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# The Stuff of Literature

## Raw materials and the books of the Iron Library

Christopher Zoller-Blundell

**While the Iron Library's guiding interest in the history of materials science makes it an incredibly rich assemblage of literature for examining the development and uses of innumerable raw materials in the history of science, industry and economics, the physical substance of the books themselves presents fascinating raw materials stories too. Using a few selected examples from the holdings of the library's old and rare books collection, this article will provide an insight into these raw materials histories. Along the way, it will also show some of the more curious material qualities of individual works in the collection that are indicative of trends in the resource consumption of the publishing industry or else highlight features of the books' unique biographies.**

**A**sk somebody what a book is and you will likely cause confusion, as what a book is, is generally considered self-evident. It is a word that has come to denote both the object and anything that imitates its form, and in the latter case there are even dedicated collections.<sup>1</sup> Books are, however, deceptively simple items. When dissected, a volume can prove to be made not just from paper and pigments but also card, adhesives,

thread, leather, wood, metal, glazes, paints, fabrics and so on, with the leaves folded, cut, sewn, glued and bound to produce a whole constructed with incredible delicacy and complexity in processes taking days, weeks or months.

### Calling a book a book

The idea of the book, as it is most commonly understood and recognized, is descended from the codex, a series of inscribed surfaces bound together at one edge to form a unitary object, which emerged to supplant the scroll at some point during late antiquity.<sup>2</sup> This novel object's form was simple and yet remarkable, revolutionary and disruptive.<sup>3</sup> People seem to have been at a loss to find a word to describe it adequately, however. To do so, some turned to words derived from those used to denote the method of production, such as the word meaning "to write," as is the case with Chinese ("shū"), Hebrew ("sippā") and Arabic ("kitāb").

Other language groups used words derived from those given to the raw materials used to make books. Examples of this can be found deeply engrained in the etymologies of words in the European languages. For instance, "book" in English, "Buch" in German, "boek" in



1 Pigments and their raw materials on display in the Ernst Müller Zimmer, home to the majority of the Iron Library's old and rare books collection.

Dutch, and “bog” in Danish derive from the Norse “bok” or proto-Germanic “bokiz,” meaning “beech,” which was the wood most commonly used to make writing tablets.<sup>4</sup> This is similar to the root of “codex,” Latin “caudex,” which originally meant a “wood balk” or “log.”<sup>5</sup> The French “livre,” Portuguese “livro,” Spanish and Italian “libro,” even the Gaelic “leabhar” and Welsh “llyfr” all stem from the Latin “librum,” which itself derives from the proto-Italic word used to denote the inner bark of trees such as birch.<sup>6</sup> These natural sheets have long been used as media for carrying writing.<sup>7</sup> Meanwhile, “Bible” derives from the Greek “biblion,” a word that had come to mean a piece of writing but also meant “papyrus scroll,” a name taken from the port of Byblos, which was the primary exporter of Egyptian papyrus in the ancient world.<sup>8</sup>

From late antiquity, the material requirements for producing books developed, becoming larger and more complex, gradually emerging as an industry so successful that books can be considered among the most highly produced cultural items in human history. While the total number in the world is beyond calculation, an estimate by data miners at Google back in 2010 put the total number of unique titles published as books in history at an estimated 130 million.<sup>9</sup> According to Worldometer, which aggregates

the statistics put out by publishers and gathered by UNESCO, by the end of the first half of 2022 the number of new book titles will stand at over 1.3 million globally.<sup>10</sup> The result of this is an enormous demand for raw materials, though as time passes this impact is proportionally diminishing per title each year as digital publishing proliferates.

An estimate by data miners at Google back in 2010 put the total number of unique titles published as books in history at an estimated 130 million.

The demands of the book industry for raw materials have not been consistent, and underwent significant changes in requirements from the medieval through to the Renaissance, early modern and Enlightenment periods. To highlight trends in the book industry over time, but also to give space to pick out the curious qualities unique to the material biographies of some of the individual print works in the collection, this article will focus on a selection of works from the collection of the Iron Library. Since its founding in 1948, the Iron Library has gathered a collection of print

works that currently counts over 47,000 items. Among these are 8,000 titles that fall into the category of old and rare print works, which is to say older than 100 years, hard to find and of particular scientific value.

### **The makings of an illuminated codex**

To begin on this journey through the material history of publishing in the library, one cannot start anywhere but the oldest book in the collection: the Aristotle-Albertus-Magnus manuscript.<sup>11</sup> Produced in the late thirteenth century, the codex is a composite manuscript, which is to say that it comprises several parts, distinct in terms of both content and artistry, bound together to make one volume. These include Aristotelian and pseudo-Aristotelian works, writings by Albertus Magnus, Michael Scotus and Averroës, all in Latin translation, thematically covering mineralogy, comparative anatomy, astronomy, mathematics, botany, natural history and philosophy. It is a remarkably scientific compendium of writings for its era, containing a high number of illustrations meant to depict Aristotle. The manuscript is bound in leather and the texts are handwritten on 100 leaves of parchment with richly illuminated letters using numerous pigments and gold. It was studied extensively by Rudolf Gamper during the 1990s and more recently by Federica Volpera, both of whom have concluded that it was produced in a scriptorium – a secular book workshop – in northern Italy, possibly Genoa, during the last third of the thirteenth century.<sup>12</sup> From its binding to the parchment leaves and pigments, the book's materials give many insights into its production and the raw materials requirements for a medieval manuscript.

### **Binding**

The dark brown leather binding is not the original and is typical of the fifteenth century.<sup>13</sup> To produce medieval leather, one began with animal hides, stripped of hair using lime and then tanned in urine and plant extracts, such as tannins from chestnut wood. The coloring comes from a combination of further plant extracts, such as oak bark, and metal salts.<sup>14</sup> While standard leather could be a local product, requiring only locally sourced raw materials, bookbinding required a more supple and expensive leather, which in turn called for materials from further afield, such as alum, an aluminum salt. Much of the alum used in Europe's middle ages came from the African continent in the region of Chad or Egypt.<sup>15</sup> It is for this reason, as well as the Mediterranean trade routes and optimal climatic conditions, that leather became such a major industry in Italy.<sup>16</sup>

### **Parchment**

As with most surviving medieval manuscripts, the text-carrying surfaces of the Aristotle-Albertus-Magnus manuscript are parchment. Parchment is a remarkable product,

which kept in the right conditions is able to survive for over a thousand years. For that, its preparation is very laborious.

To make it, the pelts of calves, sheep or goats must be soaked in a lime solution for between one and two weeks to remove hair and cure the skin. After soaking, the parchmenter takes a pelt and scrapes it to remove all other layers but the outer membrane. This scraped skin is then soaked again for several more days in order to remove residual lime, before being stretched on a frame, moistened, scraped and stretched taut again before being left to dry, which depending upon climate can take weeks.<sup>17</sup> Before being used for writing, parchment must be cut to size and buffed with chalk. Calves and young goats or sheep are preferred because they have not had an opportunity to scratch themselves or acquire the diseases or parasites that typically affect the skins of herd animals. Their skins are also softer and more pliable, allowing the production of larger, thinner sheets without mottling or blemishes.<sup>18</sup> Therefore, while the general use of animal skins to produce parchment was part of a low-waste economy in the middle ages, a manuscript that would have been pristine when new called for a high degree of raw materials quality control and the use of the hides from what would amount to a moderately sized herd – a fact now being demonstrated by DNA analysis.<sup>19</sup>

**Parchment is a remarkable product, which kept in the right conditions is able to survive for over a thousand years.**

The leaves of the Aristotle-Albertus-Magnus manuscript are, for the greater part, without flaws, indicating that there was a high degree of raw material quality selection in its production. The analysis from the 1990s suggested that the parchment came from goats and calves, which is to say that it is in part a manuscript on vellum.<sup>20</sup> The terms parchment and vellum are often used interchangeably, but there is a difference: vellum is more specific in animal origin and derives from words for veal, or "veau" in French, and "vitellus" in Latin. Parchment, from the Latin "pergamenum" is so called because of a likely apocryphal story passed down by Pliny the Elder.<sup>21</sup> He attributes its invention to King Eumenes of Pergamon in the second century BC, who did so in response to a shortage in papyrus caused by a trade blockade. Pergamon at that time was building up a library that competed with that of Alexandria, a fact that rattled the prestige of Ptolemaic Egypt.<sup>22</sup> Whether or not it was the king himself who invented the material is debatable; however, the case nonetheless illustrates just how early the importance of control over the raw materials for producing literature was recognized.

magno usq[ue] et fudit desup q[ue] roscata odifora uj  
lit et decolorat totu[m] gote d[omi]ni indeat et caput q[ue]  
desu[m] deinde collat de y[er]e et q[ue] dimitat d[omi]ni et  
perficit. Consurgit ponat et de rigore belosay. et  
ponat d[omi]ni de opa[m] ambe[m] et diagme et opa[m] opa[m]  
muso. q[ue] diagme et ponat d[omi]ni electu[m] et illu[m]  
deinde s[ed] magnis b[ea]tis et medias libe[m] et puluis  
lapidis pacis nube et celestis et flavi colou[s]e. vi.  
Signe. q[ue] 2 de quib[us] et de lucis suis m[od]is. et q[ue] 18  
ali puluis autem vni signe. Deinde ponat d[omi]ni etatu[m]  
num. usq[ue] ad fumato cu[m] ligno d[omi]ni. Deinde  
ponat sub d[omi]no ut descendat cu[m] uerba spirale. q[ue]  
1. d[omi]ni et ne[m] p[re]mitat illa nocte q[ue] luna est ultima  
la et ante cursum signorum aut radiis suis. Q[ue] d[omi]ni  
splendor est n[on] h[ab]et modu[m] et similius est hec d[omi]ni h[ab]et  
mondi. Accepit de ipso q[ue] abu[m] d[omi]ni et q[ue] abu[m].  
Signo. Quia es summa omnia et d[omi]nus et f[ac]tus  
et d[omi]nus intentio[n]is ad fugandu[m] malleum et flossem  
et collora et dolorem venum ad fugandum omnia et  
repellendum placidu[m] et ad d[omi]nandum abu[m] et ad cepe[n]d[re]  
et oplexione[n]. ad scutulandum n[on] sculpsit ac ad gescu[m]  
cynips et collendum dolorem caput. ad d[omi]nandum  
v[er]sum. et reuidenda se v[er]tutem. et subaldu[m] uocem  
et fugandu[m] firmat[ur] et gesco[m] ad malleum et ex-  
cidit q[ue] aff[ec]tus et occultus. q[ue] applatione[m] expellit uocis  
modu[m] et ne[m] p[re]mitat locu[m] apostemam. ut collectio[n]e h[ab]et  
et i[de]m p[re]dicat mortale. firmat[ur] et humectat[ur] et facit  
b[ea]tum uirum collit tuisam et operat spinu[m] et mictu[m]  
operat i[de]m fumigati ho[m]ini cu[m] difficultate respicit[ur] leu-  
ficat et gaudiu[m]. Et nostra alia bona facit a  
longu[m] et etiu[m]a. q[ue] h[ab]et sp[irit]u[m] p[re]ceps ad gradu[m]  
colleccio[n]is. et n[on] uendit[ur] corib[us].

¶ opere te. o. dñe. nullo quā summo mediorū  
vel apie ueni. luc. sacrificare alijs locū y et noluntur  
et osilio horū sacrificari. astre. Quia uelut nacu  
mbo clarificatur in hoc; **capitulū. 29.**  
Luc. e. o. dñe ne a simili mediorū ut uero apie alijs  
locūs fac astre. Quia uelut dñe mediorū exaltat  
in similitudine hoc; **capitulū. 30.**

volvitur plerorumque ut sanguinis canum non accipit  
et alijs horum factis non nouum in eis auctoritate credunt  
adole. Et canis ne sit linea et tanto ut pister et poca  
ne. Et spiritu ad lunam descendere. Et dicitur canis sunt  
luna in generatione ex istis. Et agusto. Cane etiam non  
sunt canis. In generatione ascendente ut est oportet.  
et dicitur deo de sermo. Et valens horum ad aperteone u  
nus et de luna dedicare nisi lunas. Ita et luna  
sit linea diminuta. Et sic et luna et scorpionis et  
canis noctis et ieiuniis et non est linea et tunc linea et tunc  
canis sunt. Ita regna ut noua. In diminutione uos  
quid non perpetue uenit. Et sacrificatione canum can  
fuerit linea auctoritate linea non resupinatur ad ipsam stelle  
noctis. sed oportet malum. Et quod linea sit ari

venient respiciat ea neq; ut manuus. Cum ad luna  
fuerit ascensione ad descendere. tunc h[ab]et dominum ut p[ro]p[ter]a  
sup[er] eodem loco in corpore; **capitulio. q[ui] 10.**  
omni uoluntate accepit ordinari luna. q[ui] sitat luna  
et occupione vel in libra vel in p[er]petuo. Et p[ro]p[ter]a  
de affluatione luna ad sciam. Quia tunc facit q[ui]  
se illam habens et ordinari in eam. Et pro magis elo-  
gat luna astre tanto uelocius et nec est amandum cu[m]  
fuerit in eam. Sic itaq[ue] p[ro]p[ter]a tunc omnis luna ordinata  
ne luna. et ei absentia anomaliu[m] statim. et excepita  
com[par]atione ascensu[m] notabilium subsiget figura; **capitulio. q[ui] 12.**  
Non volueris dare ordinari luna in quo sit sic  
sol. q[ui]d p[ro]p[ter]a p[er]ficit nossem si diligenter ipsa  
luna et inde p[er]ficitur h[ab]et desiderio. Si est in eam etiam  
signo o[ri]entis aut alicuius ordinari et in eam illud p[ro]p[ter]a. Si  
aut[em] flagrante modo ait flagrante et non sit in  
sol plumbis et stringit uenit in et levat. Preterea est  
diligenter attendendit uenit luna sic et collatio si  
signo. Aut collacione aut flagrante. Si et ambo luna  
nauia et collatio signis se recipiunt ut responsum ordi-  
naria non alicuius data parum uidebitur. Si id in  
collacione aut o[ri]ent aut muletum p[er] accepit subiectum.  
Quod si flagrante signis sol et luna exhibetur. si  
alle ordinari signa ducatur. Et p[er]p[et]uus si sunt luna  
et augm[ent]o sunt ut sic plini. Conferente luna sunt  
tunc omnis humanae. et cum sunt et lecamini et ergo  
omni significatione. descendente luna et cetera sunt  
via. Hec non secretum a op[er]ario p[er]dulub[us] cogitare po-  
sit quiaq[ue] Et ipso ea ergo voluntate; **Expositio.**



¶ qualitatibus  
et pectentibus oculis  
naturis quicquid  
habet. et de ea  
nisi valentibus  
diciuntur. et  
de oculis capillis  
et membranis;  
In aliis signis  
libet plene de  
pernibus lapidum et sub hinc et natu planeari  
declaramus. Et ideo que nunc dicenda est de planis  
et lapidis. Quia ad sensum opus suum. Et sic de-  
bet. Quod si in planis diuise est in diversis  
vires diuinitatis. sicut in lapidis diuise est  
in diversis specie et uirtutibus. quia per diuinitatis  
potest in operabilibus exarum et principaliis genitibus  
regis maiestatis. decoratis regis diadema lapi-  
dibus protulit. quos per diuinitatis uirtutem visus. animo et  
animo dicitur. et ex eo uirtute genitio ex diuinitate  
a corpore expellit; sine aliis partibus est operis et



3 Tannin-rich galls on an Aleppo oak branch in winter, the preferred raw material for pigment in medieval ink-making.

### Pigments

The pages of the manuscript have endured centuries and yet look almost as crisp today as on the day that they were first written. Looking at the vibrant figures and designs of the illuminated letters, with their patches of burnished gold on pages covered with flourishes of red and blue fleurons, one quickly comprehends why these books were so expensive to make. Perhaps as impressive as the artworks themselves, however, are the potential distances traveled by the raw materials used to make the pigments on the page.

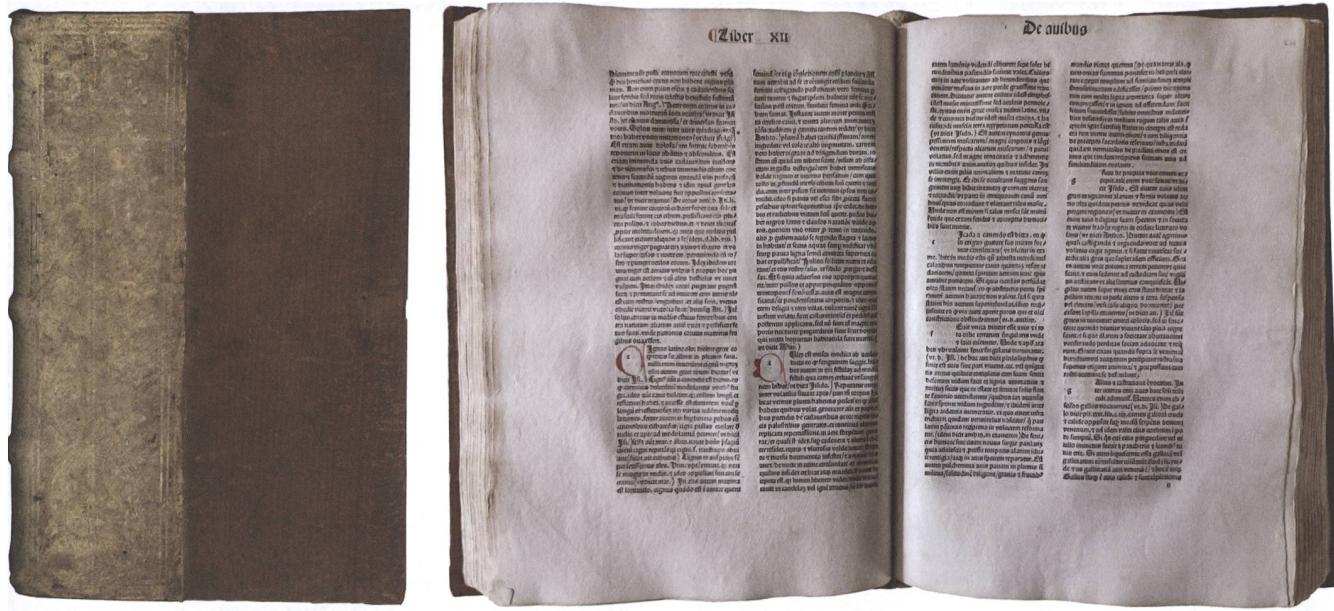
**It is thought that between antiquity and the medieval period, up to a third of the gold that was circulated in Europe had its origins in Hungary.**

The vivid red likely contains cinnabar, the highly toxic ore of mercury, which at the time was an export from the Iberian Peninsula, or else a mixture of cinnabar with lead compounds.<sup>23</sup> The blue could be azurite, of which there were sources in Bohemia and the Alps, or ultramarine produced from lapis lazuli, which if so would mean the raw material

having been traded down the Silk Road from Afghanistan.<sup>24</sup> An analysis of the skeleton of a woman from twelfth-century Germany discovered a grain of lapis lazuli in the calcified deposits on her teeth, attesting both to its availability and to her possible employment in manuscript production.<sup>25</sup>

The gold is more of a mystery. Before the European colonization of the Americas and the extraordinary quantity of gold that resulted from that, most gold that was hammered into leaf or made into dust for paint had previously been in circulation as currency: florins, ducats and Hungarian gulden were typically the most pure.<sup>26</sup> Indeed, it is thought that between antiquity and the medieval period, up to a third of the gold that was circulated in Europe had its origins in Hungary.<sup>27</sup> The gold on the pages of the Albericus Magnus manuscript is particularly lustrous and looks almost three-dimensional. This suggests that the design for the gold was applied using a gesso, a thick paste-like glue, onto which the gold leaf adhered. Once dry it was burnished to a rich, glowing shine, and the remainder of the design was painted in around it.<sup>28</sup>

Even the humble-appearing black ink, known as iron gall ink, was a complex and high-status product, made from ingredients that had potentially traveled significant distances. Gall ink is waterproof when dry and remained



4 The Iron Library's 1482 edition of 'De proprietatibus rerum,' the oldest printed book in the collection.

the most permanent available ink until the development of synthetic alternatives in the twentieth century.<sup>29</sup> The core ingredients are iron sulfate (sometimes called copperas or iron vitriol), oak galls, and gum arabic.<sup>30</sup> Oak galls are growths found on oak trees and are caused by parasitic gall wasps. The wasps sting leaf buds and lay an egg inside, from which hatch larvae. Around the larvae grow dense, tannin-rich bulbs, out of which the adult wasps eventually emerge.<sup>31</sup> Though oak galls can usually be found throughout Europe, the most prized for making ink in the medieval period were those that grew on Aleppo oak trees, which (in spite of the name) could be found on the Eastern Aegean islands, through Turkey, and down into Syria and the Levant.<sup>32</sup> The dark color of the ink is created by a reaction between the tannins in the galls and iron sulfate, a pale green-blue granule that occurred rarely in sufficient quantities in nature and demand for which drew the attention of alchemists and the early chemical industry.<sup>33</sup> The adhesive element in the mix was the gum arabic, though this is a misnomer. It is not a gum but a resin extracted from one of several varieties of acacia tree that grow in the Sahel region of Sub-Saharan Africa, stretching from Senegal to Sudan.<sup>34</sup> The “arabic” part of its name derives from it being exported across the Mediterranean to Europe from ports in Arab lands.

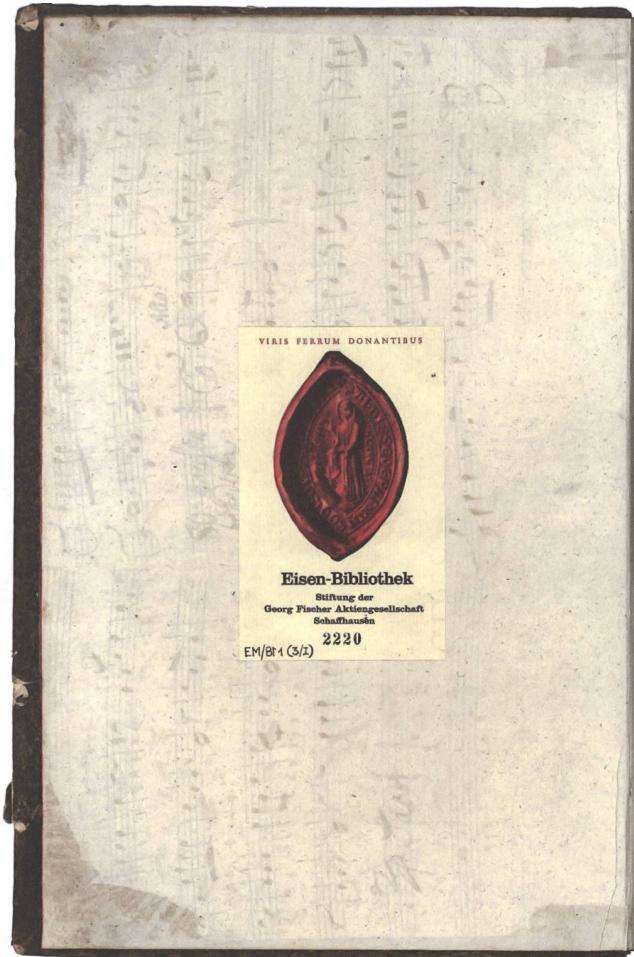
## Gutenberg's printing revolution

Moving on from the Aristotle-Albertus-Magnus manuscript, we come to the Iron Library's oldest printed book, 'De proprietatibus rerum,' which was published by Pierre Hongre in Lyon in 1482.<sup>35</sup> An incunabulum, or cradle print, is a print work from the era between Johannes Gutenberg's invention of the printing press and the year 1500, while the book industry was in its infancy. 'De proprietatibus rerum' or 'On the Properties of Things' was originally written as a manuscript around the year 1240 by Bartholomaeus Anglicus, a Franciscan monk based in Magdeburg. It is considered a predecessor to the encyclopedia.<sup>36</sup> It is half-bound with parchment and, by coincidence, the book has beech wood plates for its front and back covers.

Gutenberg's printing press revolutionized the production of books in Europe not just through the ability to mass-produce a text but also in terms of the raw materials requirements. Each individual character in 'De proprietatibus rerum' was impressed upon the page by a cast type character made from a very specific alloy of lead, tin and antimony invented by Gutenberg.<sup>37</sup> The relatively low melting point of the recyclable alloy, yet its firmness when set, meant that with little heat, a specially designed reusable copper alloy hand mold could be used to mass-produce and replace movable type characters.<sup>38</sup> As a sign of the



5 Damage to the corner of a cheap nineteenth-century card transport binding, revealing the recycling of old sheets of paper.



6 A transcribed classic or a private composition shamefully disposed of? Music sheets used to line a 1774 edition of Leopold's *Wasserbaukunst*.

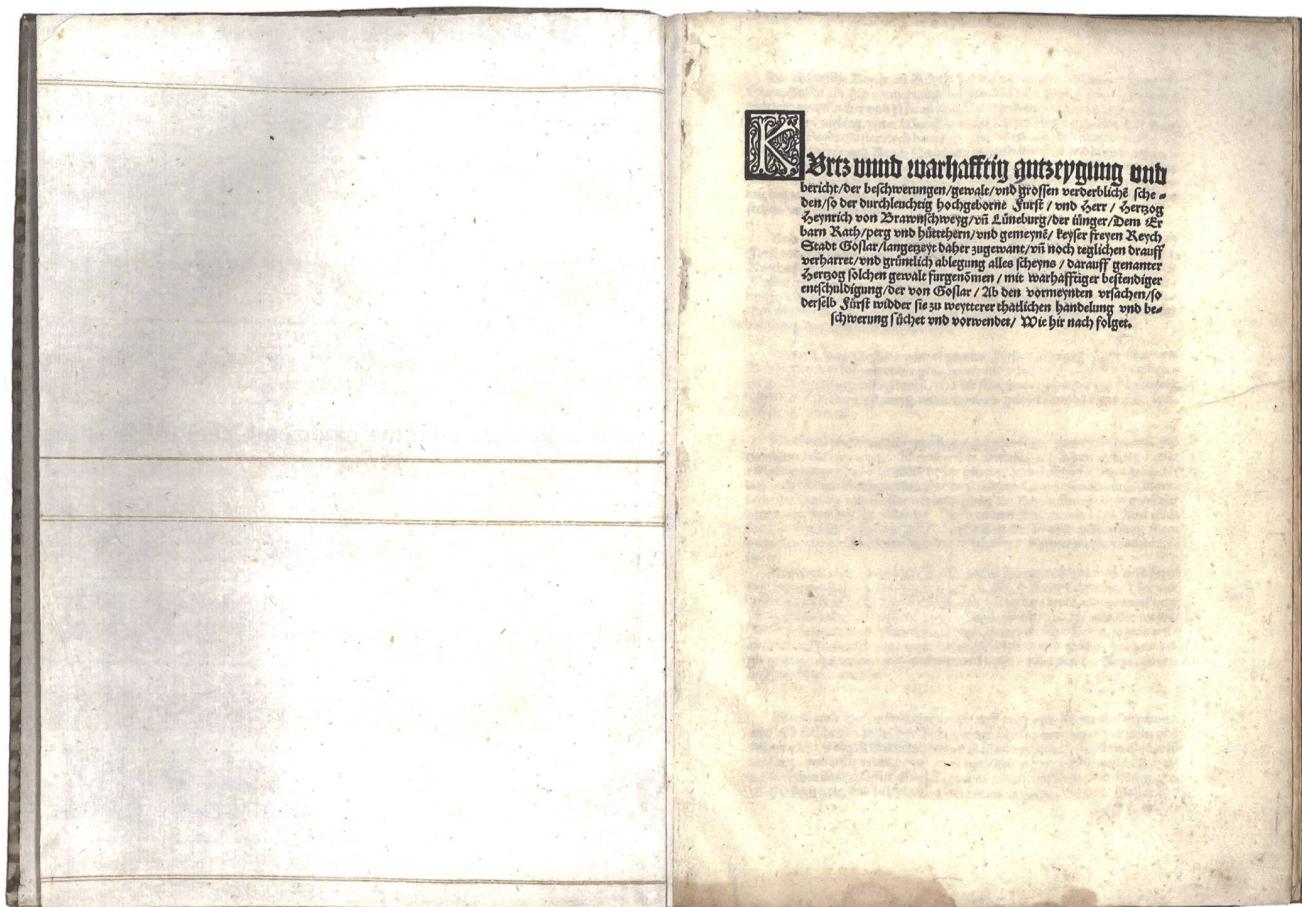
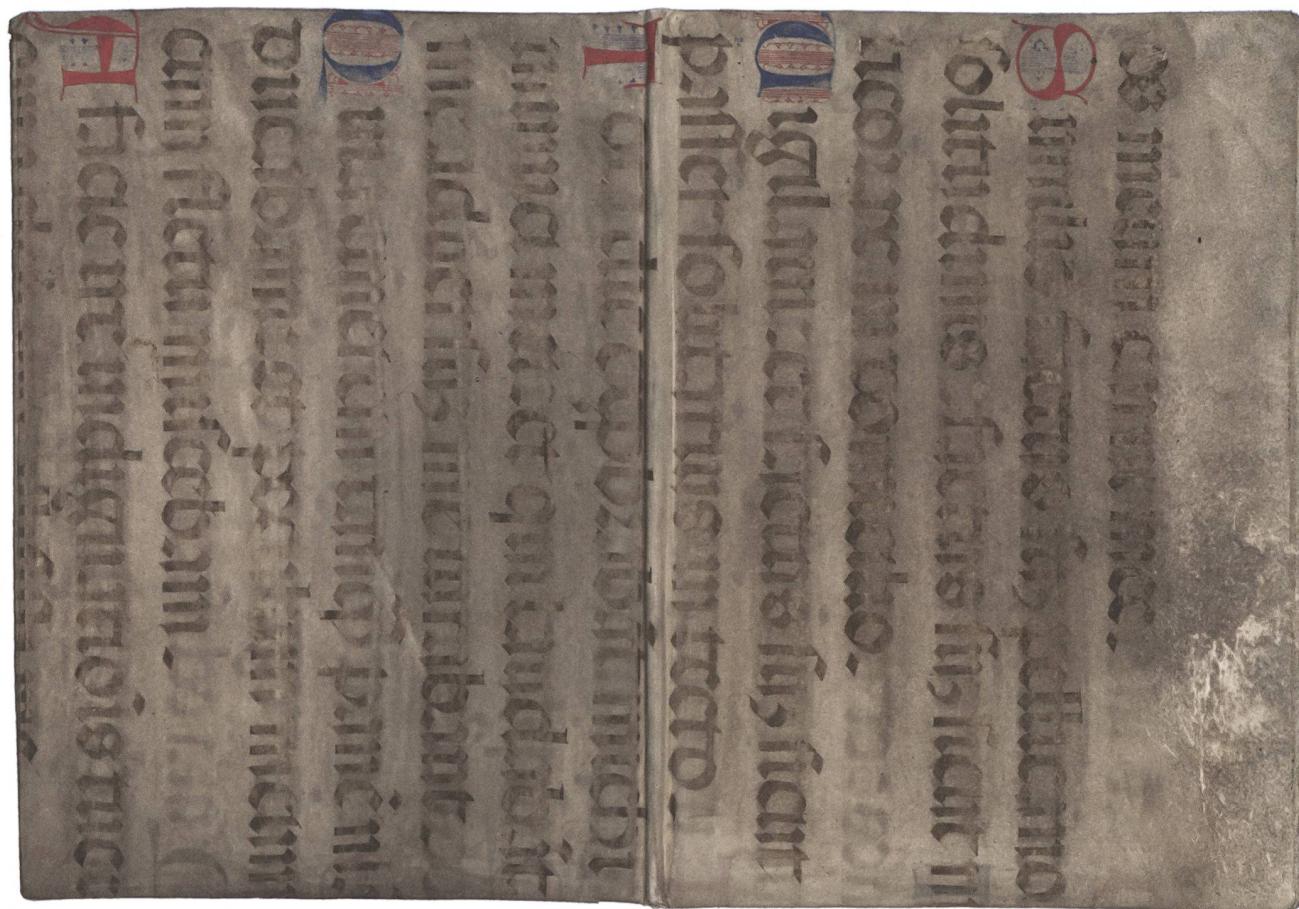
then-growing importance of sea lanes for transporting and easing the acquisition of specialist raw materials, it is perhaps unsurprising that although Gutenberg invented print in Mainz, it was editions printed in Venice that dominated the market by 1480.<sup>39</sup>

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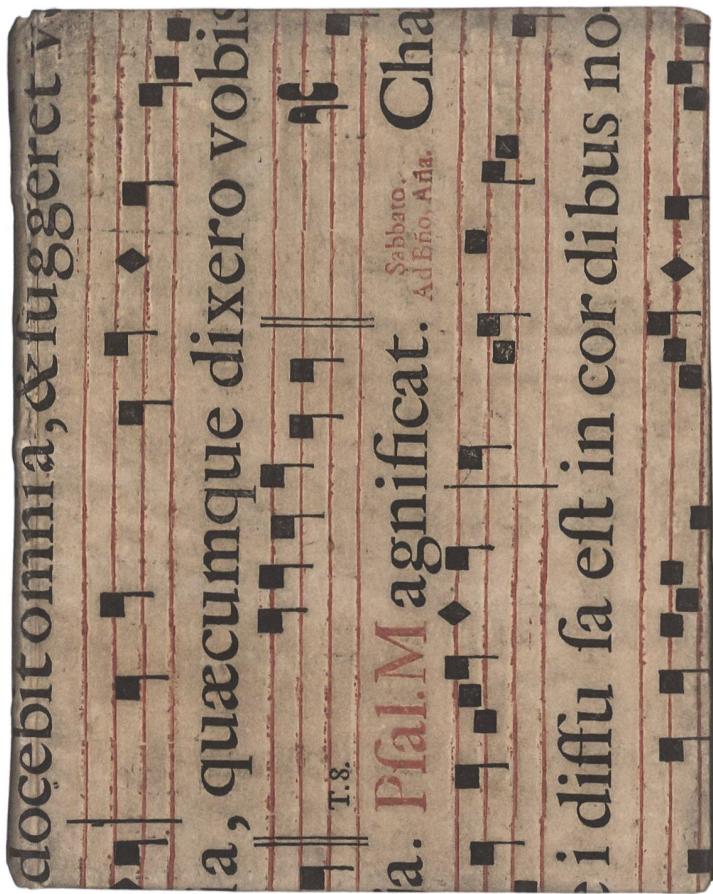
Gutenberg's publishing revolution led to the expansion of industries that could turn a profit supplying the raw materials required to produce books, and gradually this brought a cheapening of those raw materials. This, combined with the spread of the technology and the increase in the number of printers, led to a decline in the price of books, an increase in literacy, and an increase in the consumption of books, and therefore raw materials, and so on to the modern day. To put the scale of this increase and the impact of the printing press into some perspective, according to one

study in the year 1550 alone the printers of Western Europe turned out around three million books, which is more than the total number of manuscripts estimated to have been produced during the entirety of the fourteenth century.<sup>40</sup>

One key material of this revolution was paper, the raw material for which was rags. Paper of the era was different from that which is used nowadays, which is wood pulp-based. Up until the nineteenth century, most paper used in Europe was made using the pulped fibers of linen, hemp or cotton.<sup>41</sup> It is for this reason that old books have that "old book smell" of grass and vanilla, caused by the slow breakdown of substances such as lignin in the linen fibers.<sup>42</sup> The rags were treated by washing, boiling, milling, fermenting and bleaching to create a paste which, when dried, produced lightly colored sheets.<sup>43</sup> This sort of paper is very stable and renowned for its durability and longevity.<sup>44</sup> The rags were initially gathered locally, but eventually had to be brought to papermaking centers from further afield due to the increasing demands of the industry. Because of this and their entwined raw materials demands, the textile and papermaking industries came to be found in the same locations, often developing alongside one another.<sup>45</sup> It is therefore no surprise that Lyon, where 'De proprietatibus rerum' was printed, was both a textile and paper-



7 The complaints of a protestant nobleman and known dissolver of monasteries, Duke Heinrich I of Brunswick-Wolfenbüttel, bound in parchment likely recycled from a monastic library that fell victim to the Reformation.



8 Guns bound in a Benedictus: music paper with the words and notes for songs of thanksgiving, protecting one of the earliest treatises on practical gunnery.

making center in the fifteenth century.<sup>46</sup> The flax used in this textile industry was not always a local product, however, and through Hanseatic traders entered the European market from as far away as Novgorod and Livonia.<sup>47</sup>

The Iron Library's incunabulum demonstrates a shortage of two very particular resources in its biography, the poetic raw materials of any craft: time and patience.

Linseed oil, pressed from the seeds of the flax plant, was also required by Gutenberg's printing method. The thickened oil was the basis of the viscous printing inks that best adhered to the paper.<sup>48</sup> The pigment requirements, though based upon mostly locally sourceable raw materials, were not entirely revolutionary in style. While materially far removed from the illuminated manuscript, incunabula like 'De proprietatibus rerum' nonetheless show a stylistic adherence to trends set by manuscripts, such as in the width of the columns and the use of rubrication to decorate the pages. In this regard, the Iron Library's incunabulum demonstrates a shortage of two very particular resources in its biography, the poetic raw materials of any craft: time and patience. Though some pages show very beautiful ornate letters, others have been left entirely unfinished.

#### Circular economy: old literature into new

The papermaking industry's circular economy of rags to paper had a continuation in the recycling of paper into new paper and card. By the late eighteenth and nineteenth centuries, some printers sold larger or more expensive books in a protective sale binding of basic card, which the purchaser could have removed, to then have the pages rebound in a style of their choosing. These protective transport bindings rarely survive, and yet in the Iron Library there is a volume of Carl Friedrich Wiebeking's 1812 book 'Wasserbaukunst' (Hydraulic Engineering) that was kept in this binding, with its pages also left uncut.<sup>49</sup> Damage to a corner has revealed a letter in Fraktur font, demonstrating how old, waste and rejected sheets had been recycled into card. Another book on hydraulic engineering, a 1774 edition of Jakob Leupold's 'Theatrum machinarum hydrotechnicarum, Schauplatz der Wasser-Bau-Kunst,' shows how a binder used old music paper to line the insides. Whether this is a transcription from another score or a discarded personal composition is hard to tell.

There are cases of recycling where the combination of their material and literary contents can encapsulate an era in microcosm. Of all of the books in the Iron Library, none perhaps does this better than the pamphlet 'Kurtz unnd warhafftig antzeygung und bericht, der beschwerungen, gewalt, und grossen verderblichen scheden, so der ...

Hertzog Heynrich von Brawnschweyg' ('Short and true account and report of the troubles, violence, and great pernicious harms, to the ... Duke Heinrich of Brunswick').<sup>50</sup> It is an example of the weaponized word during the territorial tumult of the Reformation. The 1527 text enlarges on claims to the profitable mining industry of Goslar by Duke Heinrich I of Brunswick-Wolfenbüttel.<sup>51</sup> Heinrich's claims precipitated a minor regional war, during which several territories were occupied and their monasteries dissolved, he being a Protestant and member of the Schmalkaldic League.<sup>52</sup> The pamphlet is bound in a recycled parchment page taken from what looks to be a thirteenth- or fourteenth-century psalm book, likely taken from the library of a dissolved monastery.

The same somewhat darkly poetic style of binding can be observed in 'Büchsenmeisterey, das ist kurtze, doch eigentliche Erklärung deren Dingen, so einem Büchsenmeister fürnemlich zu wissen von Nöthen'.<sup>53</sup> This 1609 treatise on gun making and gunnery by Christoph Dambach, published in a lull in the European Wars of Religion, was bound in music paper carrying the notes and words of canticles from the Gospel of Luke, the Benedictus and Magnificat, which are songs of thanksgiving.<sup>54</sup> From this, it could be suggested that a previous owner may have found the book's contents particularly helpful.

#### Summary

From the words used to describe them to the ink on the pages, the history of the book is as much a history of raw materials as it is of ideas. A material examination of books as artifacts can tell multifaceted stories about how they came into being: stories that are not just about the economy and society that produced them but that can also hint at the personality of previous owners. The production of the Aristotle-Albertus-Magnus manuscript required skilled artisans with specialist knowledge, a remarkable array of raw materials that had traveled great distances, and a great amount of time before the bound volume was completed. With Gutenberg's printing revolution, new raw materials demands were created. The library's copy of 'De proprietatibus rerum' is a very typical example of a print work from this era, showcasing how the form of the codex was adapted to mostly entirely new raw materials, many of which were at least more locally available if not always locally sourced. It was this change in materials that arguably ended the exclusivity of literacy, creating an increased demand, which in turn sparked the ingenuity of an extensive circular economy to ensure that the demand for print works was met.

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Christopher Zoller-Blundell has been the academic librarian of the Iron Library since 2019. After studying archaeology and human paleopathology at the University of Durham, he began work on a PhD in the history of archaeology and the international scientific organizations of the League of Nations at the University of Heidelberg and at the International Graduate Center for the Study of Culture in Giessen. Between 2015 and 2019 he worked in various university and county archives, as well as for the library of a private art gallery. He is a member of the Bibliosuisse Rare Books Working Group, and the Lake Constance Association of One Person Libraries.

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