do not share the same dimensions and at present we are unable to conclude where the model or models came from.

The analysis of both the bowl and foot of the National Museums Scotland ciborium showed an amount of zinc in the range of 1.6 to 2.1 wt % in the copper, which is unusual compared to published data from analysis of Limoges enamels. None of the eight enamelled objects from the
collection of the Metropolitan Museum, New York, analyzed by energy dispersive X-ray spectrometry contained detectable zinc in the metal. All were nearly pure copper with trace impurities of iron, lead, nickel and arsenic being detected. The metal of 24 enamelled and gilded 12th-century Romanesque pieces from the British Museum have been analyzed by XRF. Although only a pair of plaques, a cross, a cover to a bowl and the ciborium which is the subject of this volume are attributed to Limoges, the rest are Mosan or from workshops in England, Spain or northern Germany. Nevertheless, the metal of all of these enamels is copper, with zinc only detectable as a trace impurity of 0.06% or less, though contemporary pieces with no enamelling were found to contain several percent of zinc in the metal. From the published analyses it is clear that the later medieval craftsman deliberately chose copper free from zinc to enamel.

Interestingly, the zinc content of the National Museums Scotland ciborium was already questioned in the late 1960s in correspondence between M.R. Taylor, Assistant Keeper at the British Museum and Mrs Atkins, Assistant Keeper at the Royal Scottish Museum. Commenting on the results of the analysis of the British Museum ciborium and an English ciborium cover (reg. no. BM 1850,0722.1) dating to the 12th century, undertaken in 1968 by Harold Barker at the British Museum Research laboratory, Taylor wrote:

These three samples [two from the British Museum ciborium and one from the cover] show small variations in their percentages of copper, lead and silver. But none showed any traces of tin and zinc as yours [NMS] did, and ours were all found to contain silver. Unfortunately at that time there had been little published analysis of Limoges objects for them to compare further. We can now see the zinc content as indeed being atypical for Limoges objects.

Analysis by Röhrs has shown that both the enamelling and the cabochons contain around 40% of lead, assumed to be from the use of lead arsenate as an opacifier. Such compositions are characteristic of 19th century and later work, and have been found for instance in some 20th-century forgeries. They do not correspond to the composition of medieval or Limoges enamels, nor do the findings of chromium (in some of the blues) and uranium (orange/yellow) as colorants for the enamels. Furthermore the mounting of the cabochons is not in a bezel setting as one would expect on Limoges work. The glass is fired onto the surface rather than being set like stones decorating other champlevé works. The only technological feature which the National Museums Scotland ciborium has in common with Limoges work is that it is gilded by the mercury amalgam method.

Where did the object come from? As noted at the start of this paper we do not consider the full art historical background. However we note that the catalogues of prestigious enamel collections dating to the late 19th century make no references to anything which might be this ciborium. It would be unusual to carry out mercury gilding after the mid-19th century but the first reference to the existence of this ciborium which we are aware of is in the catalogue of Lee dated 1965. If the object was made shortly before that date then the need for conservation in 1967 would suggest that it, or the two component parts, had indeed been deliberately ‘aged’.

Conclusion
This study has drawn together a number of separate aspects of the construction and composition of the National Museums Scotland ciborium which are characteristically different from those of both the British Museum and the Maître Alpais ciboria as well as other Limoges enamels. The object is cast; there are no rivets to assemble the elements; the metal composition is different; and the method of enamelling and composition of the enamel are atypical. Some colorants found in the glass cabochons were not used before the 19th century, and the inner bowl probably has electrolytic gilding, though this inner bowl can perhaps be discounted from the discussion as it may have been added to hide some feature of the inside of the bowl or its join to the foot.

Individually it is possible to imagine situations whereby some of these technical differences might reflect workshop practices or overzealous 19th century restoration. However, from all this cumulative evidence it is hard to believe it is 12th century French workmanship.

We cannot unfortunately provide information on the place of fabrication of the object (England or the continent?), the person who manufactured it, or whether it was intended as a
copy or a deliberate forgery. We know that at the time the ciborium was acquired by National Museums Scotland, some objects by the forger Louis Marcy had already been brought to light, but the ciborium bears little resemblance to the Marcy objects exhibited today at the Victoria and Albert Museum and the British Museum.  

The recent investigation has greatly added to our understanding of the methods of manufacture involved and has ultimately led to the re-assessment of its date from medieval to modern, most likely early 20th century. At the time when the object was acquired by National Museums Scotland there was less comparative material, and very limited access to scientific investigation that would have helped in revealing its authenticity. While we cannot draw conclusions about the identity of the craftsman who made the object, it remains an undoubtedly impressive – if modern – object.

Acknowledgments
The authors would like to thank colleagues at National Museums Scotland, particularly Godfrey Evans and Virginia Glenn. Also Neil McClean for undertaking the object’s photography; Thierry Borel for sharing the X-radiographs of the Maître Alpais ciborium; and Bet McLeod, Stefan Röhrs and Maickel van Bellegem, for fruitful discussion. Finally we would like to thank the reviewer for helpful comments.

Notes
1 See relevant papers in this volume.
2 Glenn, this volume.
3 Röhrs, appendix.
4 Röhrs, appendix.
5 National Museums Scotland Lab Ref. 083/68.
The analysis of vitreous materials of the National Museums Scotland ciborium was carried out to investigate the authenticity of this object. It was hoped that the results would allow to establish a production period for the enamels, beads and cabochons.

The glass compositions used for enamelling in the 19th century differ from those used in the medieval period. It had been shown that 19th century enamels are high in lead content as they are not made from soda-lime-silica glass, so they are easily distinguishable by composition from the original medieval material. Another indicator of 19th-century work are elements such as uranium and chromium: these were not known as colorants for glass before the 19th century. Hence the deliberate use of these colorants indicates recent manufacture and excludes medieval production.

Analytical methods

The National Museums Scotland ciborium was studied by micro X-ray fluorescence analysis (XRF). This method is somewhat less accurate than the PIXE method especially for the light elements sodium and magnesium. These elements are of importance to identify soda-lime-silica glass and therefore it might be difficult to distinguish between mineral soda and halophytic plant ash glass from XRF results. However, the results are sufficient to distinguish soda-lime-silica glass from lead glass.

Table 2: Results of the XRF measurements of the enamel and cabochons

<table>
<thead>
<tr>
<th></th>
<th>Enamel</th>
<th>Cabochons</th>
<th>LOD</th>
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<tbody>
<tr>
<td></td>
<td>green</td>
<td>light blue</td>
<td>red</td>
</tr>
<tr>
<td>Na2O</td>
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<tr>
<td>MgO</td>
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<td>nd</td>
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<td>NiO</td>
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<td>CuO</td>
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<td>UO2</td>
<td>nd</td>
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For quantitative calculation the PyMCA code was used. This code uses a fundamental parameter calculation and the Corning glass standards were used to verify the results. The accuracy of the analysis was between 2 and 12 % rel. for main and minor elements. No normalization of the values to 100 wt% was used. The estimated limits of detection (LOD) for each element are given in Table 2.

Results and discussion

From the vitreous decoration of the National Museums Scotland ciborium some representative areas were chosen for analysis. The dark blue and green enamel and orange, turquoise and red cabochons were analyzed by X-ray fluorescence. Their compositions were different from those of the British Museum ciborium and different from other medieval pieces. In Table 2 the results are summarized. The lead oxide content of the glass used for the enamels and cabochons is high, with over 40 wt%. The potassium oxide contents are over 6 wt%. The sodium content was not estimated as this method does not allow detection of minor sodium contents, but from the results it is obvious that the glass used for the cabochons and the enamels is not a soda-lime-silica glass. Two types of glass have been used: one glass with around 40 wt% PbO, 30 wt% SiO2, 6 wt% K2O and 2-7 % CaO for opaque green, opaque light blue and opaque turquoise glass; the second type is a very high lead containing glass, with around 70 wt% PbO for the translucent red and orange glass. The latter glass has low calcium (0.2 wt%) and silicon (15 wt%) contents.
Arsenic was found in the opaque colours (green, light blue and turquoise). Therefore, it can be assumed that lead arsenate was used to opacify the glass. The colours of the opaque glass are due to copper (turquoise), cobalt (blue) and chromium (green). For the transparent enamels uranium was identified as a colourant in the orange glass but no colourant was identified in the red glass. Possibly the red is due to the ruby colour of metallic copper or of gold in very low quantities.

The high lead and arsenic content of the glass and the addition of uranium and chromium as colourants are indicative for the production period. Biron, Dandridge and Wypyski (1996) found high lead contents in post medieval enamels. Comparative studies on painted enamels have shown that lead arsenate was used not earlier that 1750. The elements chromium and uranium were both discovered at the end of the 18th century and were used to colour glass and glazes from about the early 19th century. These observations lead to the conclusion that the enamel work and the cabochons of the National Museums Scotland ciborium are of a post-1800 date.

Apart from the composition, another difference from medieval Limoges work can be observed: the cabochons are not set in the same way as for original Limoges work where cabochons are set like gemstones in a collar. The cabochons on the National Museums Scotland ciborium seem to be fused to the surface like the enamel. In Figure 9 a red rim is visible at the border of the turquoise cabochon. This red rim is probably formed by copper oxide which was formed by copper from the support and migrated into the glass of the cabochon while it was soft. This phenomenon can be observed sometimes on white lead-rich enamels fused on copper. Biron, Dandridge and Wypyski reported that enamel can show this type of discoloration from contact with the substrate.

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Notes
26 Biron et al., 1996; van Bellegem, Röhrs and McLeod, 2008.
27 Ion beam techniques as PIXE and PIGE were used in Biron et al., 1996 and Röhrs, this volume, but were not available for the analysis of the National Museums Scotland ciborium.
28 Solé et al., 2007.
29 Röhrs, this volume.
30 Biron et al., 1996, p. 448–9.
32 Biron et al., 1996, p. 51.

Bibliography
London 1855. Catalogue of the Celebrated Collection of Works of Art from the Byzantine Period to that of Louis Seize (Christie and Manson), W. Clowes and Sons.
London 1875. Catalogue of the Special Loan Exhibition of Enamels on Metal, held at the South Kensington Museum in 1874, London.
The Limoges ciborium, now in the collections of the Musée du Louvre, Paris, bearing the inscription MAGI[SEL]ER M: ALPAI: ME FECIT: LEMOVICARUM engraved in the centre of the bowl, is rightly acclaimed as an artistic masterpiece. Although it is well known that Limoges, in west-central France, was a major artistic centre in the Middle Ages and a large number of champlevé enamels of varying quality have been attributed to it, little is known of individual workshops or artisans and there are few surviving examples of enamel work that are inscribed with the Limoges provenance. A search for a better understanding of the characteristics of genuine Limoges work has driven much recent research into the style and the materials of Limoges craftsmen, and was a key theme of the study culminating in this publication.

The two ciboria which are the main focus of this study are the Maître Alpais ciborium, with its cover, and a seemingly related ciborium, missing its cover, in the collections of the British Museum. A ciborium with stylistic similarities to the two above, acquired in 1966 by the National Museums Scotland was also studied, as well an electrotype copy of the Maître Alpais ciborium, purchased in 1888 by the Victoria and Albert Museum. These copies belong to their large collection of reproductions of fine works of art which were intended to inspire and educate designers for industry and improve the standard of public taste. The contributions to this publication are presented by curators, scientists and conservators, together working to address different aspects of all four ciboria.

The Maître Alpais vessel is generally recognized as dating to c. 1200, at the artistic peak of Limoges production. Unlike the ciborium at the British Museum, it has been the subject of a number of publications over the years. Two papers are presented here on the Maître Alpais ciborium: one proposes that Islamic architectural influences can be seen in the ornate form of the vessel and its cover, and discusses possible identities of the figures depicted. The second paper is a scientific study of the techniques and materials used in its decoration, in particular the enamels and the glass gems.

The British Museum ciborium is much less well known and although they share many characteristics of form and decoration it is not easy to assess its relationship to the Maître Alpais vessel. The dearth of publications relating to the British Museum ciborium may in large part be attributed to its secondary status in comparison to the Maître Alpais example, the lack of a published image until 1924, the obvious later additions and alterations, and very considerable wear. One of the most important outcomes of this publication is that this ciborium is fully described for the first time, and its significance assessed. The scientific study of the piece, particularly of the enamel beads and cabochons, has firmly restored it to its place in the medieval repertoire, and the comprehensive conservation programme now allows it to be seen in something closer to its former glory.

These studies have resulted in advances in our understanding of the materials and techniques used by the craftsmen in the medieval period which have been invaluable in allowing the assessment of the ciborium of the National Museums Scotland, which also bears a resemblance to the Maître Alpais ciborium. The known history of this piece cannot be traced back further than the year before its acquisition. The programme of studies led to this piece being subjected to a detailed scientific examination which found that both its materials and manufacturing techniques are inconsistent with those of medieval enamelled metalwork. The electrotype ciborium, unsurprisingly, also differ from the medieval originals in their materials, as well as in their manufacturing technique: the coloured ground decoration is not enamel but is an organic material that imitates champlevé work but does not require high temperatures for its application.

The Maître Alpais ciborium is in excellent condition apart from wear to the gilding inside the bowl, suggesting it was frequently used but kept safely over the centuries. The British Museum ciborium, on the other hand, has had a long history of use, damage, loss of original components and even reuse, suspended by added brass loops. It may even have been discarded and buried for a short time. In spite of this there are obvious visual similarities between the British Museum ciborium and the Maître Alpais vessel, though the latter is a little larger. Both have a separately-made openwork foot and a band of pseudo-Kufic script with similar components around the rim of the bowl. The chemical compositions of the enamels and the glass cabochons of both fit comfortably within the now large database of Limoges enamels and glass, though the decorative repertoire of the British Museum ciborium is arguably less assured. Although it is a little smaller and has engraved angels’ heads, rather than applied relief heads, it would seem to have been modelled from knowledge of the Maître Alpais ciborium. The chemical composition of the enamels indicate that the British Museum ciborium should be dated before about 1235, the end of the intermediate period for medieval glass production. Stylistic considerations further refine this to suggest a date of c. 1210–25 for its production:

This volume encompasses diverse themes. The cross-cultural influences of Islam and Christianity in the medieval period are evidenced in the ciboria, by their form, the decorative use of inlaid turquoise-coloured opaque glass beads and the pseudo-Kufic script. The complex issues of connoisseurship and museum acquisitions in the 20th century...
formed an essential part of the researches. The materials and
techniques of medieval craftsmen and of those who would
imitate their work are arguably the key to much of our
understanding of these ciboria. As a result of the research we
now know much more about the characteristics of genuine
Limoges work, particularly the style, techniques and materials
of the Limoges craftsmen. The task is by no means complete
and this study has raised many new questions, but there is no
doubt that the collaboration between curators, scientists and
conservators has proven especially fruitful in describing the
heritage of ‘Maître Alpais’.

Notes
1 See bibliographies in Antoine, this volume; Biron et al., this
volume.
2 Antoine, this volume.
3 Biron et al., this volume.
4 McLeod, this volume.
5 Röhrs, this volume.
6 Van Bellegem and La Niece, this volume.
7 Glenn, this volume.
8 Troalen et al., and Röhrs (Appendix), this volume.
9 McLeod et al., this volume; Neilson, this volume.
10 Röhrs et al. Appendix to McLeod et al., this volume.
11 Antoine, this volume; McLeod, this volume; Röhrs, this volume;
Porter, this volume.

Figure 1 Enlarged detail of the worn, openwork gilt-copper foot of the British Museum ciborium. The relief head was made separately and the eyes inlaid.