In Closer Detail : The 1456 Henry VI Lincoln Charter Seal

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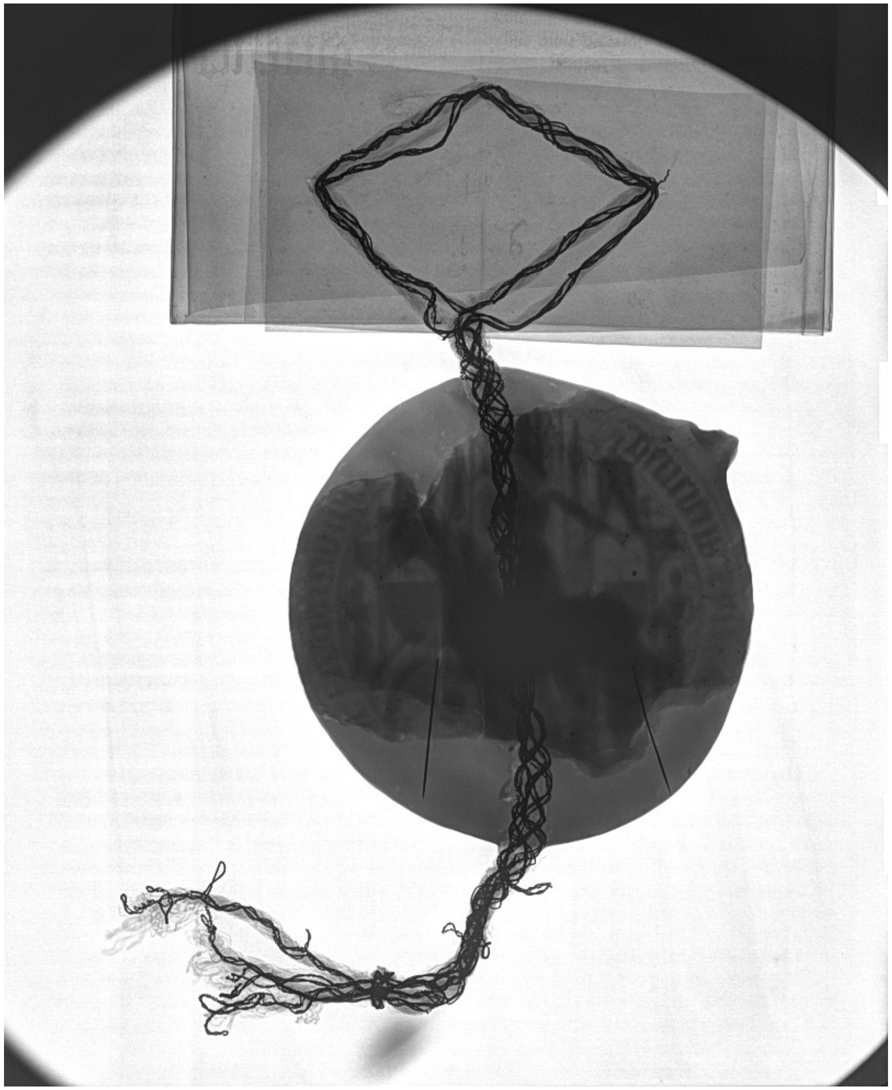

Fig.1 – Beirne & Liao (2020) *Henry VI Charter, 1456 : x-radiograph 20 seconds at 15kvp* [digital x-radiograph image] personal collection.

The Charters of Lincoln are a series of public documents spanning several centuries during the Middle ages, each issued by the monarch of the day to confer certain rights and privileges upon the citizens of the city.

The historical importance of the text of the Charters of Lincoln has long been recognized. In 1911 de Gray Birch noted that they are collectively invaluable for documenting the evolution of the rules and regulations that defined the morals and manners of English society in the Middle Ages, (p.viii). The 1456 Charter of Henry VI is significant among the charters collection as it granted the city the ability to purchase land from the Crown for the first time. While at this time, in 1911 the preservation of the charters 'very words' was celebrated, (p102), the physical material of the charter is also important for the insight it can give us of the age in which they were created, and the subsequent generations since that have cared for them. A more in-depth examination of the Great Seal attached to the charter, and the cord used to secure it reveal some interesting details to add to our understanding of the document.

Figure 2 – Antao, Beirne, Liao & Reeves (2020) *Henry VI Lincoln Charter, 1456 : detail of seal face* [digital image] personal collection

The Great Seal

As we know today, a seal attached to a document signals one’s authorisation of the contents. At the time of the Charters drafting it also functioned as evidence of the authenticity of the document as well as rendering its written terms indisputable, (Burns, 1998, p180). The seal attached to the charter by braided cords or ‘laces’ hanging down from the lower edge is one of the Great Seals of England, the symbol of the office of the Chancellor of the Exchequer and when attached to a document represents the approval of the Sovereign of the day. The Great Seal has been and still continues to be used by every sovereign of England since the time of Edward the Confessor in 1042, with most sovereigns commissioning a new design to mark their reign, (Wyon, 1887, p2). The impression of the Great Seal as such wields great power and authority and as a result has always had two sides, a feature which makes it more difficult to tamper with and imitate, but also necessitates the need for it to hang from documents so that both sides can be inspected, (Burns, p.181). The seal attached to the Charter here is that of Henry VI. He, his father, Henry V, and grandfather, Henry IV, were notable for having more than one Great Seal, as well as reusing the seal designs of their predecessors with only minute changes, (Wyon, 1887, p47 / Maxwell-Lyte 1926 p313). The main distinguishing feature of this particular seal of Henry VI’s, a small quatrefoil within the decorative border beneath the horse on the reverse side was unfortunately within the area that has been subsequently damaged and lost (see Fig.3 and Fig.4). Based upon the diameter of the seal and the order of the remaining text of the legend, however, the seal on this charter can still be distinguished as the Silver Seal of Henry VI, (Wyon, plate XIII).

Fig. 3 – (2010/2020) Distinguishing Quatrefoil *of Henry VI seal : Seal on the Royal Letters Patent of Henry VI, 1442* [digital photo of seal in College archive], Kings College Cambridge

Fig. 4 – Antao et al. (2020) *Henry VI Lincoln Charter, 1456 : detail of seal reverse* [digital image] personal collection

Why is it green?

The use of green wax for a Great Seal, as with the use of laces to attach it to the document discussed further below, had an administrative significance. It was used by the Royal Chancery primarily for more important documents in the Middle Ages particularly those of a perpetual nature such as a charter, compared to documents that were of temporary value, such as letters patent or letter close that would only be valid within a fixed timeline, (Maxwell-Lyte p302 / Fowler 1925 p106/ Dalton 1992 p26).

Verdigris, a copper acetate pigment, is noted as the most likely pigment used to create green medieval wax in a recent study in 2019, though the author was unable to find physical evidence of the pigment in cross-sections and wax dispersions of a number of medieval seal samples, (Whatley, p47). An XRF analysis of this charters seal wax as well as the toffee coloured repaired sections revealed a high level of copper and silicon present which supports this conclusion, (see Table.1), while an x-radiograph shows denser speckled spots within the original wax which are likely to be undissolved particles of verdigris pigments, (see Fig.5). The presence of copper in the XRF analysis of the toffee repairs while initially confusing can be explained when the location is viewed in the x-radiograph; a projection of the original wax crosses into the tested area beneath the surface, (see Fig.5 and Table.2)

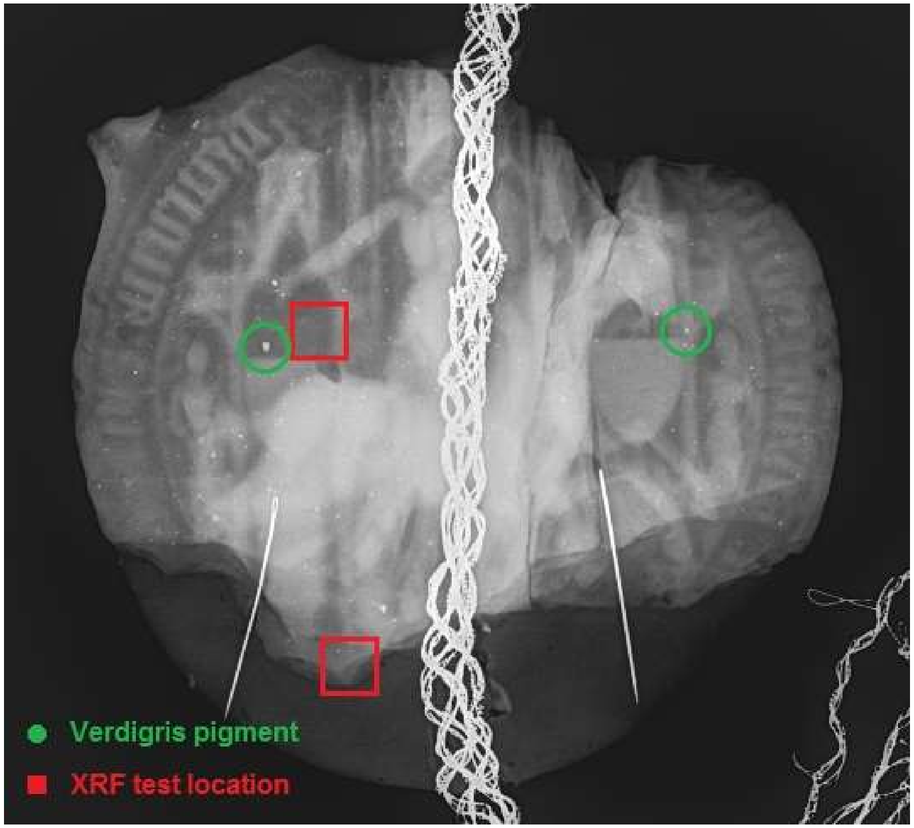

Fig. 5 – Beirne (2020) *Henry VI Lincoln Charter, 1456 : X-radiograph 30 seconds at 15kvp with highlighted details* [altered digital x-radiograph image] personal collection.

Operator: User	No.: 417	Date: 11/03/2020	Time: 16:17:00

Name: Henry VI
ID: 18/001
Field1: L Charter
Field2: seal
Duration: 30.0 s
Application: Alloys 2
Method: LE Al4015
Alloys: C630-Al Brz (0.0)
C623-Al Brz (0.0)
C642-Si Al Brz (0.0)

Element		Min [%]	Conc. [%]	Max [%]	Stddev. [%]
Copper	Cu		67.99		0.65
Silicon	Si		12.48		0.42
Magnesium	Mg		7.55		2.31
Aluminium	Al		6.22		0.68
Lead	Pb		2.80		0.26
Cobalt	Co		1.23		0.38
Iron	Fe		0.92		0.12
Chromium	Cr		0.28		0.10
Nickel	Ni		0.23		0.04
Zinc	Zn		0.15		0.06
Titanium	Ti		0.15		0.02
Manganese	Mn		0.01		0.00

Table.1 – XRF results of green wax (Henry VI Lincoln Charter, 1456)

Operator: User	No.: 418	Date: 11/03/2020	Time: 16:18:00

Name: Henry VI
ID: 18/001
Field1: L Charter
Field2: new wax
Duration: 6.0 s
Application: Alloys 2
Method: LE Al4015
Alloys: C868-Mn Brz (0.0)
C867-Mn Brz (0.0)
C863-Mn Brz (0.0)

Element		Min [%]	Conc. [%]	Max [%]	Stddev. [%]
Copper	Cu		41.86		1.63
Zinc	Zn		18.85		1.04
Silicon	Si		16.03		8.88
Iron	Fe		4.41		0.80
Chromium	Cr		1.91		0.71
Nickel	Ni		1.56		0.34

Table.2 – XRF results of repair wax (Henry VI Lincoln Charter, 1456)

Why are the repairs so obvious?

A number of studies of medieval English wax seals have revealed that they usually consist of only beeswax, (Whatley, 2019, p47 / Young et al. 1987). In these same studies it was noted that while there was very little chemical change to the waxes compared with later resin compositions, the soft nature of the beeswax had of course resulted in considerable physical alterations and damage to some seals. There are some notably obvious toffee coloured repairs to this charters green wax seal, perhaps dating to the reputed repairs of the city's Town Clerk Samuel Lyon in 1788, (Norton, 2018). An x-radiograph of the seal revealed the mechanics of the repairs; two slender pointed metal pins (one distinguishable as a sewing needle by its eye) were used to anchor the wax repairs to the original green, (see Fig.5).

The repairs may have been carried out in this distinctly obvious manner for a reason. A restoration of the seal; attempting to replicate the original colour and design could have been interpreted by later generations as an attempt of forgery, or called into question the legitimacy of the charter. By making all repairs clearly distinguishable from the original seal, the legal integrity of the seal has been maintained, (Burns, p185).

How is it attached to the parchment?

There were numerous different methods used to attach the Great Seal to documents at the time. The three-eyelet lace method used in this charter was one of the most elaborate. It was often used by the Royal Chancery in medieval times to represent the greater importance of royal documents intended for perpetual use such as a charter, compared to documents that were of temporary value, such as letter patents or letters close, (Dalton p26/ Maxwell-Lyte p302). This method is also more robust than the other sealing methods no doubt to ensure the important document will survive intact longer. The bottom of the parchment underneath the writing is folded over to create a double thickness, called a *plica* (Burns p183) from which to suspend the hefty wax seal, measuring 12cm in diameter, (Maxwell-Lyte p300). The use of three-eyelets in a triangular formation instead of two-eyelets (a simpler method) is also an added step to reduce the strain on the parchment, (Dalton, p26). As noted by Dalton, two cords, usually braided in different colours, are threaded through the eyelets in the sequence demonstrated in Fig.6 and Fig.7 after which the seal is affixed to the cord in the method described below, (p26 / Burns p192).

Fig.6 – Beirne (2020) *Henry VI Lincoln Charter, 1456 : Green lace threading sequence* [altered digital image] personal collection

Fig.7 - Beirne (2020) *Henry VI Lincoln Charter, 1456 : Pink lace threading sequence* [altered digital image] personal collection

How are the laces made?

Both of the coloured laces are individually braided using a finger loop method. In the European Middle Ages, loop braiding was the main production method for creating laces, bands and cords and was used professionally by craftspeople as well as privately by individuals for everyday use, (Nutz 2014, p118). Loop braiding is different from the open-ended braiding we are familiar with today. Threads are paired to create loops at one end, with the open ends fixed in place by a knot or support. Each loop end is mounted on a finger and the loops are then exchanged, one at a time between two or more hands following a prescribed sequence, (see Fig.8 for a medieval illustration of the process from the altarpiece of Iglesia de Santa Maria de Tarazona in Spain). Different sequences and numbers of loops create an expansive variety of different patterns and structures, (p118). A common lace would use five loops whereas many bands would use seven or eight loops. The individual laces of the charter each consist of approximately eight to ten loops each; six to eight loops of yarn and two loops of metallic thread, (see Fig.1).

Fig.8 – ALBARIUM (2020) *Image depicting loop braiding on the altar piece 'Virgin with Child' attributed to Nicolás and Martín Zahortiga, 1465 in the Iglesia de Santa Maria de Tarazona, Borja* [digital image of altar piece] Photographic Archive of the Government of Aragon, Spain

Altogether now : The Sealing

Fig.9 – Antao et al. (2020) *Henry VI Lincoln Charter, 1456 : Front* [digital image] personal collection

Fig.10 - Antao et al. (2020) *Henry VI Lincoln Charter, 1456 : Back* [digital image] personal collection

Following the threading of these individual laces through the parchment eyelets in the sequence mentioned above, the two laces now become four and are braided together and tied at the end with a knot, (Dalton, p26). The thick braid would then have been placed between two layers of warm wax with its end passing through the bottom of it. The layers of wax were fused into one by pressing them between the two sides of the silver seal matrix, the metal mould which creates the seal impression, (Maxwell-Lyte, p311 / Burns p182). The orientation of the Great Seal when attached to documents was quite specific; the head of the sovereign had to be perpendicular to the writing on the parchment on both sides of the seal. On the front of the seal, the side facing upwards with the text of the document, is the representation of the sovereign enthroned while on the reverse they are displayed heading the military or naval forces, usually astride a horse, (Maxwell-Lyte, p300). The sides of the matrix were reputed to have projections or ears in order to align the seals accurately, (Maxwell – Lyte, p311 / Burns p182). The projecting piece of wax on the top side of this charters seal is most likely an impression made by one of these, (see Fig.2). Once the sealing was complete, any attempt to add or remove sheets by tampering with the lace would cause obvious damage and call into question the documents authenticity, (Burns, p183).

Laces : What do the colours mean?

Fig.11 – Antao et al. (2020) *Henry VI Lincoln Charter, 1456 : detail of laces x10 magnification* [digital image] personal collection

The laces used to affix the seal are of two colours, green and pink, with two strands of gold coloured metallic thread woven through each lace, (see Fig.11). While many other features of the Charter such as the method of sealing and the colour of the wax used have specific administrative significance, it is purported that the colour of the laces used to attach the Great Seal was completely arbitrary, though the use of two different colours did seem to be a common feature, (Maxwell Lyte, p300 / Burns p.182 / Dalton p26). Green and red is noted as a popular choice, (Maxwell-Lyte p300), and it is possible that the pink cord of this Charter was originally a red that has now faded from photo degradation. The inclusion of 'gold' or metallic threads in the laces of the Great Seal is not unusual but is definitely more of a rarity, (Maxwell-Lyte p300), perhaps chosen to highlight the greater consequence of this particular Charter.

Silk or Linen?

Fig.12 – Beirne & Reeves (2020) *Henry VI Lincoln Charter : green fibre sample.1 x400 magnification* [digital microscopy image] personal collection

Fig.13 – Beirne & Reeves (2020) *Henry VI Lincoln Charter : green fibre sample.2 x400 magnification* [digital microscopy image] personal collection

The fibres of the laces' yarn have a lustrous and smooth quality which initially suggested they may be silk, (see Fig.11). From anecdotal records, silk is the usual choice of material for laces attaching the Great Seal to documents, further reflecting the importance of such documents by use of such an expensive material at the time, (Dalton 1992, p25/ Wyon pxvi). A small sample of detached green fibres was discovered in the storage box of the Charter matching the tone and shade of those of the laces, presenting an opportunity to separate out a few filaments to examine under microscopy, (see Fig.12 and Fig.13)

When cross referenced with identified samples from the CAMEO fibre database, (see Fig.14), it was discovered that the green fibres in fact were most likely a plant based bast fibre such as flax and not a proteinaceous one such as silk. Flax (linum usitatissimum) was the principal bast fibre used in the textile industry of medieval Europe. While it is often associated with linen domestic textiles such as underclothes and bedclothes because of its breathability and warmth, in higher standards of production the fibres could be polished or glazed by rubbing with a heated, hemispherical glass ball to produce a finer and lustrous material, as we see in the green yarn of these laces, (Crowfoot et al. 2006 p18 / Huang & Jahnke 2015 p105 / Mathews 2018 p679).

No such filament sample could be examined from the pink yarn without causing damage and so was not attempted. However, on the metallic gold threads woven into the pink yarn there is a slightly higher level of tarnish evident compared to those in the green, (see Fig.11). Tarnish or corrosion would not be expected on a pure gold thread, however the majority of methods used to manufacture gold threads during the Middle Ages involved the use of gilded silver or silver-copper rather than solid gold, (Hacke, Carr & Brown 2004 p415). It was established by Hacke, Carr & Brown in 2004 that photo and thermal degradation of animal based fibres such as wool or silk can increase corrosion on silver and copper, due to the presence of sulphur containing amino acids in the silk and wool, (p424). It is possible therefore that the pink yarn may be composed of silk fibres while the green is made from polished flax.

Fig.14 – Beirne & Reeves (2020) *Linen sample fibres x400 magnifacation* [digital microscopy image] personal collection

Metallic Threads : How were they made?

Fig.15 – Beirne (2020) *Henry VI Lincoln Charter, 1456 : metallic thread x120 magnification.1* [digital microscopy image] personal collection

Fig.16 – Antao et al. (2020) *Henry VI Lincoln Charter, 1456 : metallic thread x 120 magnification (dinoeye).2* [digital microscopy image] personal collection

The physical characteristics of the metal threads are also revealed in more detail under microscopy; the thread is made of flattened metal strips coiled around a natural coloured, undyed yarn in an s-twist, (see Fig.15), curiously differing from the z-twist of the pink and green yarn, (see Fig.11 and Fig.18). The metal coils appear relatively uniform in width and depth as well as displaying a uniformity of colour on both sides of the metal, (see Fig.16). These features point to a manufacturing method that makes use of wire, a common practice in metallic thread production in the Middle Ages as it could produce long continuous uniform filaments of metal. The usual method used would involve firstly the gilding of a rod of base metal, often silver or copper before drawing it by hand with a pliers through a series of successively smaller holes in a 'draw plate', (see Fig.17). This produces progressively thinner and thinner wire with double sided gilding. Following this the wire could be used as is, twisted to strengthen it, or flattened to make strips and wound onto a core as we see in the threads used in this Charter. (Toth, 2013 / Hack, Carr & Brown, 2004, p415 / Oddy 1977). Other methods of production, such as hammering a gilded bar to create a thin foil can also produce a flattened strip but usually with only one side of gilding, (Toth / Oddy/ Tímar-Balázsy & Eastop 2011)

Fig.17 - Germanisches Nationalmuseum, 2020*, Polbach Hausbach (MS 3227a), 1389 : detail of use of wire draw plate* [altered digital scan], Digitale Bibliothek

Is it gold?

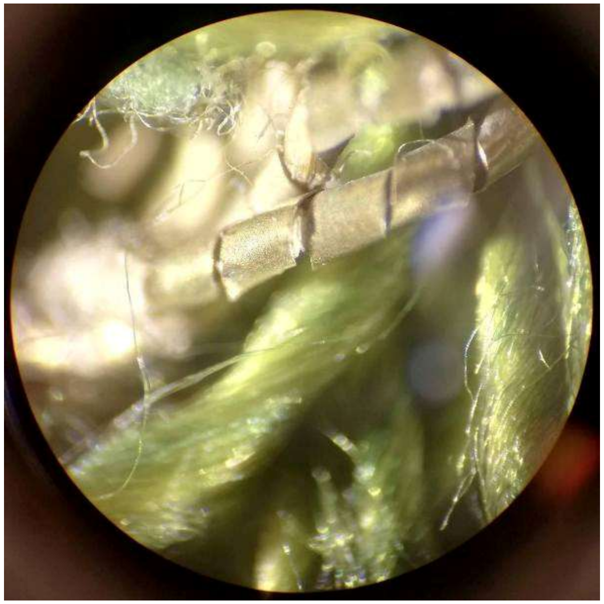

Fig.18 – Beirne (2020) *Henry VI Lincoln Charter, 1456 : metallic thread x40 magnification* [digital microscopy image] personal collection

An XRF analysis of the metallic thread woven into the pink yarn revealed a high level of copper, zinc and aluminium, (see Table.3), indicative, though not conclusive of a copper alloy, (Tímar-Balázsy & Eastop, p128). While no trace of gold was detected in the XRF results, this is not conclusive of a lack of gilding. The absence of substantial tarnish over the majority of the thread is suggestive of some degree of gold coating the surface though possibly a very thin and fine layer, perhaps partly worn away over the years, (p145). Fire gilding, a gilding practice used in medieval times, would usually leave high-level traces of mercury detectable so is unlikely to be the method used in this case if gilding is present, (p131). A simpler and more common practice was hammering a fine gold layer onto the base metal before heating and polishing, (Hacke, Carr & Brown, p415), though when gilding copper it was usual to first apply a layer of silver before the gold, (Tímar-Balázsy & Eastop p131) a metal also notably absent from the XRF results.

The Pinchbeck method of treating copper wire with zinc vapour to create a gold-coloured brass followed by the application of a slight wash of gold on the surface to prevent tarnish would seem to coincide with the results of our XRF analysis, (p131 / Percival 1912 p357). This method, however, is thought to have been invented by Christopher Pinchbeck in the late 17th century, and so postdates the Henry VI Charter, its seal and attached cord by 250 years.

Weiszberg et al.'s 2017 study of the 'Medieval Gilding Technology of Historical Metal Threads' notes that analysis of the surface of metal threads alone, even when paired with methods such as XRF, are unlikely to yield conclusive results about their manufacturing methods. Corrosion in the base metal beneath possible gilding, as well as natural abnormalities in the metals themselves are likely to lead to results that can be easily misinterpreted. They note that for more conclusive results it is necessary to at least pair such analysis with 3D texture of cross-sections of the metal analysed by scanning electron microscopy (SEM). This, however, is a destructive method of analysis requiring the careful sectioning of a sample of the metal thread and would only be deemed a necessary procedure when exact knowledge of the threads composition would be needed in order to prevent it actively deteriorating.

It is probable that there is a very fine layer of gilding on the threads considering the relatively low proportion of corrosion evident, though it is also possible that the threads are 'false' gilded and made solely of a copper alloy, (Toth, 2013).

Fig.19 – Beirne (2020) *Henry VI Lincoln Charter, 1456 : metallic thread x120 magnification.2* [digital microscopy image] personal collection

Operator: User	No.: 415	Date: 11/03/2020	Time: 16:14:00

Name: Henry VI
ID: 18/001
Field1: L Charter
Field2: metal thread
Duration: 31.0 s
Application: Alloys 2
Method: LE Al4015
Alloys: C863-Mn Brz (0.0)
C867-Mn Brz (0.0)
C868-Mn Brz (0.0)

Element		Min [%]	Conc. [%]	Max [%]	Stddev. [%]
Copper	Cu		46.69		0.66
Zinc	Zn		16.02		0.35
Aluminium	Al		13.81		1.01
Magnesium	Mg		10.32		3.54
Silicon	Si		9.03		0.44
Iron	Fe		2.15		0.21
Lead	Pb		1.47		0.26
Nickel	Ni		0.24		0.06
Titanium	Ti		0.20		0.03
Manganese	Mn		0.08		0.03

Table.3 – XRF results of metallic thread (Henry VI Lincoln Charter, 1456)

Metal Corrosion : Silver or Copper?

Fig.20 – Antao et al (2020) *Henry VI Lincoln Charter, 1456 : metallic thread corrosion x120 magnification (dinoeye).1* [digital microscopy image] personal collection

Fig.21 - Antao et al (2020) *Henry VI Lincoln Charter, 1456 : metallic thread corrosion x120 magnification (dinoeye).2* [digital microscopy image] personal collection

Observation of the small areas of tarnish and corrosion visible on the metallic thread give us some further insight into the metals' possible composition. Gilded metallic threads can show evidence of corrosion where the gold layer may have been worn away and no longer forms a continuous protective surface over the base metals beneath.

Initial visual inspection of the metallic threads show a grey and black tarnish on some areas, (see Fig.11), which would initially suggest the presence of silver corrosion in the form of silver chloride or silver sulphite, (Tímar-Balázsy & Eastop p136).

By observing the threads under microscopy, it is evident however, that there is initially a reddish-brown corrosion which accumulates to form the denser grayish-black product, (see Fig.20 and Fig.21). Both copper oxide and silver sulphite, copper and silver corrosion products, initially begin as a reddish-brown before accumulating to a denser grey then black product. Silver sulphite is known to have a distinctly purple/blue tint in its earlier stages, however, which is not very apparent here, (Tímar-Balázsy & Eastop p136 / Selwyn 2017). Coupled with the results of the XRF analysis, this appears to be conclusive evidence of a high presence of copper or copper alloy in the metallic threads of the Charter which may possibly be covered with a very fine layer of gilding.

To conclude, an in-depth non-destructive investigation of the sealing components of the1456 Henry VI charter has revealed some interesting details about its significance and use. The materials used in its production are of a high quality though they do point to a more cost effective display of prestige, while the methods of their production reveal a high quality of care and craftsmanship, which altogether demonstrate the importance of this document at the time of its production.

To examine the faces of the seal and its laces in more detail, a Reflective Transformation Image (RTI) can be examined **here.**

And the transcribed text of the Charter in its original Latin format, and in translated English can be read **here**.

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