Paper, as we know it today, did not exist in the ancient Mediterranean world. Instead, people wrote on an enormous variety of other materials. While almost every substance imaginable has been used as writing material at one time or another, in this chapter I focus on the common ones. First, I naturally consider papyrus since the overwhelming majority of ancient texts are written on this material. Parchment, ostraca, and wooden tablets also receive considerable attention, while linen (e.g., mummy bandages) and stone (mainly Coptic limestone ostraca inscribed with ink) receive minimal attention.

An overall view of the use of various writing materials for Greek documentary texts can easily be acquired from the Heidelberger Gesamtverzeichnis der griechischen Papyrusurkunden Ägyptens einschließlich der Ostraka usw. der lateinischen Texte, sowie der entsprechenden Urkunden aus benachbarten Regionen (hereinafter HGV). Out of a total (as of April 2004) of 54,312 published documents, the distribution on writing materials is given in table 1.1. In columns 4 and 5 I have added the figures and percentages for literary texts, which are taken from the total of 9,875 items incorporated in the Leuven Database of Ancient Books (hereinafter LDAB).

The aforementioned figures are for texts in Greek and Latin. If we look at Coptic documentary texts, which extend past the end of antiquity, ostraca are the most important medium (47.5 percent), while papyrus is second (40.5 percent). Limestone accounts for 10.5 percent, while skin (leather/parchment), paper, and wood represent less than 1 percent each.
Table 1.1. The Frequency of Various Writing Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Documents</th>
<th>% of Documents</th>
<th>Literary Texts</th>
<th>% of Literary Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td>papyrus</td>
<td>35,591</td>
<td>65%</td>
<td>7,100</td>
<td>79%</td>
</tr>
<tr>
<td>ostraca¹</td>
<td>15,195</td>
<td>28%</td>
<td>339</td>
<td>3%</td>
</tr>
<tr>
<td>wood²</td>
<td>2,500</td>
<td>5%</td>
<td>148</td>
<td>1%</td>
</tr>
<tr>
<td>parchment</td>
<td>349</td>
<td>0.6%</td>
<td>2,575</td>
<td>25%</td>
</tr>
<tr>
<td>graffiti</td>
<td>234</td>
<td>0.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>linen</td>
<td>84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wax tablet</td>
<td>73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>stone</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cloth (mummy linen, etc.)</td>
<td>30</td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>leather, etc.</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>various semiprecious stones</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>limestone</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bone</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gold and silver</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bronze</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lead</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iron</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>schist</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>reed</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. This category includes fragments of ceramic on which the text is written in ink or engraved after firing.
2. A good many of these are mummy labels. One could also include wax tablets and the description Klappierte (4 items in HGV). For reasons of geography the HGV includes neither the Vindolanda (T.Vindol., 833 items) nor the Vindolanda tablets (T.Vindon, 99 items). Otherwise, the wooden tablets would account for 6 percent of the total.

**Papyrus**

Where and How Did Papyrus Grow?

According to Theophrastus, whom Pliny copies without acknowledgement,⁶ papyrus grew in water no deeper than 90 centimeters (two cubits). Pliny adds on his own account (or from another source) that it grows in the swamps of Egypt, which are stagnant after the floods. This was certainly true in his day and at the time of Theophrastus as well, but before man interfered with the floods of the Nile, where would papyrus have grown in Egypt? Without human intervention, the floods did not leave stagnant pools for very long, and the annual change in the water level would not have agreed with the papyrus plant. It is thus no surprise that *Cyperus papyrus* L. died out in Egypt when it was no longer cultivated for paper making, and I suspect that it never grew there spontaneously but was imported from tropical Africa at a very early period. In the 1960s a surviving specimen was discovered in Wadi Natrun but typically not on the Nile.⁷ The papyrus that now grows in Egypt and is used by modern papyrus makers was imported from the Jardin du Luxembourg, Paris, in 1872 and planted in front of the Egyptian Museum in Cairo. From there, a number of plants came to the Cairo Zoo and were in turn transplanted by Dr. Hassan Ragab to his plantation on Jacob's Island. The origin of these plants appears to be Syracuse, where papyrus was introduced (or rediscovered) by the Arabs during the Middle Ages. In any case, the origin of the plants must have been Egypt.⁸ Pliny (HN 13, 72–73) also mentions papyrus in Syria and Mesopotamia.

**How Was Papyrus Made?**

We have three sources of information on papyrus making: analysis of ancient papyri, ancient descriptions, and modern experiments with manufacture. If we start with the simplest form of analysis, looking at a piece of papyrus paper, it is obvious that it is made of two layers of fibers placed perpendicularly to one another. As for descriptions, I consider that we have no good description from antiquity of how papyrus was made. The Egyptians apparently never recorded the process, and the only classical author who describes it is Pliny (HN 13, 74–83), whose account is problematical in several ways. The principles of textual criticism dictate that we try to reconstitute what the author wrote, but our natural tendency is to try to make sense of what Pliny wrote so we tend to assume that he knew what he was talking about. This is, however, not necessarily the case, since Pliny had never been to Egypt and papyrus paper must be made from fresh papyrus; thus, it can be made only where papyrus grows. It is therefore almost certain that he had never witnessed the manufacture of a papyrus sheet, and it is consequently difficult to determine how we should deal with the obvious shortcomings of Pliny's text. He must have been excerpting a written source, but we have no idea what it was or whether it was correct. So, in general, emendations of Pliny's text should be avoided. What we can do (and what several commentators, including myself, have done) is to try to interpret the words in such a way that they can be harmonized with what we believe to be the truth. This procedure contains an obvious danger of circular argumentation. To complicate matters, I believe that Pliny is mixing personal experience of papyrus he had bought and used in Rome with whatever source he was using to describe its manufacture, and I believe that, while his source
must have given an account of papyrus making in pharaonic times, his own experience was, of course, of papyrus as produced in his own day.9
I quote a translation of the relevant passage, adapted from Lewis (1974: 37–41):

74. Paper is made from the papyrus plant by separating it carefully10 into very thin strips as broad as possible. The choice quality comes from the middle, and after that come the other cuts in order. The (choice) quality, in former times called "hieratic" because it was devoted only to religious books, has out of flattery, taken on the name of Augustus, and the next quality that of Livia, after his wife, so that the "hieratic" has dropped to third rank.

75. The next had been named "amphitheatric" from its place of manufacture. At Rome, Fannius' clever workshop took it up and refined it by careful processing, thus making a first-class paper out of a common one and renaming it after him; the paper not so reworked remained in its original grade as "amphitheatric."

76. Next is the "Satic", so called after the town where it is most abundant, made from inferior scraps, and, even more like bark, there is the "Taenotic," named after a nearby place (this is sold, in fact, by weight, not by quality). The "emporphic," being useless for writing, provides envelopes for papers and wrappings for merchandise, and its name accordingly comes from [the Greek for] merchants. After this there is the end of the papyrus stalk, which is similar to a rush and useless even for rope except in moisture.

77. Paper of whatever grade is fabricated on a board moistened with water from the Nile: the muddy liquid serves as the bonding force. First there is spread flat on the board and quite straight a layer consisting of strips of papyrus of whatever length they may be. When the ends are squared off a cross layer completes the construction. Then it is pressed in presses, and the sheets thus formed are dried in the sun and joined one to another, in declining order of excellence down to the poorest. There are never more than twenty sheets in a roll.

78. There is great variation in their breadth, the best thirteen digits, the "hieratic" two less, the "Fannian" measures ten, the "amphitheatric" one less, the "Satic" a few less—and it is not strong enough for malletting—and the narrow "emporphic" does not exceed six digits. Beyond that, the qualities esteemed in paper are fitness, firmness, whiteness, and smoothness.

79. The Emperor Claudius changed the order of preference. The "Augustan" paper was too thin for writing with a pen; in addition, as it let the ink through there was always the fear of a blot from the back, and in other respects it was unattractive in appearance because excessively translucent. Consequently the vertical (under) layer was made of second-grade material and the horizontal layer of first-grade. He also increased its width to measure a foot.

80. There was also the "macrocolumb," a cubit wide, but experience revealed the defect that when one strip tears off it damages several columns of writing. For these reasons the "Claudian" paper is preferred to all others; the "Augustan" retains its importance for correspondence, and the "Livian," which never had any first-grade elements but was all second-grade, retains its same place.

81. Rough spots are rubbed smooth with ivory or shell, but then the writing is apt to become scaly; the polished paper is shinier and less absorptive. Writing is also impeded if (in manufacture) the liquid was negligently applied in the first place; this fault is detected with the mallet, or even by odour if the application was too careless. Spots, too, are easily detected by the eye, but a strip inserted between two others, though bilious from the sponginess of (such) papyrus, can scarcely be detected except when the writing runs—there is so much trickery in the business! The result is the additional labour of reprocessing.

82. Common paste made from finest flour is dissolved in boiling water with the merest sprinkle of vinegar, for carpenter's glue and gum are too brittle. A more painstaking process percolates boiling water through the crumb of leavened bread; by this method the substance of the intervening paste is so minimal that even the suppleness of linen is surpassed. Whatever paste is used ought to be no more or less than a day old. Afterwards it is flattened with the mallet and gone over with paste, and wrinkles are again removed and smoothed out with the mallet.

In general this description corresponds well to what we may deduce from observation of existing papyri, but a few obscure points remain. The papyrus stalk was harvested and cut into sections, separating sections from the lower, the middle, or the upper parts. Pliny becomes a little confusing when describing the qualities resulting from these various cuts because the criteria for the qualities combined both the firmness and opacity of the writing material and the width of the sheets. The lower part of the stalk contains relatively more pulp between the fibers than the higher part, so the sections from the lower part of the stem produce a thinner papyrus sheet than the middle.11 Because of the change of writing implements from reed brush (as used for Egyptian) to reed pen (καλαμος) (as used for Greek and Latin), the very fine papyrus favored in pharaonic times was less attractive for the Greeks and Romans.12 However, the qualities also differed in the width of the individual sheets.13 When the papyrus was sold in roll form, one asked for a roll of a given quality, and since the width of the twenty sheets was fixed, the length of the roll (i.e. twenty sheets of the width appropriate to that quality) was also known for every quality. The height, on the other hand, could vary. The somewhat confusing statement in 77 would give the impression that every roll contained all the qualities, which of course is nonsense. What Pliny means is that the best sheets of the quality in question were put first in the roll for the customer to see, rather as strawberries tend to be arranged for sale in the punnet.14

Another point that may need some explanation concerns the procedures of "Fannius's clever workshop." The posttreatment of Fannius has long excited commentators. Pliny does not tell us what the method involved and the reason may be that he did not know. The only thing Pliny does say is that the sheets or rolls were made larger. Fannius presumably guarded his professional secret. Lewis "speculates within
the bounds of reason” that Fannius may have added a third layer of better quality in order to produce a better writing surface. I find it difficult to see how this would enlarge the sheets. C. H. Roberts is quoted by Lewis for a similar idea, namely that the original papyrus was split and a layer of better quality was substituted as writing surface. Again, I do not see that this would enlarge the sheet/roll. Besides, such a procedure would have been difficult, not to say impossible. If I, too, may be allowed to speculate within reason, I believe that the only way to make an existing sheet or roll larger is to beat it with a mallet. This would inevitably make a dry papyrus sheet more brittle, but if the sheet was first moistened, it might be possible to increase its size by about 10 percent while making the paper thinner. The main risk when moistening papyrus, as all restorers know, is that the ink may run, which is not pertinent in this case. Anyone who has tried his hand at restoration will have noticed that the fibers regain much of their original flexibility when wet. In fact, I believe that in 78 Pliny is telling us that the paper was hammered out; he writes that the Saitic quality is even smaller nec malleo sufficit (and is not strong enough to be malleted). Why else would he mention the mallet in connection with the size?

**Modern Experiments**

The best-known modern experiments are those of Hassan Ragab, Cairo, and Corrado Basile, Syracuse. Both have produced papyri of a useable quality, and both are sure they have recreated the ancient procedure, although it is obvious to anyone who handles their paper that something is wrong. The few examples I have seen of the Sicilian papyrus are very soft, white, and pliable but do not feel like papyrus at all. The Ragab papyrus feels like ancient papyrus but has the characteristic “grid pattern,” that is, the individual strips are seen very clearly, which is not the case with ancient papyrus. The problem is whether to place the strips side by side (with the risk of gaps forming between them as they dry), or placing them with an overlap, as Ragab did, thus producing the grid pattern. Pliny’s description (given earlier) does not mention any overlap, and the ancient papyri do not show any grid pattern. So we still do not know exactly how papyrus was made. In an attempt to find a solution, I. Hendriks proposed that Pliny’s diviso acu meant exactly that—with a needle—and that the papyrus stalk was unrolled by the so-called peeling method. The theory created a certain amount of interest at the time, but as I have shown, Pliny’s text contains too many counterindications. Besides, having tried it myself, I know that a papyrus stalk does not react kindly to being peeled. It breaks whenever one tries to “go around a corner” in order to open the next side of the triangle, and using a needle instead of a knife tends to tear the pulp. Besides, it has never been clear to me why using a needle would lead to the peeling method (see figures 1.1-1.4).

---

**Figure 1.1.** An ancient papyrus on the lightbox (*P.Sorb. inv. 2245*). There are no overlaps or bare patches between the papyrus strips. We clearly see a kōlésis somewhat to the left of the middle of the image. Photo by Adam Bülow-Jacobsen.

**Figures 1.2.** Diagrams from Hendriks’s original article: 1. the initial cut into the triangular stem; 2. the peeling schematized on a cross-section of the stalk; 3. the peeled section; 4. a peeled section seen from the edge. Reproduced courtesy of Habelt Verlag.
In Latin, parchment was called pergamena (n. pl.) or, much more often, membrana (f.). The most common Greek word is δερματα (derma), but in the fourth century περγαμική (pergamikē) and δέρμα were also used.20 The word parchment comes from the name of the city of Pergamon in Asia Minor, and the ancients believed that the use of untanned skins originated there. Pliny quotes Varro as the origin of the following well-known story: King Ptolemy (V Epiphanes, 205–180 BCE) of Egypt and King Eumenes (II, 197–159 BCE) of Pergamon competed on creating the best library. To thwart his adversary, Ptolemy stopped the exportation of papyrus, and so the Pergamenes invented parchment.21 The story is unlikely to be true, however, for skins were used for writing long before that period; Aramaic parchment documents from Bactria from the fourth century BCE have been found (Shaked 2004), and documents on parchment from the early second century BCE have been found at Dura-Europos.22

Contrary to papyrus, the method of making parchment is well known. Skins, mostly of calf, goat, or sheep, are cleaned, scraped free of hair, stretched while drying, and treated with alum and chalk.23 Parchment, or vellum, as it is also called, is different from leather in that it is not tanned.

When looking at a parchment codex, it is a sobering thought that every double folio page represents a whole sheep or goat.

Wood

Wood in several forms was regularly used for writing.24 Wax tablets, wooden boards (whitened or not), and concertina leaves are the most important of these. In Greek a wooden tablet is called πίνακας, πυκνάς, δελτίον, δελτίδιον, πυκνίον, or γραμματείον. In Latin tabula or tabella is used, or, for a wax tablet, cera.

Wax Tablets

The surface of a wooden board was gouged out, leaving a border at the edge, and the hollow thus created was filled with beeswax. The writing was scratched into the wax with a γραφῆς (Latin stilus), which was a pointed pin of wood, bone, or bronze, whose opposite end was normally formed as a spatula for smoothing out when the scribe wanted to correct something.25 Quintilian recommends writing on wax tablets, although older people may have difficulties because of the low contrast between the writing and the background. Writing on parchment with a pen and
ink, however, disturbs the flow of thought—so Quintilian says—because of the frequent need to dip the pen. Also, he says, it is easier to correct on wax tablets.26 Wax tablets were clearly the everyday notebook for bookkeeping, business correspondence, and literary drafts. The problem is that the wax does not often survive, and the writing is then preserved only in the scratchings left in the wood underneath the wax.27 If holes were drilled in the edge and a string passed through them, wax tablets could be arranged in a kind of codex. The "pages" between the first and the last tablet could be hollowed out and waxed on both sides.

Wax tablets were often written in lines parallel to the long side of the tablet. Thus, when they were bound together into a codex, the notebook would not open with a left and a right page, but with an upper and a lower page.

Wooden Boards

A wooden board covered with white paint presents a very good writing surface for pen and ink and must always have been used. We know that such boards, οὐσίδες, were used in Athens for the publication of official texts, either impermanent ones or before they could be carved in stone.28

In Egypt such boards, whitened or not, are found occasionally, first of all as mummy labels; these are small wooden tablets (never whitened as far as I know) on which the name of the deceased was written in pen and ink or very occasionally incised. The label was attached to the mummy with a piece of string that passed through a hole in the label. Labels of similar design were also attached to sacks or baskets that were sent, for example, to people working away from their families (figure 1.5).

The most spectacular wooden tablets are the codices from the oasis of Dakhla.29 These recent finds are unique in their genre so far and also interesting because of their perfect condition. They are sawn from a block of acacia wood, the

Figure 1.5. Ἱμίων Χαμονοῦ. Wooden label with its string intact (O.Claud. inv. 4271). Photo by Adam Bülow-Jacobsen.

Figure 1.6a-b. A letter written on a folded leaf tablet and a concertina tablet. From T.Vindol. I 383a. Reproduced by permission of A. K. Bowman.
norm apparently being eight leaves from a block. The two outer leaves were sawn to a thickness of about 5 mm, while the inner leaves are 2–3 mm. The separated leaves were marked with notches by the carpenter, so that the original order could be maintained. Holes were drilled at the edge, and a string was passed through them. The boards are normally not whitened, but an inserted leaf in the Isocrates codex is. The text is written in ink in lines parallel to the short side of the tablets.

**Wooden Leaf Tablets**

This type of tablet is known from Vindolanda in northern England, where many have been preserved in anaerobic and humid conditions. Apart from ordinary wax tablets, the site also yielded these unique specimens. They are very thin slices (some as thin as 0.25 mm), but most are 1–2 mm thick and are of alder or birch. The surface, where it is preserved or can be reconstructed, is 16–20 cm by 6–9 cm. If such a slice were to be used for a letter, the lines of writing would normally be parallel to the longest side (thus parallel to the grain of the wood) and in two columns. The leaf was then scored lightly in the middle and folded, and it could be closed and sealed by a string drawn through holes near the left and right edges. The address could be written on the outside. If the text was an account, the writing would often be parallel to the short side of the leaf (i.e., across the grain of the wood). The tablets were again scored and folded, but if the account was a long one, several such diptychs could be tied together to form a “concertina list” (figure 1.6).

---

**Ostraca**

Potsherds were everywhere in the ancient world, since pots, although they can be reused, cannot be recycled like glass or metal once they are broken.

We must distinguish several types of ostraca (in the modern usage of the term): (1) the Athenian type; mostly black glaze (i.e., red-figure) pottery on which ostracisms were written by scratching through the black glaze so that letters are shown by the pink pottery below; (2) the ancient Egyptian type of flat limestone with writing in ink; (3) sherd s of broken pots written on with pen and ink (or brush and ink for the demotic ones); (4) whole pots inscribed with the contents, the origin, the name of the recipient, or similar information.

The regular Greek word for ostraco is δετρακός, whereas Latin does not seem to have a word that covers all the meanings of the Greek term. Testa or testula are used to translate δετρακός in the Athenian sense (type 1 above) of a voting ballot. Ostracum is found very occasionally in texts from Egypt.

---

**Figure 1.7. Athenian ostracon (Kerameikos Museum). Photo by Adam Bulow-Jacobsen.**

Ostraca of the Athenian type are of course preserved under most climatic conditions, while the other two types, even if the ostracon itself is preserved, need a relatively dry climate if the ink is to remain legible (figure 1.7).

Ostraca of the Athenian type do not seem to have been used for purposes other than balloting. Type 3 ostraca, on the other hand, were used for most kinds of writing in Egypt, although they were considered a surrogate for papyrus. Obviously, ostraca were suited only for short texts and could not easily be archived, nor could they be bound together if more than one was needed for a longer text, and letters on ostraca could not be sealed to protect the text from prying eyes. In addition, they were much heavier than papyrus. Nevertheless, all these disadvantages were outweighed by one important advantage: Ostraca were completely free. In many places one only had to bend down and pick them up. However, in places like Mons Claudianus, where stonemasons were employed, we sometimes find ostraca that were prepared for writing with much more care. In a suitable sherd, holes were drilled to mark the circumference of the desired ostracan, and the worker then carved out the writing ostracan using these holes as a guide. In this way one could obtain a pleasant oval or a rounded square. Edges were then beveled, and the writing surface often smoothed, presumably by polishing it in sand. Such ostraca were sometimes washed and used again, but this shaping-procedure was exceptional and is not found in sites where military personnel were predominant (figures 1.8 and 1.9).

The best-known use of Greek and demotic ostraca was for tax receipts, especially in southern Egypt, but there is mounting evidence of their use for all kinds of writing in the desert. In particular, the many Roman sites in the Eastern Desert that have been excavated during the last twenty years continue to produce large amounts of ostraca and very few papyri. This is not difficult to explain: Provisions of wine, salt, fish, olives, oil, and even pickled meat and fish for the people who lived and worked in the desert arrived in jars, mostly the standard Egyptian amphora of about 6½ liters with pitch on the inside, which may have been reused on site but were mostly broken (figure 1.10). So there was never any shortage of ostraca. On the other hand, papyrus had to be brought from the valley.
Letters on papyrus that had arrived from the valley must also have been a temptation when one was in need of kindling. In Coptic, ostraca were also used for tax receipts, but the great mass of surviving ostraca, which come from monasteries, contain letters. It is striking how few Arabic ostraca have been found so far.

Figure 1.9. A good example of a shaped ostracon (*O.Claud. III* 522, natural size). Photo by Adam Bülow-Jacobsen.

Figure 1.10. A giant ostracon (40.5 cm tall) using an almost complete amphora to write a register of post riders (*O.Krok. I* 1). Photo by Adam Bülow-Jacobsen.
INK (μέλαν, atramentum)

In antiquity, ink was what we now call India ink: soot with a little gum arabic suspended in water. Both in China and in pharaonic Egypt ink was kept in blocks, and the writing brush could be inked directly on the block if a little water (spittle) was applied to its surface. Since Greek and Latin were written with a calamus (a reed pen), which had to be dipped into the ink, the scribe had to prepare a quantity of ink every day. The earliest occurrence of metallic ink is from the third century BCE, but from the second century BCE and particularly from the third century onward, the mordant metallic inks make their appearance. These are made from powdered gallnuts, a metallic salt (iron or copper), gum arabic, and water. While the India inks do not fade, iron-gall inks turn from black to brown with time. They may fade to almost the same shade of brown as the papyrus and become very difficult to read. The mordant quality of iron-gall ink makes it more penetrating, but may also eventually damage the papyrus or parchment.

Books in Antiquity: The Volumen and the Codex

Book (Liber, βιβλίον), as far as the ancients were concerned, meant a roll (Lat. volumen). Although the codex format was known at a fairly early time, it was not until the second century CE that it really appeared in Egypt, but already in the fourth century the majority of literary works were written on codices.

The situation is well illustrated by Ulpian (128 CE) commenting on Sabinus (first half of the first century) and Gaius Cassius (mid-first century). The discussion is about what constitutes "a book" when donated in a will:

Under the term books (librorum appellatione) are included all rolls, whether of papyrus or parchment or any other material. And even if they are of rind of the lime or linden tree (as made by some) or of some other bark, the same must be said. But are they due if they are in codex-form, either of parchment or papyrus or ivory or some other material, or of waxed-tablets? Let us see. Gaius Cassius wrote that loose parchments are due also, when books have been bequeathed. Therefore, it follows that the others too will be due, unless this is contrary to the testator's intentions.

So, in Rome, in the first century of our era, a jurist's response was required to decide whether a codex was a book. Yet, when Ulpian wrote in the early third century, the codex was gaining steadily on the roll and in another century would

The Bookroll

The roll was the normal unit in which papyrus was produced and sold. As we have already seen from Pliny HN 13.77, the papyrus sheets were pasted together, twenty a year, and sold as rolls. When a scribe wanted to write a document, he cut a sheet of an appropriate size from the roll, but when writing literature, the scribe presumably used the roll as it was. If the length of the work he was transcribing did not correspond to the length of the roll—and there was no reason it should—he would add on or cut off in order to obtain the right length.

As Pliny has told us, papyrus was commercialized as rolls made up of sheets pasted together. The reason for this was probably that the individual sheets would each present four edges, and the edges are the weakness of papyrus, always presenting a risk of fraying. Pasted together into a roll, the twenty sheets would present only four edges in all, and additional measures were taken to protect the ends. At the beginning of the roll was the protokolion, an unwritten sheet, while at the end there was probably the οὐσαβάλος or umbilicus, the wooden stick around which the papyrus was rolled; but even if no umbilicus was present, the end was protected inside the roll. The sheets of the roll were pasted together in such a way that the left sheet was always over the right one in any given join. The joins are called κόλλησις (singular κόλλησις). If the roll was to be used for demotic writing (from right to left), it was turned 180 degrees. In this way the writer would always write "downward" over the join and feel a minimum of resistance when passing over a "step." The face used first was always the inside of the roll, where the fibers
were parallel to the length of the roll and to the lines of writing. This is not because it is easier to write with the fibers rather than across them, nor is it normally because the surface on the “back” is less well suited for writing. Given a fragment of papyrus without original edges, writing, or kollesis, papyrologists (even experienced ones) will have trouble telling which side is the front and which the back. When a kollesis is present on a fragment, it is easy to see which side is the front and which side is the back since the kollesis on the front makes a break in the fiber pattern. However, it is much more difficult to see the join from the back, where the edge of the sheet follows the same direction as the fibers (“vertical”). The reason for having the “horizontal” fibers on the inside and the “vertical” on the outside was probably that vertical fibers would be squeezed together and risk detachment if they were on the inside.

The writing would be on the inside, front, in columns (seidades, paginae) unless the document was written transversa charta (i.e., “having turned the papyrus”), in which case it would present one long column running down the roll with lines of writing across the fibers (figure 1.13).28

For practical reasons, a bookroll could be written on one side only. When we find, as we often do, that there is writing on both sides of a papyrus, we are dealing with an example of reuse. Quite often a roll would be turned inside out when the primary writing was no longer of interest, and the back could be used for further writing. Of 3,265 literary rolls listed in the LDAB, more than 400 are examples of literature written on the back of documentary rolls that have been turned over. There are also several examples of demotic literature that was written on the back of Greek rolls, although demotists have a tendency to consider the demotic text as the “recto” or the front, regardless of the fiber direction and other evidence.

The height of the roll depended on the constituent sheets, not, as we have seen, on the quality of the papyrus, and ranges from 15 cm to more than 40 cm (a height of 20–30 cm is normal). The length of the bookroll was theoretically unlimited, and Ulpian mentions, for the sake of the argument, the possibility of getting all forty-eight books of Homer onto one roll.29 Ancient Egyptian rolls could be very long (the longest known exceeds 40 meters), but most of these very long rolls are ornamental copies of the Book of the Dead, meant to be buried with the deceased, not to be read in this world. Greek rolls were no longer than 10–11 meters and generally much shorter, but few complete Greek rolls exist, and the original length of a fragmentary roll is mostly a theoretical projection on the basis of letters per line and lines per column calculated against a known text.

To modern people who are used to the codex format, the disadvantages of the roll seem many: It does not readily contain more than part of a prose work, like, for example, a book of an historian; it has to be rolled back when read; and it is difficult to refer to a passage. Besides, the roll is fragile. The edges fray, especially the lower edge, which may rub against the reader’s clothing, and the roll is easily torn.
probably not. I believe that these texts may give us a glimpse of what books in the Pergamon library looked like.

The Codex

To understand the development of the codex, consider that, if the material is not papyrus but rather tablets or parchment, the bookroll is not a natural result. Neither tablets nor parchment have frail edges that need protection, and they are more difficult to concatenate. Parchment rolls are sewn together, not glued. The "concertina" tablets from Vindolanda (mentioned earlier) have been regarded as precursors of the codex but could also have been an attempt to make a roll. Wooden or waxed tablets might also have been concatenated like sheets in a roll.32

The format adopted when a longer text was to be written on tablets or parchment was the codex (canales, pugillares, membranae), which began its career far from the bookroll's world of classical literature. Letters, drafts, and accounts were routinely written in this form, not least, of course, outside Egypt, where papyrus was less easily obtained. A natural way to link tablets together is to bore holes in one edge and bind them with a piece of string or a leather thong. This way, both sides of the tablet are useable, the inner surfaces are protected, the "book" can be sealed if it contains a letter, and it is easily transportable. Such books, with as many as fifteen leaves (thirty pages), are well known from a number of places in the Roman Empire. The special case of the Dakhla tablet books has already been described, but waxed tablets were undoubtedly more common.

Latin authors also mention notebooks made of parchment, called membranae.33 The point of departure here would be a large sheet of parchment that was folded and cut at the edges, precisely like modern printed books before the
bookbinders began to do it for us. A sheet folded once in each direction will produce four leaves or eight pages, a "quarto" format. Folding once more makes an "octavo" format of eight leaves, and so on. These folded sheets, called "quires" in English (derived from Latin quaternio [a set of four]), are then sewn together with other quires to form a codex. By following this procedure, one automatically obtains the aesthetically pleasant effect that any opening of the finished, cut book presents two pages of "flesh side" or two pages of "hair side."

All this is quite different, however, if you want to make your codex of papyrus, as would be natural in Egypt. Here the starting point is the roll made of sheets pasted together. This roll must be cut into sheets twice the width of the desired page and folded once in the middle. The early papyrus codices were often made as "single quire" codices, in which the cut sheets were placed in a pile (normally all with the front up), which was folded in the middle. This method put great strain on the outer leaves and produced an irregular and fragile front edge. Every possible method seems to have been tried, and, besides the single-quire codices, there are papyrus codices that range from one to at least five sheets per quire. Eventually, however, a preference for the quaternio (four sheets per quire) was established. The principle of facing pages having the same surface was, as we saw, automatic with parchment, but with papyrus it was not. Apart from the single-quire codices, a practice seems to have developed in which the outside leaf in a quire normally had horizontal fibers and the following ones alternated, so that an opening always showed two facing pages with the same fiber direction. Sometimes the codex is well enough preserved to permit reconstruction of the roll from which the leaves were cut (figure 1.15).

The competition between the roll and the codex lasted a couple of centuries but was eventually completely won by the codex. It seems that the Christians took to the codex with alacrity, perhaps because the roll was associated with classical elite, literary culture, while the first Christians were mostly humble people who were more used to accounts and business letters than to Homer and Aeschylus. Presumably they also wanted their books to be different from the Jewish Torah rolls. The codex was also easier to refer to, simpler to transport, and more economical since the back of the sheet could also be used. As early as the second century, when the struggle had just begun, only about 4 percent of 1,772 papyri of classical literature were codices, whereas 75 percent of 37 Christian works were codices. In the third century, 13 percent of classical texts were written in codex form, while 75 percent of the Christian works were codices. In the fourth century the codex had already claimed 64 percent of classical literature and 81 percent of Christian. By the fifth century 90 percent of classical and 95 percent of Christian literature was in codex form (table 1.2). The era of the literary bookroll had definitely ended.46

Figure 1.15. A reconstruction of the roll from which the first four sheets for a codex were cut. As is evident, no account is taken of the original kollései. From J. Scherer, Extraits des livres I et II du Contre Celse d'Origène d'après le Papyrus no. 88747 du Musée du Caire, Cairo (1956).

Table 1.2. The replacement of the volumn by the codex

<table>
<thead>
<tr>
<th>roll</th>
<th>codex</th>
<th>dates for roll and codex</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC3</td>
<td>BC2</td>
<td>BC1</td>
</tr>
<tr>
<td>AD1</td>
<td>AD2</td>
<td>AD3</td>
</tr>
<tr>
<td>AD4</td>
<td>AD5</td>
<td>AD6</td>
</tr>
<tr>
<td>AD7</td>
<td>AD8</td>
<td></td>
</tr>
</tbody>
</table>


NOTES

2. See, for example, Pliny HN 15, 69.
6. Theophr. HP 4, 8, 5; Pliny HN 13, 70.
8. Ragab (1980, 52–53). Contrast, however, Ragab (1988, 514–515), who states that the plants in his plantation came from the Sudan. Moreover, Basile (1998, 29) claims that, around 250 BCE, Hieron II had transported the plant from Egypt to Sicily, where it was used only for cordage since the Sicilians did not know the secret of paper making.
9. Thompson (1965, 23): "His description applies specially to the system of his own day; but no doubt it was essentially the same as had been followed for centuries."

10. This translation is based on a correction of the text, which I propose with some hesitation. The manuscripts have diviso aec (divided by a needle). Attempts to make sense of this have led to various interpretations, such as Hendriks (1980) (discussed later) or Lukaszewicz (1997), but all difficulties would disappear if we were to accept diviso ac<<c>>ulo<<c>>ll as a lacuna in the archetype.


12. Tait (1988). See also Clarysse (1993). Delange (1990) gives examples of demotic papyri written with carbon ink and a reed brush, while, in the same document, the Greek subscription is written in metallic ink with a calamus.


17. Lewis (1989, 22): "How did the 'clever workshop' make the papyrus thinner? By malleting?"


19. See, for example, Turner (1980) but also Lewis (1981).


22. Roberts and Skeat (1983, 5–7) do not believe that the story can be true; they cite arguments from a thesis by Richard R. Johnson, "The Role of Parchment in Greco-Roman Antiquity" (Ph.D. diss., University of California, Los Angeles, 1968), which I have not seen.

23. For references to more detailed descriptions, see Turner (1968, 9 and 9491).


25. Quintilian (Inst. Or. X, 4) even claims that the erasing capacity of the stylus is at least as important as its capacity to write.

26. Quintilian, Inst. Or. X, 3, 31–27. See, for example, T.Vindol. (= Speidel (1996)).

27. See, for example, Andokides, περὶ τῶν μνημείων 88; Lysias XXVI 10.


30. A perfect example is T.Vindol. II 310 (figure 1.6a). A similar type of folded leaf tablet is P.Yadus 54.

31. See T.Vindol. I, 4 (figure 1.6b).

32. Cuvigny et al. (2003 II 470–473) present a more thorough analysis of the use of ostraca than the space here permits. There are also quotations from unpublished ostraca that present excuses for not writing on papyrus.

33. See also Cocke (1983, 150).

34. τοῦ μελαμ ταις βεβαιωμ ("to grind the ink"); see, for example, Demosthenes, De Corona 258.


37. The most recent and comprehensive description of the bookroll is Turner (1978).

38. This was apparently customary when writing to the senate in Rome; cf. Suetonius, Div. Inst. 52.6.

39. Justinian, Digesta. 32.1.52.11. On a conservative estimate such a roll would have been a monster of about 140 meters.

40. Chester Beatty Library, inv. W 145. See the description in Quecke (1975). See also P.Köln IV 174, which is part of the same roll and where the full bibliography may be found.

41. Greek ααιδής, but no proper Greek word seems to have existed.

42. This format is in fact found in Nimrud, where waxed ivory tablets of the late eight century BCE were hinged together to make a concertina (Wiseman 1955; Howard 1955). These waxed tablets were made of wood and ivory and contain writing on both sides.

43. Passages illustrating books and reading are conveniently collected in Kenyon (1951: 121–124).

44. To me, there is little doubt that the papyrus codex is derived from the parchment codex, but the great specialists on the matter, Roberts and Skeat (1983), see it differently. Two chapters of their book are devoted to various theories about both this and the Christian preference for the codex.

45. For makeup and statistics on the early codex see Turner (1977).

46. LDAB.

---

BIBLIOGRAPHY


Turnhout: Brepols.


Turnhout: Beoods.


Ragab, H. 1980. Le papyrus [Contribution à l'étude du papyrus (Cyperus papyrus. L) et à sa transformation en support de l'écriture (papyrius des anciens)]. Cairo: Dr. Ragab Papyrus Institute.