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JUST A LITTLE ROUGH AROUND THE EDGES: THE USE OF PUMICE ON PAPYRUS[1]

Brent Nongbri
MF Norwegian School of Theology, Religion, and Society

Abstract

Papyrological handbooks published in the second half of the twentieth century suggest that pumice was used in antiquity to smooth the surface of papyrus in preparation for writing. Experimentation with modern papyrus and pumice calls this claim into question. The ancient literary references to pumice and papyrus, when they are properly understood, demonstrate that when pumice was used on papyrus rolls in antiquity, it was not used for the purpose of smoothing the writing surface. Pumice was instead used to smooth the *frontes*, the top and the bottom of the closed papyrus roll. This fact that was quite well established at the end of the nineteenth century, but it seems to have been largely forgotten over the course of the second half of the twentieth century.

Keywords: Roman book production, papyrus manufacture, papyrus rolls, pumice, *pumex*, *frontes*, voluminology

The volcanic rock pumice (Latin *pumex*, Greek κίσηρις or κίσηλις) was used in antiquity for several different purposes, including a variety of medical usages and for depilation.[2] The application of pumice was also a routine part of the preparation of animal hide writing surfaces. Several ancient and medieval discussions of the production of parchment mention the use of pumice at different stages in the process and in different forms

[1] I am grateful to the journal's editors and the three anonymous reviewers for their helpful critiques and suggestions. Thanks also to Mary Jane Cuyler, AnneMarie Luijendijk, Ariadne Kostomitsopoulou Marketou, and Candida Moss for feedback on earlier versions of this essay and to Felicity Harley McGowan for a crucial bibliographic assist. Thanks also to the staff of the library at the American Academy in Rome. This research was supported by the Research Council of Norway, project 314240.

[2] See Pliny's discussion of pumice in *HN* 36.42. See also Dioscorides, *De materia medica* 5.108.

(as a stone and as a powder or paste).[3] These recipes seem to suggest that the purpose of the pumice was twofold. At the macro level, it continued and refined the work of smoothing begun by using a blade to scrape the skin while it was held under tension. That is to say, it helped with the removal of the last bits of hair and fatty matter from the skin. At the micro level, it also abraded the skin, making it more receptive to ink.

Given that pumice played this role in the preparation of animal hide writing surfaces, it is perhaps natural that references to the use of pumice on papyrus in ancient literature have sometimes been understood in a similar manner. Such claims can be found regularly in the introductory literature. Italo Gallo, for instance, states that smoothing with pumice was a step in the production of papyrus. According to Gallo, after the thin strips cut from the papyrus stem had been pressed together in perpendicular layers, the resulting papyrus sheet "was then allowed to dry, and was finally polished with a pumice stone, an ebony tool, or a shell."[4] Eric Turner's introduction to Greek manuscripts also favors the idea that pumice was used to smooth the writing surface of papyrus.[5] Introductory handbooks from a century earlier also mention pumice, but they note that it was used to smooth the cut top and bottom edges of

[3] For a collection of the medieval Latin instructions for making parchment, see R. Reed, *Ancient Skins, Parchments and Leathers* (London 1972) 118-173. For a set of instructions in Coptic preserved on papyrus (now *P.Bodm.* 58), see W.E. Crum, "A Coptic Recipe for the Preparation of Parchment," *Proceedings of the Society of Biblical Archaeology* 27 (1905) 166-171.

[4] See I. Gallo, *Avviamento alla papirologia greco-latina* (Naples 1983) 24: "veniva asciugato, levigato con la pomice o un utensile di avorio o una conchiglia." (=I. Gallo, *Greek and Latin Papyrology* [trans. M.R. Falivene and J.R. March; London 1986] 7)

[5] E.G. Turner, *Greek Manuscripts of the Ancient World* (2nd ed.; ed. P.J. Parsons; BICS Supp. 46; London 1987) 7 (also 5, n. 10). So also E.G. Turner, *Greek Papyri: An Introduction* (Oxford 1980) 3. See also the more recent comments of A. Willi, *Manual of Roman Everyday Writing, Volume 2: Writing Equipment* (The LatinNow Project 2021; https://latinnowepubs.github.io/WritingEquipmentVol2/mobile/index.html) 75: "Roman authors mostly refer to its [pumice's] use for smoothing their book pages, i.e. papyrus." Similarly, T.C. Skeat, "Early Christian Book-Production: Papyri and Manuscripts," in G.W.H. Lampe (ed.), *The Cambridge History of the Bible Volume 2: The West from the Fathers to the Reformation* (Cambridge 1969) 54-79 at 55: "The [papyrus] sheet thus formed was then trimmed, and the surface smoothed with pumice." So also R. Winsbury, *The Roman Book* (London 2009) 17: "The inner surface was smoothed by rubbing with a pumice stone." For a similar statement in German scholarship, see H. Blanck, *Das Buch in der Antike* (Munich 1992) 58: "Das…Blatt (griechisch: kollema) wurde anschließend an der Sonne getrocknet und dann geglättet, wozu man sich eines Bimssteines, gelegentlich auch einer Muschel oder eines Elfenbeinstabes bediente." This list could go on.

papyrus rolls rather than the writing surface.[6] Some practical experiments with modern papyrus suggest that the older handbooks are correct. Furthermore, the ancient literary references, when properly translated and understood, support this conclusion. Unless new evidence comes to light, we should hesitate to accept that pumice was normally used on the actual writing surface of papyrus.[7]

Experiments with Modern Papyrus and Pumice

Recent study has shown that the physical and chemical properties of modern commercially available papyrus differ from the properties of ancient papyrus and of modern papyrus produced following a process that more closely resembles that described in Pliny's account.[8] In addition, the exact sort of pumice used by ancient book makers has never been studied, to the best of my knowledge. I am aware of only one relevant contextualized archeological find of what may be a writer's pumice stone, the so-called "Tomba dello scriba" found during the excavation of the necropolis of the Via Triumphalis in the Vatican and dated to the first third of the second century CE. The items found in the assemblage in

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[6] See, for instance, E.M. Thompson, *Handbook of Greek and Latin Palaeography* (New York 1893) 56; T. Birt, *Die Buchrolle in der Kunst: Archäologisch-antiquarische Untersuchungen zum antiken Buchwesen* (Leipzig 1907) 236-238; and J.W. Clark, *The Care of Books* (Cambridge 1901) 28.

[7] At the time when this article was first submitted in 2021, I was not aware of any other recent investigations of the ancient use of pumice on papyrus. I can now report two brief enquiries in this area that reach conclusions similar to what is presented here. See Miriam Blanco Cesteros, "Ὀδοντίζω: New Clues on Ancient Book Production from Alchemical Papyri," *Nuncius* 35 (2020) 1-19, at 9 n. 31. And thanks to one of the journal's anonymous peer reviewers for alerting me to an unpublished thesis from 2023 that also touches on this topic: M. Freeman, *The Hands That Write: Life and Training of Greco-Roman Scribes* (Ph.D. dissertation, Duke University, 2023).

[8] For broad overviews of techniques for manufacturing papyrus based on practical trials and experiments, see H. Ragab, *Le Papyrus* (Cairo 1980); C. Basile and A. Di Natale, "Un contributo alla manifattura dei papiri: esperienze, teorie, nuove ricerche," *Quaderni dell'Instituto Internazionale del Papiro* 7 (1996) 85-135 and C. Basile and A. Di Natale, "Ancora sulla manifattura del papiro. Alcune osservazioni," *Quaderni del Museo del Papiro* 16 (2019) 177-196. For a more recent approach with more explicitly quantifiable data, see F. Bausch, M.J. Rosado, J. Rencoret, et al., "Papyrus Production Revisited: Differences Between Ancient and Modern Production Modes," *Cellulose* 29 (2022) 4931–4950 https://doi.org/10.1007/s10570-022-04573-y. The authors conclude that "the analytical data clearly show the involvement of a strong alkaline treatment followed by chlorine bleaching for commercial papyri, as expressed by higher pH values, altered lignin structures, and chlorinated lignin compounds" (4931). An online video describing the current methods of papyrus production in Egypt mentions that after the papyrus strips are cut from the reed, they are typically soaked in hot water and potassium hydrate before being rinsed with water and chlorine ("Meet Some of the Last Papyrus Makers in Egypt," https://youtu.be/SBdVhvo2UUM, last accessed 29 August 2024).

the tomb include a cylindrical bronze inkwell, at least one stylus, and a hemispherical piece of pumice.[9] Many examples of hemispherical pumice stones of similar size survive from Pompeii (often housed in bronze casings), but they either lack a clear archaeological context or are part of what appear to be cosmetic kits.[10] In any event, for the purposes of the present discussion, the point is moot, as the surviving stones do not provide any precise indications of exactly how they may have been used in the production of papyrus books.

Despite these unknowns, it seemed useful to conduct some experiments with modern materials to observe the effects of pumice on papyrus. Figures 1-3 below illustrate the results of experiments in which a pumice stone was rubbed against the surface of three types of modern papyrus—commercially sold papyrus prepared in Egypt (Figure 1), commercially sold papyrus prepared in Italy (Figure 2), and homemade papyrus produced only by drying strips of papyrus reed under pressure with no additional processing (Figure 3).[11] Figures 1-3 show the horizontal fibers of papyrus surfaces before and after 10 seconds of moderate rubbing with a pumice stone. The images show the papyrus under magnification using a Dino Lite digital microscope.

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[9] See E.M. Steinby, *La necropolis della Via triumphalis: Il tratto sotto l'Autoparco Vaticano* (Rome 2003) 106-108.

[10] See the two hemispherical pumice stones in bronze casings that were found together with a set of toiletries in the Casa delle Origini di Roma in Pompeii (V 4, 13), discussed and illustrated in R. Berg, *Il* Mundus Muliebris *a Pompei: Specchi e oggetti da toletta in contesti domestici* (Rome 2023) 122-123, 382-386 and tavola 35 (Pompeii inv. 55394 and 55395). Other similar pumice stones and/or their bronze casings found in Pompeii have less specific archaeological contexts: inv. 6828 (I, 8, 11 and 17, a house); inv. 6842 (I 8, 5-6, a house attached to a tavern); inv. 7150 (I 8, 12, a workshop and stable area); inv. 10796 (I 11, 6, the atrium of a house); inv. 12219 (I 14, 13, a shop); inv. 14130 (unspecified area north of VII 16). See S. Tassinari, *Il vasellame bronzeo di Pompei*, 2 vols. (Rome 1993) 1.73-1.74.

[11] The Egyptian papyrus was purchased from Römer Shop (https://www.der-roemer-shop.de/Papyrus-sheet-40x30cm-natural-border). The Italian papyrus was purchased from Zecchi in Florence and produced by Papyrus Tarascio in Siracusa (I trust that the sellers are reporting the origins of the materials accurately). I prepared the homemade papyrus using a sample generously provided by the Botanical Garden of the Natural History Museum at the University of Oslo. Thanks to Charlotte Sletten Bjorå for harvesting the stalks.

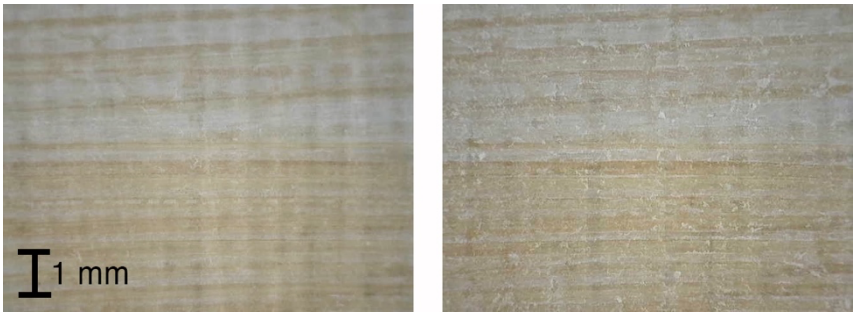

Figure 1: Modern commercial papyrus from Egypt before rubbing with pumice stone (left) and after (right)

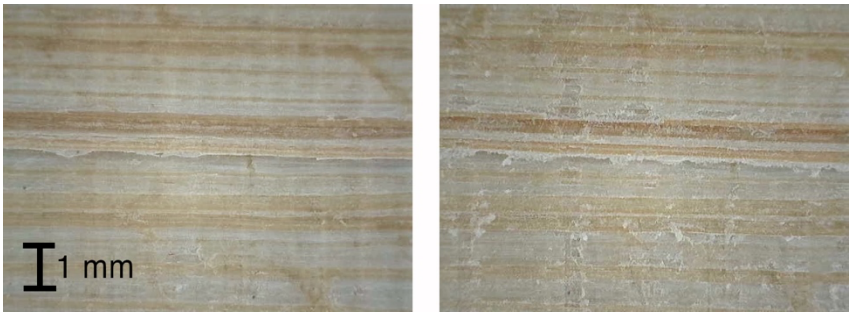

Figure 2: Modern commercial papyrus from Italy before rubbing with pumice stone (left) and after (right)

Figure 3: Modern homemade papyrus before rubbing with pumice stone (left) and after (right)

All three examples resulted in an abraded surface after treatment with pumice. The tearing is somewhat more severe on the homemade papyrus sample (Figure 3) presumably because it was considerably finer—that is, less thick—than either of the commercial samples and perhaps also because it was more recently produced and may have retained more moisture.

As one might expect, adjusting the pressure that one applies to the pumice stone can increase or decrease the level of tearing. Also, the porousness of the pumice stones can vary widely and affect the level of tearing (see Figure 4).

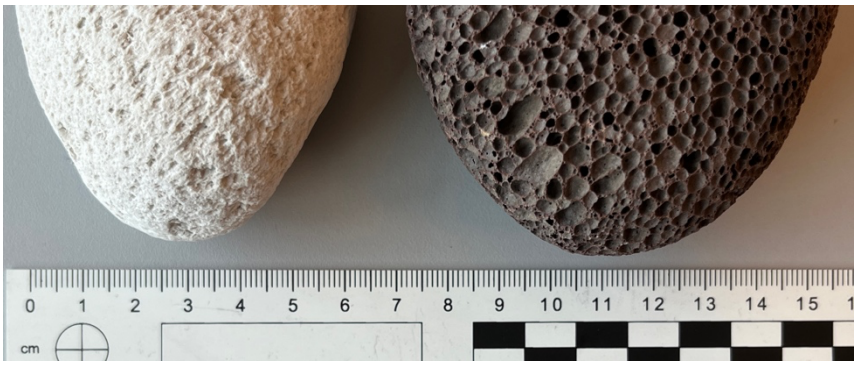

Figure 4: Two modern pumice stones

In the samples shown in Figures 1-3, I used the finer pumice stone shown on the left in Figure 4. The more porous pumice stone on the right simply shredded the papyrus. In none of the trials did rubbing papyrus with pumice create a smoother writing surface.[12] Rather, rubbing pumice on modern papyrus *tears away* parts of the writing surface in an irregular and unpredictable way.

When viewed under magnification, ancient papyri sometimes show patterns of damage that appear similar to what we see in the images of modern papyrus treated with pumice. Examples of this type of damage are provided in Figure 5, which shows micrographs of abraded surfaces of three seemingly well-produced papyrus rolls that were probably

[12] Depending on the methods used for the production of the papyrus, it is debatable whether any such "smoothing" would be necessary after the papyrus sheet was dry. Papyrus produced by compressing the layers of strips together with a rolling pin and drying the sheets under heavy pressure yields a surprisingly smooth surface, considerably smoother than the surface of most modern commercial papyrus.

copied in at some point in the first three centuries of the common era (*P.Dura* 2, *P.Oslo* 3.169, and *P.Wash.Univ.* 2.67).[13]

Figure 5: Three ancient papyrus rolls showing surface abrasion that has torn away ink as well as the upper layer of papyrus (*P.Dura* 2, *P.Oslo* 3.169, and *P.Wash.Univ.* 2.67)

Although there are some similarities in the rough appearance of these writing surfaces and that of the pumiced modern papyrus in Figures 1-3, in the ancient examples, the ink has also torn away along with the surface of the papyrus. The loss of ink in addition to papyrus suggests that such damage was the result of surface abrasion that took place *after* the papyrus was inscribed. Such abrasion might have been caused by two papyrus surfaces rubbing against each other over time, by sand, or by other abrasive agents (or some combination of these factors).

The simple experiments described above show that treatment with pumice is not useful for improving the writing surface of modern papyrus. If papyrus produced in antiquity responded to pumice in a similar manner, then ancient producers and users of papyrus would have been unlikely to use pumice as a part of the process of preparing the surface of papyrus for writing.[14]

[13] *P.Dura* 2 (TM 59208) is a fragment of a papyrus roll probably containing Appian, usually assigned to the third century (certainly no later than 256 CE). *P.Oslo* 3.169 (TM 63584) is a fragment that appears to have come from a papyrus roll that has the remains of an unidentified text in Greek. It was assigned by its editor to the second century CE. *P.Wash.Univ.* 2.67 (TM 63306) is a fragment from a roll that contained an unknown medical treatise assigned by its editor to the early second century CE.

[14] This is not to say that pumice had no use for the surface of the roll *outside* the written area. Although we lack any ancient evidence for the practice, it is plausible that pumice could be used to treat uneven or fraying edges of κολλήσεις, the points of overlap at which independent sheets (κολλήματα) are pasted together. I am grateful to one of the anonymous peer reviewers for the suggestion.

The Ancient Literary Evidence for Pumice and Papyrus

These observations actually fit quite well with the ancient literary evidence. In his famous account of the production of papyrus, Pliny suggests that only *smooth* objects, such as a tooth or shells (*dente conchave*), were used to reduce rough spots on freshly made papyrus.[15] In his discussion of papyrus in Book 13, Pliny makes no mention of gritty materials like pumice. In his direct discussion of pumice in Book 36, however, Pliny does cite Catullus in connection with the use of pumice on "books" (using the term *libri* rather than *papyrus* or *chartae*).[16] And indeed, the writings of Catullus and other Latin poets do mention with some frequency the use of pumice as a part of the production of deluxe papyrus rolls.[17] In these passages, however, the purpose of applying pumice is not to smooth the writing surface of the papyrus. The following survey of the relevant ancient texts shows the problem and also presents the solution.

The texts and translations below are drawn from the Loeb Classical Library editions, but I will occasionally take issue with a particular word or phrase. In what follows, I leave aside discussion of the many tropes and plays on words and focus exclusively on these lines as descriptions of the process of writing and of the characteristics of papyrus rolls as material

[15] Plin. *HN* 13.74-82. See also the commentary in N. Lewis, *Papyrus in Classical Antiquity* (Oxford 1974) 34-69. Martial (14.209) also commends the use of a shell (*concha*) for smoothing the writing surface of papyrus. Rubbing a smooth shell or bone on modern papyrus *presses down* the fibers to create a flatter writing surface over which the nib of the reed pen can move with fewer skips. This is quite different from the tearing effect of rubbing pumice on papyrus.

[16] Plin. *HN* 36.42, in reference to Catull. 1.1, to be discussed immediately below. The Loeb edition of D.E. Eichholz first published in 1962 (and reflecting the earlier consensus) adds a footnote to this passage: "Catullus refers to the use of pumice in smoothing the edges of the book roll."

[17] We also find reference to pumice in lists of tools associated with writing in book 6 of the *Greek Anthology*, 62 and 295. The exact use of the pumice in 6.62 is ambiguous; the pumice is simply described as being from the sea. In 6.295, however, it is possible to interpret the pumice as being used on the writing surface, as the pumice is said to be for "polishing" or "smoothing" (λεάντειραν), a phrasing that could indicate use of pumice on the ends of the closed roll or on the writing surface. Yet, six other very similar epigrams that also list writing tools but do not specifically mention pumice (6.63-6.68), state that rough or porous stones serve to sharpen the reed pen. In 6.62, a knife (σμίλαν) is used for that task.

objects.[18] We may begin with the passage in Catullus to which Pliny referred, the opening lines of the opening poem of Book 1:

> *cui dono lepidum novum libellum*
> *arido modo pumice expolitum?*
>
> To whom am I to present my pretty new book,
> freshly smoothed off with dry pumice-stone?

The dry pumice has been applied *modo*, which I might render in this context as "just now" (that is, "freshly smoothed off" in the sense that the use of the pumice stone represents one of the concluding steps of the book-making process). The implication is that the smoothing with pumice has taken place *after* the papyrus has been inscribed, and the *libellum* is ready to be given away. Martial seems to imply a similar scenario. When he reflects on the ways that one author might steal the work of another, Martial sarcastically(?) recommends trying to obtain a copy of an unfinished work rather than one that is already well known (1.66):

> *mutare dominum non potest liber notus.*
> *sed pumicata fronte si quis est nondum*
> *nec umbilicis cultus atque membrana,*
> *mercare: tales habeo; nec sciet quisquam.*
>
> A well-known book cannot change author.
> But if you find one whose face is not yet smoothed by the pumice stone,
> one not embellished with bosses and parchment cover,
> buy it. I have such, and nobody will be the wiser.

The idea is that the would-be plagiarizer might be able to find a papyrus roll that is *already* inscribed with a text but "not yet" (*nondum*) had its *frons* polished with pumice. The translation of *frons* as "face" may give the impression that the writing surface itself is under discussion, but in reference to papyrus rolls, the *frontes* are the top and bottom of the closed roll.[19] As Theodor Birt succinctly phrases it in reference to this passage, "Die *frontes*

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[18] For an excellent exposition of these dimensions of the language, see S.A. Frampton, *Empire of Letters: Writing in Roman Literature and Thought from Lucretius to Ovid* (Oxford 2019).

[19] The old Loeb edition of Walter Ker, first published in 1919, translated *fronte* as "ends." Similarly, the earlier Budé edition (by H.-J. Izaac, first published in 1930) uses French *bords* ("edges"), but the more recent Budé edition (by Sophie Malick-Prunier in 2021) uses *front* ("forehead"). Paul Barié and Winfried Schindler opt for the German *Ränder* ("edges"); see P. Barié and W. Schindler, *M. Valerius Martialis: Epigramme* (Berlin 2013).

libri…sind der obere und untere Schnitt des geschlossenen Konvoluts; denn die *frons* heißt *pumicata* (Martial I 66, 10); *pumex* aber diente dazu, diesen Schnitt zu glätten."[20] That is to say, in the order of events envisioned in this passage, the "polishing" is taking place *after* the roll was inscribed and applies to the *frons* and not to the area of the papyrus that is inscribed.[21] Martial elsewhere (4.10) describes another new book in similar terms:

> *Dum novus est nec adhuc rasa mihi fronte libellus,*
> *pagina dum tangi non bene sicca timet...*
>
> While my little book is new, the edges not yet trimmed
> and the page, still damp, afraid to be touched...

The translator's "page" is perhaps not an ideal English rendering of *pagina*.[22] What is wet is the newly written columns themselves; the ink is fresh and not to be touched. The ink has been inscribed on the papyrus, but the *frons* is still not shaven or smoothed (*nec adhuc rasa*). Pumice is not mentioned explicitly here, but the smoothing process again applies to the *frons* and again takes place *after* the roll is inscribed with text.[23] Martial seems to presuppose a similar order of events in 8.72:

> *Nondum murice cultus asperoque*
> *morsu pumicis aridi politus*
> *Arcanum properas sequi, libelle*
>
> Not yet decked in purple
> and polished by the bite of dry pumice,
> you hasten, my little book, to follow Arcanus

So also Horace, who addresses one of his books as follows (*Epistle* 1.20):

> *Vortumnum Ianumque, liber, spectare videris,*
> *scilicet ut prostes Sosiorum pumice mundus.*
>
> You seem, my book, to be looking wistfully toward Vertumnus and Janus,

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[20] Birt (n. 6) at 236. See also T. Birt, *Das antike Buchwesen in seinem Verhältniss zur Litteratur* (Berlin 1882) 364-365.
[21] There is a similar implication of pumice being the finishing touch on a literary production in Prop. 3.1.8: *exactus tenui pumice versus eat*, the poetry is brought to completion by the use of fine pumice.
[22] All the editions cited above in note 19 use the equivalent of "page" (*page*, *Seite*).
[23] Martial elsewhere pairs the verb *rado* with *pumex* (1.117: *rasum pumice*).

> in order, forsooth, that you may go on sale, neatly polished with the pumice of the Sosii.[24]

The application of pumice here seems to take place at the bookseller—so, again, presumably after the text itself has been copied.[25] Given this order of events, what is the point of polishing a papyrus roll with pumice? A hint is provided in Ovid's description of a sad bookroll that has been denied luxury production techniques (*Tr.* 1.1.11-12): [26]

> nec fragili geminae poliantur pumice frontes,
> hirsutus sparsis ut videare comis.
>
> Let no brittle pumice polish your two edges;
> I would have you appear with locks all rough and disordered.

As we have seen, when the location to which pumice is applied to the roll is specified, it is the *frons*. Thus, when it comes to the preparation of literary papyrus rolls, the purpose of rubbing with pumice was to smooth the top and bottom of the papyrus roll, to clear these areas of any loose fibers that might remain from the initial cutting of the sheets for the roll.[27]

A Second Experiment with Modern Materials

Once again, experiments with modern papyrus are compatible with this interpretation. When I cut papyrus sheets for making model codices, I use an X-Acto knife in combination with a steel straight edge on a firm PVC cutting board. Generally, this results in a very clean cut and smooth edge (See Figure 6).

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[24] The editor of this Loeb edition (first published in 1926), added a footnote here: "The pumice was used to smooth the ends of the roll."
[25] Horace mentions the Socii as booksellers at *Ars P.* 345, and a scholion on that line attributed to Pseudo-Acron adds the detail that the Socii were two brothers.
[26] For a very similar reference to the use of pumice, see Tib. [Lygdamus], *Elegiae* 3.1.9-14.
[27] Given that this meaning is quite clear from the examples given so far, it makes sense to interpret the somewhat more ambiguous phrasing in Catull. 22 (*pumice omnia aequata*) in a similar way.

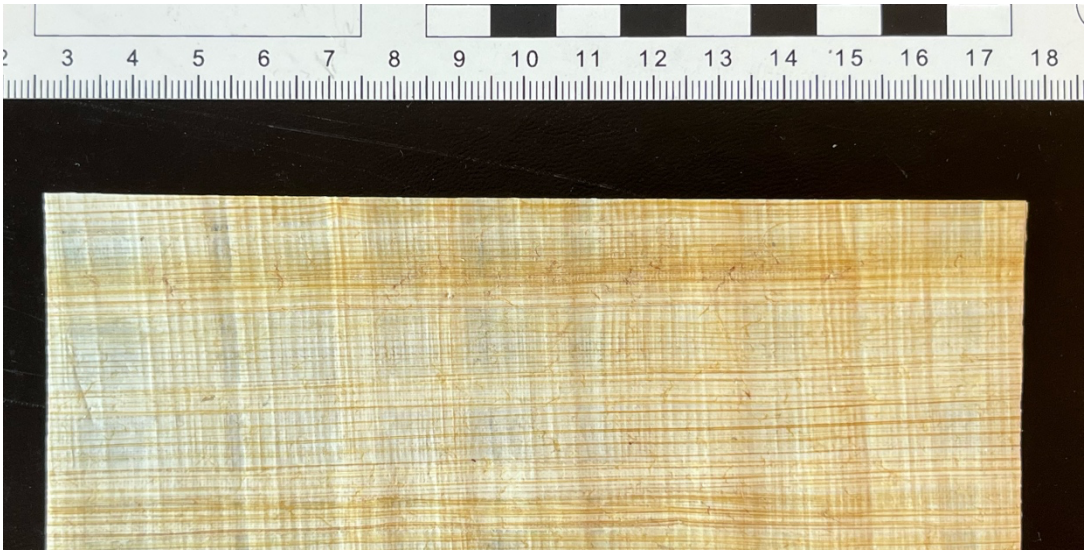

Figure 6: Modern commercial papyrus cut with sharp X-Acto blade

Even using these well-made modern tools, however, I sometimes will get a split fiber or two along the cut. Cutting with a somewhat duller blade (say, a typical kitchen knife) can produce a rougher edge, as some tearing of the fibers occurs (see Figure 7).[28]

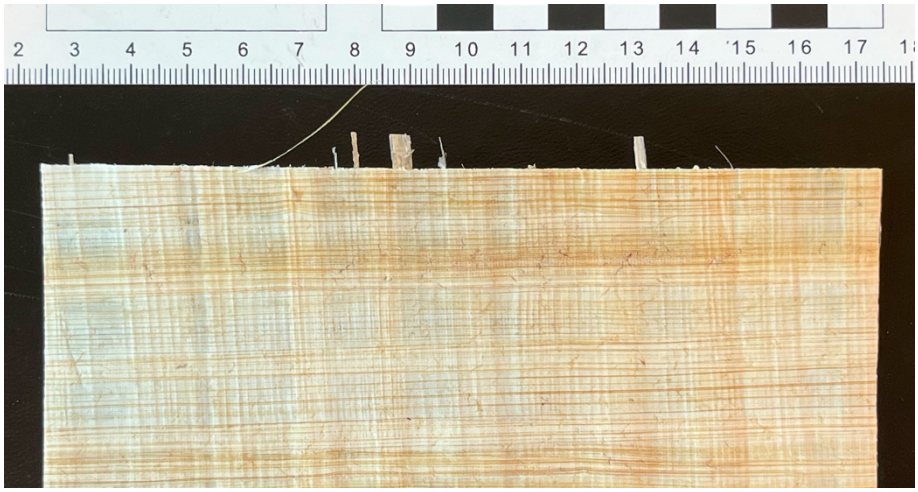

Figure 7: Modern commercial papyrus cut with a kitchen knife

Yet, this rough edge can be smoothed quite easily with just a few strokes of a pumice stone (see Figure 8).

[28] Cutting papyrus with a replica of ancient iron scissors yields a clean cut comparable to what is achieved with the X-Acto blade, but maintaining a straight edge is challenging.

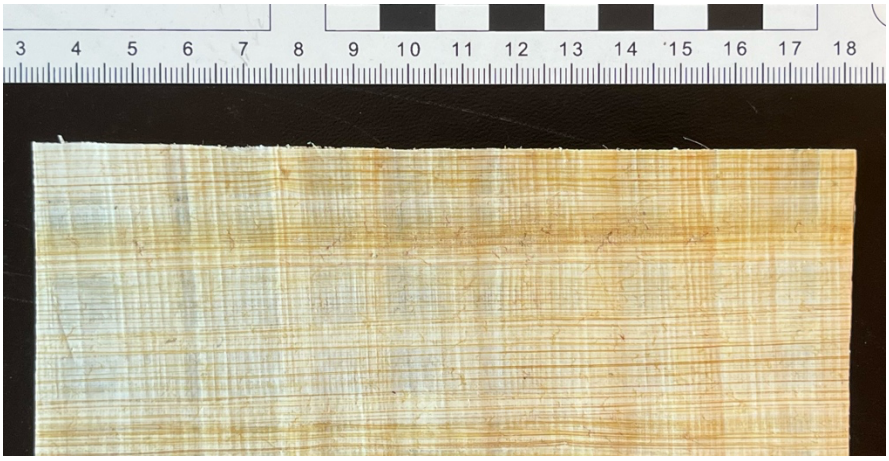

Figure 8: Modern commercial papyrus cut with a kitchen knife and then rubbed with a pumice stone

Experiments with modern materials are thus consistent with what we learn from the Latin poets: As one of the final steps in the production of a deluxe book roll, a pumice stone can be used to remove any loose fibers or rough spots on the top or bottom of the closed roll.

Conclusions

The evidence reviewed here reestablishes a fact that seems to have been relatively well known and understood by scholars in the late nineteenth and early twentieth centuries but which passed out of the realm of common knowledge during the twentieth century. I am not certain when it became normal to suppose that pumice was used on the writing surface of papyrus. It would seem to have occurred at least as early as 1932, when Frederic Kenyon described the production of papyrus sheets in the following way: "The two layers were then fastened together by moisture, glue, and pressure until they formed one fabric—a fabric which, though now so brittle that it can easily be crumpled into dust, probably had a strength nearly equal to that of good paper. This is shown by the fact that pumice-stone, in addition to a mallet and ivory or shell polishers, was used to give it a smooth surface."[29] This may be the source of what has become a common misunderstanding. In any event, the ancient Latin

[29] F.G. Kenyon, *Books and Readers in Ancient Greece and Rome* (Oxford 1932) 46.

authors and modern practical experience are in agreement that pumice was effective at smoothing the ends (*frontes*) of a papyrus roll, but there is at present no good evidence to suggest that pumice was used to smooth the surface of papyrus in preparation for writing.