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Written Sources on the Use of Reagents in the Palimpsests Veronenses XV, XL, and LXII: Towards an Archaeology of Destruction

Abstract: The three palimpsests Verona, Biblioteca Capitolare, Veronenses (hereafter: Veron.) XV, XL, and LXII contain rewritten bifolios of late antique copies of works by Gaius, Vergil, Livy, and other classical Latin authors. Because they are very old, and in some cases the only, witnesses of the manuscript tradition of these works, they have attracted the attention of scholars since the beginning of the nineteenth century, when chemical reagents were the only means to make the washed-off letters visible again. Scholars applied a great variety of reagents to them and attested to their use in an unusually open way in private letters and print publications. These three codices are thus ideal objects for a case study on the use of and thoughts on chemical reagents in nineteenth-century palimpsest research. Although this widespread technique did enormous damage to outstanding cultural heritage in many Western European libraries and thus has had a significant impact on the field, it has not yet been widely explored via a historical approach based on written sources.

1 Introduction

The Biblioteca Capitolare in Verona houses three manuscripts for which erased and reinscribed parchment pages of late antique Latin manuscripts were used. In this way, Gaius's *Institutes* have been preserved as undertexts in Veron. XV (13); a Vergil with scholia, a Livy, a Latin translation of Euclid's *Elements*, and an introduction to and summary of the Platonic dialogues are preserved in Veron. XL (38); and the Codex Iustinianus is preserved with the Greek *Scholia Veronensia* in Veron. LXII (60). Although none of these deleted copies are complete (in the case of the Gaius, almost complete), they are nevertheless of outstanding importance due to their great age and, accordingly, their prominent position in the stemma of the respective text tradition. Some of the undertexts – Gaius, the scholia on the

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Codex Iustinianus as well as those on Vergil, the Euclid translation, and the treatise on Plato's dialogues – are even entirely or largely the only extant witnesses.[1]

Since Barthold Georg Niebuhr's visit to the library in 1816, the discovery, study, and edition of these three palimpsests in the nineteenth century was closely linked to German studies on Roman law and the rise of the Historische Rechtsschule (German Historical School of Jurisprudence).[2] All three palimpsests, however, also share the fate of having been subjected to intensive and repeated chemical treatment to make the underlying text more visible, leading to a severe darkening of the entire treated surface, if not to its actual destruction.

The present article provides an overview of the history of reagent use on the palimpsests Veron. XV, XL, and LXII from a historian's viewpoint. It is based on a compilation of testimonies written by men who were involved in what, today, can only be described as very regrettable damage to first-rate cultural heritage.[3] Although the use of chemicals in palimpsest research was widespread in the nineteenth century, in many cases today we can only make assumptions about where, when, and by whom reagents were used because the users did not comment on this aspect of their research in their publications or because we do not know on which texts tinctures were tried without any mention at all. The documentation for the three Veronese palimpsests discussed here, by contrast, is particularly favourable and can serve as an informative case study for the handling of palimpsests at the time.

Among recent research contributions on the topic, I would like to highlight Felix Albrecht's overview of the most important reagents and their consequential damage to palimpsest manuscripts,[4] as well as the edition and explanation of nineteenth-century sources by legal historians, particularly Mario Varvaro.[5] However, Albrecht focuses on the chemical composition of the agents, not on the

1 Giuliari 1888, 79 [1993, 79]: '[…] i tre nostri più famosi *palinsesti* ai N. XV, XL, e LXII […]' ('[…] our three most famous *palimpsests* nos. XV, XL and LXII […]'). For a description of the three manuscripts, see Spagnolo and Marchi 1996, 64–67, 90–92 (with colour plate between pp. 64 and 65), 119–120. On Veron. XV, see recently in great detail Ammirati 2020. On Veron. XL, see also Mommsen 1868, 153–156.

2 On the connection between the Historical School and the discovery of Gaius, see, for instance, Vano 2008.

3 In the appendix at the end of this article, I translate the most important of these sources dealing with the application of reagents or the mixing of tinctures. I cite them using 'source' numbers: S1, S2, etc.

4 Albrecht 2012 and 2015. See also the remarks on the use of reagents all over Europe in Lo Monaco 1996, 709–717.

5 Varvaro 2009a; 2009b; 2012a; and 2012b.

sources, and does not look into the situation in Verona, while Varvaro, in contrast, is mainly interested in the history of the discovery of Gaius. Therefore, sources on the use of reagents in the Biblioteca Capitolare were published in a scattered manner and are not easily accessed. My focus lies on the use of reagents in all three Veronese manuscripts (Veron. XV, XL, and XLII) and I treat the sources in a systematic, albeit concise, way.

The researchers working in Verona often spoke quite blatantly about the use of chemicals, which were the most modern – and only – way to make the erased texts visible again.[6] Pages that were chemically treated only once, in the nineteenth century, are often still quite well preserved today. Their undertext is much more legible than that of untreated pages, and thus one can understand why the reagents were so popular. Repeated application, on the other hand, proved problematic, especially where different products were used which, in combination, dyed the parchment surface almost black. Even if, as we shall see, the sources warn against repeatedly applying reagents on the same spot, we have to reckon with the possibility that they were applied not only by different researchers over the course of the century but also by one and the same person in rapid succession.[7]

In the written sources on the decipherment of the Veronese palimpsests, the application of primarily five reagents in common use in the nineteenth century is discussed, namely:

1. Oak gall tincture (*Galläpfeltinktur*); based on gallic acid ($C_7H_6O_5$) and ethanol (C_2H_5OH).
2. Normal liver of sulphur tincture (*Schwefelleber*); a solution of potash or potassium carbonate (K_2CO_3) and sulphur (S) that results in a mixture of mainly potassium polysulphide (KS_{2X}), potassium sulphate (K_2SO_4), and hydrogen sulphide (H_2S). The whole is also called 'hydrogen sulphide of potash' after its components.
3. Volatile liver of sulphur tincture (*flüchtige Schwefelleber*); based on ammonium hydrogen sulphide (NH_4SH).
4. Giobert's tincture; based on potassium hexacyanoferrate(II) ($K_4[Fe(CN)_6]$), which is also called 'yellow prussiate of potash', and hydrochloric acid ($HCl_{(aq)}$).
5. Hofmann's first tincture; based on potassium sulphocyanate or thiocyanate (KSCN) and hydrochloric acid. It is named after August Wilhelm Hofmann (1818–1892), professor of chemistry at the University of Berlin, who suggested its use (S19).

6 For example, August Wilhelm von Schröter (1824) does so in a long essay that offers the first overview of the history of palimpsest research (S1).

7 Göschen confirms this approach in S2.

6. Hofmann's second tincture; based on ammonium thiocyanate (NH_4SCN) and hydrochloric acid.[8]

The hydrochloric acid, which was often added (as in 4, 5, and 6), served to clean the corroded surface of the remains of erased ferrous inks and thus to strengthen the reaction with the reagents.[9]

The tincture based on oak gall and ethanol (1), which stains the parchment light to dark brown depending on the strength and number of repetitions, is the oldest reagent and was likely originally used mainly by archivists to retrieve text on worn documents.[10] It was a widely used tincture and is primarily associated with Angelo Mai (1782–1854), who founded systematic palimpsest research in 1814 by editing previously unknown fragments of Cicero's speeches *Pro Scauro*, *Pro Tullio*, and *Pro Flacco*, which he had discovered in the Milan palimpsest Biblioteca Ambrosiana, R 57 sup., and who was by far the most productive scholar in this field.[11] The first attempts to read palimpsest manuscripts in the eighteenth century largely abstained from using oak gall tincture and were not very successful.[12]

The enormous upswing that palimpsest research took in its golden decade, between 1814 and 1824, which led to a considerable number of highly significant new discoveries of ancient Latin and Greek texts, to which August Wilhelm von Schröter's (1799–1865) overview impressively bears witness,[13] is mainly due to the use of reagents – largely, but not exclusively, oak gall tincture. Some scholars had

8 On the composition and production of the first five reagents and their effects on the palimpsests, see Wattenbach 1896, 310–315; Posse 1899, 4–5, n. 1; Kögel 1913, 133–135; Albrecht 2012, 148–160; Albrecht 2015, 31. See also Rabin et al. 2015. The sixth is little known.

9 In S3, Peyron states his failure when trying to treat the palimpsest Turin, Biblioteca Nazionale Universitaria, Taur. D IV 22 with an oak gall tincture without hydrochloric acid.

10 See the oldest known recipe in Canepari 1619, 179.

11 Mai probably used this reagent exclusively; see Timpanaro 1980, 227, 229–230; Lo Monaco 1996, 694–696; Albrecht 2012, 149. A number of recipes are listed in Varvaro 2014b, 86–87, n. 3. I am not aware of Mai ever having described his own recipe in a publication, but he reveals it, together with instructions for use, in a letter to Amedeo Peyron (3 November 1814; edited in Pesce 1997, 91, no. 19). Varvaro also refers to a different preparation Mai learned from a Veronese pharmacist and perhaps used in Veron. XL. On Mai's dynamism as a palimpsest researcher, see Timpanaro 1980, 230–233; Lo Monaco 1996, 674–675.

12 For the study of palimpsest manuscripts and the use of oak gall tincture before 1813, see Timpanaro 1980, 227–229, 248–262; Lo Monaco 1996, 665–672. The Benedictines of the Congregation of Saint Maur were an exception who used this tincture in Paris, Bibliothèque nationale de France, latin 12161; see *Nouveau traité de diplomatique* 1757, 52–53, 144–145, 150–154 and *Nouveau traité de diplomatique* 1759, 458–459, n. 1 (with their recipe).

13 Von Schröter 1824–1826.

a decided preference for one product, as Mai did for oak gall or Amedeo Peyron (1785–1870) for Giobert's tincture, which bears the name of the Torinese chemistry professor Giovanni Antonio Giobert (1761–1834), who developed the recipe on behalf of Peyron in March 1820 (S4).[14] Friedrich Bluhme (1797–1874) turned to Peyron when he studied the Veronese palimpsests,[15] and as late as 1869, Giuseppe Cozza-Luzi (1837–1905) sought Peyron's advice regarding Giobert's tincture (S7 and S8).

2 The use of reagents to study the three Veronese palimpsests in the nineteenth century

Based on the sources known to me, the following stages of reagent application can be reconstructed in the three palimpsest manuscripts Veron. XV, XL, and LXII. Attempts at reading these palimpsests without (as far as I am aware) the use of reagents are given within parentheses.

1816: Niebuhr discovers the only, and almost completely, preserved copy of Gaius's *Institutes* in the palimpsest Veron. XV.[16] He also studies two loose leaves that have been known for some time and kept separately, the first of which, a folium, he correctly attributes to Gaius (Veron. I appendice, fr. III) and the second of which, a bifolium of a different format, contains the text of an unknown jurist (Veron. I appendice, fr. IV).[17] These two leaves are not palimpsests. Friedrich Carl von Savigny (1779–1861), who did not work in Verona but had only second-hand infor-

14 It is quite possible that Giobert knew Blagden's essay mentioned by Peyron in S4, which had also been published in an Italian translation (Blagden 1788). It was actually Blagden who discovered Giobert's tincture, as he describes the effects of hydrochloric acid and potassium hexacyanoferrate(II), which he calls 'phlogisticated alkali', when they are applied on pale inks in parchment manuscripts. Lo Monaco 1996, 709–713 does not seem to be aware of that. On Blagden's terminology, cf. Eklund 1975, 34. For the date of Giobert's invention, see Cipolla 1907, vol. 1, 19.

15 In S5, Bluhme 1836 (one also frequently finds the spelling Blume) shares the recipe for Giobert's tincture and gives improved instructions for its use. He had received it directly from Peyron with a view to his planned, but never undertaken, Gaius edition, as can be seen from a letter to Peyron (S6).

16 The Gaius originally consisted of fifteen quaternios and one quinio, of which three written folios and the last, blank one are lost; see Göschen 1820, XXXIII–XXXIV.

17 The two loose leaves are described in Spagnolo and Marchi 1996, 50. For the location of the leaf Veron. I appendice, fr. III in the Gaius text, see Göschen 1820, XXVII–XXVIII.

mation, namely from Niebuhr, succeeds in attributing the palimpsest text in Veron. XV to Gaius.[18]

Reagent used: An oak gall tincture that Niebuhr had mixed in a hurry – he was only stopping by in Verona for two days. The reagent was apparently used without the knowledge of the library staff.[19] In Niebuhr's opinion, the normal liver of sulphur would have been more suitable, as would a tincture containing potash, probably that known under Giobert's name.[20] Niebuhr therefore already had knowledge of this reagent four years before Giobert's 'discovery', presumably thanks to Charles Blagden's (1748–1820) essay (1787). Strangely, according to Immanuel Bekker (1785–1871), Niebuhr did experiment with alkali-based reagents, to the detriment of the palimpsest (S9b). Both tinctures recommended by Niebuhr, the normal liver of sulphur as well as Giobert's tincture, contain potassium and are therefore alkaline. Of course, it could be that Bekker made a mistake here and assumed that Niebuhr had used tinctures that Niebuhr had only conceived of, whereas he and Johann Friedrich Ludwig Göschen (1778–1837), at least with regard to the normal liver of sulphur, had certainly tried them out. In the Gaius Palimpsest, however, the normal and the volatile liver of sulphur did not improve legibility and attacked the parchment, according to Göschen (S11).

Pages treated with the reagent: Veron. XV, fol. 91^{rv}.

Resultant edition: Niebuhr in von Savigny 1817, 140–146, 150–158, 165–168.

1817: Together, Göschen, Bekker, and Moritz August Bethmann-Hollweg (1795–1877) read the entire Gaius Palimpsest between the end of May and mid October on behalf of the Königlich Preußische Akademie der Wissenschaften in Berlin.[21] On this occasion, Bekker discovered fragments from Vergil, Livy, and an unidentified

18 Von Savigny 1817. The story of the discovery is also described in Bevilacqua Lazise 1817, 10–25. On the exchange among German scholars, which led to a series of articles immediately after the discovery, see Vano 2008, 101–139.

19 See Bekker in S9a. According to their own accounts, Bluhme, at least on his first visit to Verona, and Studemund, too, sometimes secretly used reagents in other libraries. See Bluhme's letter to Göschen (1 July 1821; edited in Varvaro 2009a, 246–248) and Studemund's letter to Mommsen (22 April 1866; edited in Varvaro 2012b, 304).

20 Niebuhr's letter to von Savigny reporting the discovery (4 September 1816) is reprinted with some rearrangements and minor omissions in von Savigny 1817, 130–135. Of particular interest is the passage translated below in S10 based on the original wording. In his letter to the Königlich Preußische Akademie der Wissenschaften dated 23 September 1816, Niebuhr again refers to hydrogen sulphide of potash as the reagent of choice for the reading of Gaius, and on 9 April 1817 he gives von Savigny advice on how to obtain it in Verona or, if necessary, Venice (letters edited in Vischer 1981, 69–79, here 71, and 178–179, here 178). See also Göschen 1820, XII–XIII; Varvaro 2014b, 87–88.

21 On their method, see Varvaro 2011, 249–252.

mathematical treatise in Veron. XL,[22] as well as long fragments of the *Corpus iuris civilis* with Greek scholia in Veron. LXII.[23]

Reagent used: Oak gall tincture, after experiments with normal and volatile liver of sulphur in the Gaius and other Veronese palimpsest manuscripts, as Göschen writes in S11.[24] The recommendation of volatile liver of sulphur seems to trace back to Friedrich Stromeyer (1776–1835), professor of chemistry in Göttingen, who had experimented with it (S12).[25]

Pages treated with the reagent: Systematic use of oak gall tincture throughout Veron. XV with the cathedral chapter's permission (S13), following negotiations (S14).[26]

Resultant edition: Göschen 1820 (*editio princeps* of Gaius).[27]

1817: At the end of October or in November 1817, Mai studies Veron. XL. He probably made the decision to visit Verona when he learned of the presence of the German scholars during the summer, but he did not meet them there.[28]

Reagent used: Oak gall tincture.[29]

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22 Bevilacqua Lazise 1817, 26.

23 Göschen also studied another fragment of a legal text, the Justinian *Institutes*, in Veron. XXXVIII (36).

24 In two letters to Niebuhr (6 and 26 July 1823; edited in Varvaro 2009b, 448–449, n. 49), Bluhme suspects an experiment with a liver of sulphur reagent in Veron. XV (so one must conclude from Varvaro 2014b, 88; Varvaro 2009b, 448 indicates Veron. LXII), conducted by Göschen and Bekker, which ate away the letters.

25 Giuliari 1888, 193 [1993, 195] obviously draws on Ignazio Bevilacqua Lazise's account in S12, but the reader gets the wrong impression that Göschen primarily used volatile liver of sulphur and oak gall tincture only if necessary. On Stromeyer, see *NDB* 2013, vol. 25, 578–579 (Claus Priesner).

26 The correspondence between the academy of Berlin and the Biblioteca Capitolare is collected in Veron. DCCCCLXXXIII, fasc. VI.

27 On the history of the *editio princeps* of Gaius, see von Schröter 1824–1826, 25/26, 293–302; Vano 2008, 141–187; Varvaro 2009b; Briguglio 2012, 131–181; Varvaro 2012a. Von Schröter 1824–1826, 25/26, 297–299 emphasises in particular that with this edition palimpsest research has been raised to a completely new scholarly level compared to Mai's work, whose great merits he unquestionably acknowledges and launches into a hymn-like praise (see S15). The only shortcoming that von Schröter 1824–1826, 25/26, 300–301 complains about is that Göschen's *editio princeps* does not offer a text 'mit allen Fehlern und Maengeln' ('with all its errors and defects') (p. 300), i.e. no diplomatic transcription.

28 On Mai's edition of the Vergil scholia, see Mai 1818, IV–V, n. 1; Lo Monaco 1996, 696, n. 149; Baschera 1999, 18–22. Mai's handwritten copy, which formed the basis of his edition, is preserved in Vatican City, Biblioteca Apostolica Vaticana, Vat.lat. 9555, fols 1–93.

29 In Mai 1818, III, Mai – quite against his habit, see Timpanaro 1980, 229 and Lo Monaco 1996, 694–696 – admits the use of a reagent in Veron. XL (in Latin): 'Ibi mox artificiali et notissima mihi aliisque iamdiu ad complures paginas adhibita ablutione […]' ('There, an artificially produced solution, long known to me and others, was soon applied on several pages […]'). Although neither there nor in Mai 1835, VIII–IX does he comment on the type used, it may be taken as certain that it

Pages treated with the reagent: Probably all pages of the Vergil manuscript and the Euclid translation, and perhaps also others, especially from Livy.[30] Mai did not coat the central text block of the Vergil manuscript, where the Vergil text appears in *capitalis rustica*, with reagents.[31]
Resultant editions: Mai 1818 (*editio princeps* of the *Scholia Veronensia* on Vergil); Mai 1835.

1821, 1822, and 1823: During three stays in Verona, Bluhme studied the three palimpsests, making the first mention of the philosophical treatise in Veron. XL.[32] In 1823, he was assisted by Christian Johann Caspar Maier (1799–1835).[33]
Reagents used: Experiments with oak gall and liver of sulphur reagents, potassium hydrogenoxalate (KHC_2O_4),[34] straight (although certainly highly diluted) hydrochloric acid,[35] and Giobert's tincture.[36] Bluhme prefers oak gall reagent mixed with Giobert's tincture. He already remarks upon the (too) strong darkening of the palimpsest after treatment with oak gall, the ineffectiveness of its repeated application, and the damage caused by Giobert's dangerous reagent, which he recommends be applied only on the harder hair side.[37]

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was oak gall tincture, his favourite reagent. Bluhme 1864, 451–452 believes, without mentioning a specific case, that Mai even dabbed palimpsests with saliva, since the glint on the erased writing caused by moisture alone could contribute to its decipherment.

30 Mai 1846, XXXI–XXXII speaks in a brief, roundabout way of Vergil and Livy as well as in more detail of the Euclid translation, which he calls 'fragmenta mathematici latini' ('fragments of a Latin mathematician') (p. XXXI). In this context, he also mentions his handwritten copy of Euclid (as already in Mai 1828, LXV), which is preserved in Vat.lat. 9555, fols 96^r–100^v and was used by Geymonat 1964 for his *editio princeps*.

31 As stated by the second editor of the Vergil scholia, Heinrich Keil, in Keil 1848, XII.

32 Blume 1824–1836, vol. 1, 261–264.

33 On Maier, see Bock 2015, 250–254; Bock 2017; Varvaro 2018.

34 Called *sal d'acetosella* by Bluhme; see Varvaro 2014a, 398. I know of no other use of this salt as a reagent in palimpsests studies.

35 On the effect of hydrochloric acid as a reagent, see Kögel 1913, 134. Its use for restoring yellowed printed matter was first recommended by Jean-Antoine Chaptal in 1787.

36 Bluhme did not always have permission to use reagents. See his letter to Göschen (1 July 1821; in Varvaro 2009a, 246–248), in which he describes how his colleague Ulrich Friedrich Kopp distracted the Veronese librarian while he secretly applied reagents.

37 See Bluhme's letters to Göschen (1 July 1821; edited in Varvaro 2009a, 246–248) and Niebuhr (Verona; edited in Varvaro 2009b, 504–505, n. 243); Blume 1824–1836, vol. 1, 262 as well as S5. This can be understood as an indirect and unfortunately not very optimistic response to Göschen, who had hoped to obtain precisely this effect; see S16 and also Varvaro 2011, 251. Von Savigny, too, had placed his hopes in the darkening; see S14. On Bluhme's use of reagents, see also Bluhme 1864, 450–452 (who mentions tannin as another reagent but does not recommend its use because of its

Pages treated with reagents: Probably systematic application throughout the Gaius Palimpsest, which was Bluhme's main focus (S18). Use of oak gall and Giobert's tincture in Veron. LXII[38] as well as in the Livy of Veron. XL.[39]

Resultant edition: Bluhme's papers were used by Göschen, who had commissioned Bluhme to travel to Verona, for his second edition of Gaius, published in 1824.[40] The subsequent editions of Gaius up to Krüger and Studemund 1877 were not based on independent study of the *codex unicus*.[41] Emil Herrmann and Paul Krüger used the copy of the text of the Codex Iustinianus in Veron. LXII made by Bluhme and Maier for their own editions.[42] Bluhme later passed his copy of the Greek scholia on the Codex Iustinianus, which are only attested in the palimpsest Veron. LXII, to Karl Eduard Zachariae von Lingenthal (1812–1894), who based his *editio princeps* on it.[43] Information on the extent of the Livy fragments, some variant readings on fol. 294^{r}, and the text of the few Greek scholia on Livy are published in Blume 1828.

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poor efficacy); Bock 2015, 255–258; and especially Varvaro 2014a, 394–412. Niebuhr strongly recommended Bluhme conceal the damage caused by Giobert's tincture in the Gaius; see S17.

38 Krüger 1874, VII speaks of '[membrana] quae gallae infuso et Giobertino quod dicitur remedio olim temptatae et ex parte misere pessumdatae erant' ('[palimpsest pages] which had once been treated and partly miserably ruined by the oak gall solution and Giobert's so-called remedy').

39 For all three manuscripts, see Bluhme's letter to Göschen (1 July 1821; edited in Varvaro 2009a, 246–248), for the Livy, see also pp. 35–37 in this article.

40 See Göschen 1824, LXXI–LXXVI; Varvaro 2011, 253–254; Manthe 2019, 237, 249–250. A part of Bluhme's papers was lost. He suspected (in Bluhme 1864, 447–448) that a postal official opened the dispatch in October 1822 during the European princes' Congress of Verona, and that it had aroused suspicion because the Gaius facsimiles resembled secret writing and because Bluhme, in an enclosed letter, spoke of Justinian's Greek Constitution (i.e. a decree written in Greek by the emperor) in Veron. LXII at a time when revolution was taking place in contemporary Greece, and thus it was destroyed.

41 The Gaius editions of the nineteenth century have been repeatedly discussed, most recently by Manthe 2019 and Di Marco 2020. Also in the twentieth century, certain editors dispensed with the autopsy of Veron. XV; see Colella 2020.

42 Varvaro 2014a, 400.

43 Zachariae von Lingenthal 1850, 90–91.

Fig. 1: Veron. XL (38), fol. 294^{r}: Livy; moderate use of oak gall reagent and Giobert's tincture (image processed by Damianos Kasotakis, EMEL).

(**Around 1847:** Heinrich Keil [1822–1894] studies the Vergil scholia in the Veron. XL under generally difficult conditions.[44]
Reagents used: None.
Resultant edition: Second edition of these scholia in Keil 1848, 69–107.)

44 See Keil 1848, XII–XIII; Giuliari 1888, 220–221 [1993, 222–223].

(**1853:** Otto Ribbeck [1827–1898] is the first to study the Vergil text in Veron. XL, also under difficult conditions.
Reagents used: None.[45]
Resultant edition: A study of the Vergil manuscripts in Ribbeck 1854 was followed by a complete edition of Vergil's works in Ribbeck 1859–1868.[46])

(**1857:** August Wilhelm Zumpt [1815–1877] studies the Livy text in Veron. XL.
Reagents used: None.
Resultant edition: Having been forbidden to publish the Livy text, Zumpt published a study of this manuscript and left a copy to the library, which Theodor Mommsen [1817–1903] used.[47])

(**11 October 1858:** Sönnich Detlef Friedrich Detlefsen [1833–1911] briefly looks at the Livy in Veron. XL.
Reagents used: Probably none.
Resultant edition: Publication of two facsimiles of 'Quat. XV f. 2 v' and 'Quat. XV f. 7 r' in Detlefsen 1859.[48])

First half of the 1860s: Arnold Herrmann (1837–?) works as a tutor in Verona and studies the Vergil scholia in Veron. XL.
Reagents used: Unknown, but Gian Battista Carlo Giuliari (1810–1892) testifies to their use.[49]
Pages treated with reagents: Unknown.
Resultant edition: Herrmann 1868–1870.[50] This is the third edition of the Vergil scholia after Mai 1818 and Keil 1848 and the last of the nineteenth century based on autopsy.[51]

1866, 1867, 1868, and 1869: Wilhelm Studemund (1843–1889), the leading scholar in palimpsest studies in the second half of the nineteenth century, repeatedly visits Verona for the purpose of rereading the Gaius Palimpsest, supported by

45 See Ribbeck 1859–1868, Ergänzungsband, 226–227; Giuliari 1888, 221–221 [1993, 223–224].
46 See in particular the readings given in Ribbeck 1859–1868, Ergänzungsband, 273–277.
47 Zumpt 1859, 16; Mommsen 1868, 156. On Zumpt's visit to the library, see also Giuliari 1888, 227–230 [1993, 229–232].
48 On Detlefsen's visit, see also Giuliari 1888, 227–228 [1993, 229–230].
49 Giuliari 1888, 238, 254–255 [1993, 240, 256–257]: '[…] con qualche legger tocco di reagente chimico […]' ('[…] with a slight touch of chemical reagent […]') (here p. 238 [240]).
50 In advance, Bücheler 1864 and 1866 had already reported on Herrmann's work.
51 On the history of the editions of the Vergil scholia, see Baschera 1999, 15–29.

Mommsen (1867) and Krüger (especially in 1868, briefly also in 1869 and 1873).[52] In March 1867, Studemund also studies the Euclid translation and the philosophical fragments in Veron. XL.[53] Studemund probably read them with the help of the same reagents he used for the Gaius. The binding of Veron. XV is cut open, and henceforth the bifolios are kept unbound.[54] Veron. XL and LXII are also cut open.[55]
Reagents used: The description of the reagents used by Studemund, Mommsen, and Krüger in the sources is confusing for two reasons.[56]

Firstly, the terminology of the manuscript description is problematic, because Studemund clumsily refers to the hair pages as 'inner pages' (*paginae interiores*) and the flesh pages as 'outer pages' (*paginae exteriores*). This terminology derives from the arrangement of the two sides of the parchment in the bound book in observance of Gregory's law that each layer begins with a flesh side, but it is counter-intuitive when one considers the skin of the animal.[57] Giuliari misunderstood it and assumed that Studemund used the reagent he applied to the hair side on the flesh side and vice versa.[58]

Second, the information Studemund gives regarding the reagents he used in Verona is not easy to understand. We must begin with his description of the chemical aids he used in Gaius, namely, normal liver of sulphur on the flesh side and potassium or, alternatively, ammonium thiocyanate on the hair side (S19).[59] Using

52 For details on Studemund's work on Gaius, see Briguglio 2012, 208–223, especially 220–221 on the exchange with Mommsen and 212–214 on his view that Studemund had also acted as a Prussian spy during his first stay in the midst of the Third Italian War of Independence of 1866, which could at least partly explain his good relationship with the anti-Austrian librarian Giuliari. He had to flee Verona after only one month. Giuliari became a personal friend of Studemund's and Mommsen's; see Zivelonghi 1994, 224–226; Varanini 1994, 123. On Krüger, see Krüger 1874, III. Krüger's ample archive, which I was unable to consult, is now in the Law Library of Congress in Washington DC, see Hessler 2011.

53 Giuliari 1888, 246–247 [1993, 248–249].

54 Giuliari 1888, 246 [1993, 248].

55 Mommsen 1868, 157; Krüger 1874, VII.

56 Briguglio (in 2012, 210–212 and 2013, 28–32) is unaware of the problem in his account of the use of reagents in Gaius. On Studemund's use of chemicals in Gaius, see also Varvaro 2012b, 296–318.

57 Studemund himself noticed – apparently only during printing and thus too late – that his terminology was clumsy, and he criticises it in Studemund 1874, XIII, n. d, where he uses the alternative terminology 'softer' (*molliores*) instead of *exteriores* and 'firmer' (*tenaciores*) instead of *interiores*.

58 Giuliari 1888, 241–242 [1993, 243–244].

59 The passage shows that Studemund was already aware of ammonium thiocyanate, although Kögel 1913, 135 thinks he is the first to detect its potential use as a reagent, personally preferring it to potassium thiocyanate. On Studemund's account of Bluhme's use of reagents, see Varvaro 2014a, 409–412, who speaks of a 'campagna propagandistica' ('propagandistic campaign') with the purpose of increasing his own performance and blaming Bluhme for the disastrous consequences of the reagents.

two different reagents for the hair and flesh side has, as far as scholars working in Verona are concerned, a parallel only in Bluhme's warning against the use of Giobert's strong tincture on flesh sides.[60] Potassium thiocyanate was recommended by Hofmann and I call it therefore Hofmann's first tincture. Studemund wanted to use it on a palimpsest in the Vatican Library, but was denied permission. Nevertheless, he reveals the recipe in a publication on that manuscript, although he actually applied it only later, namely to the Veronese palimpsests.[61] We also know that Studemund sent an order for tincture ingredients to Mommsen in Berlin.[62] The situation was the following: Studemund's third stay in Verona to study Gaius is coming to an end, and he requests an express shipment of 'sulphuretted ammonia' (*Schwefelammonium*), hydrochloric acid, ammonia salt, and oak gall tincture to replenish the supplies he needs for Hofmann's tincture. It is obvious that the oak gall tincture has nothing to do with Hofmann's and appears on Studemund's list only because he was apparently running out of it as well. I note in passing that its use by Studemund in Verona is not attested elsewhere. Now, Studemund says that he needs the other ingredients for Hofmann's tincture, but it is obviously not the variant containing potassium thiocyanate; rather, it is what I call Hofmann's second tincture described above (6), containing ammonium thiocyanate (NH_4SCN).[63] Finally, Studemund writes that he still has enough *Ferrocyankalium*, which must mean potassium hexacyanoferrate(II), for Giobert's tincture. It is questionable whether Studemund regularly used Giobert's tincture in Gaius, for its use by Bluhme was maligned and Studemund himself, who thoroughly appreciated it, had reservations about its conspicuous blue colour, which made it unpopular with librarians.[64]

60 See p. 28 in this article. Krüger 1898, 826 explicitly says that, judging from his own experience, he cannot confirm Studemund's advice. As for Bluhme, he later merely stated that hair sides are easier to read than flesh sides and warns that one should be particularly careful when using reagents on the latter, which are softer and therefore more exposed to the destructive effects of reagents (Bluhme 1864, 452).

61 This is the passage which Studemund refers to in S19 (Studemund 1868, 546, n. 1): '[…] 1 teil schwefelcyancalium in 15 teilen brunnenwassers mit hinzufügung weniger tropfen salzsäure […]' ('[…] 1 part potassium thiocyanate in 15 parts spring water with the addition of a few drops of hydrochloric acid […]').

62 For the text of the letter (28 August 1868), see Varvaro 2012b, 314–315, n. 108.

63 Already in 1866, in view of his first study of Gaius (22 April 1866; edited in Varvaro 2012b, 304), Studemund had asked Mommsen by letter to send him reagents, which Mommsen obtained at the Simon'sche Apotheke on Spandauer Straße in Berlin; see Varvaro 2012b, 311, n. 101.

64 See Studemund's letter to Mommsen (22 April 1866; edited in Varvaro 2012b, 304). However, Giuliari in S22, at least, does not object to the blue colouring of Giobert's tincture.

Studemund's use of reagents was brought up by Krüger, his colleague and collaborator on the Gaius edition, in an 1898 letter to the École nationale des chartes, long after Studemund's death. We do not know what occasion prompted the letter, but one can assume it was related to the Conference of St Gallen, organised in the same year on the initiative of the prefect of the Vatican Library, Franz Ehrle, and under the presidency of Mommsen, at which the librarians of leading European manuscript collections discussed, among other things, conservation measures for palimpsests damaged by chemical reagents and which testified to the professional world's now critical attitude towards these agents.[65] The letter must thus be read as an apology. In it, Krüger mentions the use of the reagent first recommended by Hofmann (i.e. Hofmann's first tincture), then by Studemund for the 'interior side of the parchment' (i.e. the hair side), in the Veronese Gaius; describes its application and effect; and then defends the use of hydrochloric acid. Krüger explains that, although hydrochloric acid is also a component of Giobert's harmful tincture, it does no damage when mixed as follows: fifteen parts water to one part yellow prussiate of potash to one part hydrochloric acid (S21). Krüger's letter, at least in the form in which the École nationale des chartes printed it, is not easy to understand. It should be emphasised that the recipe Krüger provides is not that of any of Hofmann's tinctures, the use of which he himself recommends, but that of a variant of Giobert's tincture, which is admittedly considerably weaker than the tincture used by Bluhme in the Gaius Palimpsest.[66] Krüger thus seems to defend the use of both Hofmann's and Giobert's tincture and to recommend the same mixing ratios for both. He himself had previously used them in Veron. LXII.[67] He likewise speaks in favour of hydrochloric acid, on condition that it be weakly concentrated. This remark is reminiscent of a letter addressed to Mommsen, in which Krüger writes that Studemund had used hydrochloric acid successfully in the Gaius.[68] Because Studemund himself never mentions the use of mere hydrochloric acid (i.e. not in combination with other chemicals) in the sources known to

65 On the Conference of St Gallen (30 September–1 October 1898), see Ehrle 1898, esp. 19–21; Ehrle 1899, esp. 30–31, 35; Posse 1899; Ehrle 1909, esp. 246 (S20).

66 In view of the difficult source situation, it is not surprising that Briguglio 2012, 211 avoids commenting precisely on the composition of Hofmann's tincture: 'costituito da una complessa miscela' ('composed of a complex blend'). For Bluhme's stronger recipe for Giobert's tincture, see S5.

67 Krüger 1874, VII (in Latin): '[…] adhibui kalium ferrocyanatum et sulphocyanatum cum acido muriatico eum in modum mixta, quem Studemundius in annal. Philolog. 1868 pag. 546 descripsit' ('[…] I drew on potassium ferrocyanatum [i.e. Giobert's tincture] and sulphocyanatum [i.e. Hofmann's first tincture] mixed with hydrochloric acid in the manner described by Studemund in *Philologische Jahrbücher* 1868, p. 546').

68 12/13 Mai 1868; the passage is edited in Varvaro 2012b, 314.

me, one might be inclined to interpret Krüger's remark in his letter to Mommsen as an inaccurate description of the use of a small amount of hydrochloric acid in combination with other chemicals, as is the case in Hofmann's tinctures. However, because Krüger perhaps speaks again about the use of mere hydrochloric acid in his letter to the École nationale des chartes, and because Bluhme, too, experimented with it in Verona, as we have seen above on p. 28, the use of this reagent in Gaius by Studemund is quite conceivable.[69]

Finally, Giuliari reports that he authorised Studemund to use reagents and reveals their composition. According to him, Studemund used 'a part of ammonia (*ammoniaca*), dissolved in 15 parts of pure water with a few drops of hydrochloric acid' for the flesh sides and 'sulphurated ammonia' (*ammonio solforato*) for the hair sides.[70] I have already noted that Giuliari confused the flesh and hair sides. The recipe he indicates for the flesh sides is thus Hofmann's second tincture, which Studemund used on the hair sides. Next, it is remarkable that Giuliari speaks of sulphurated ammonia instead of potassium sulphate (which would be *solfato di potassio* in Italian, normal liver of sulphur) for the hair sides, the use of which Studemund himself indicates in the preface to his apographum of the Gaius for the flesh sides. Furthermore, Giuliari's description of Hofmann's second tincture does not contain sulphur. Shortly afterwards, Giuliari also discusses the reagents used by Mommsen in the Livy of Veron. XL (S22). Since Mommsen himself does not speak about his use of reagents, Giuliari is our only source. Apparently, Mommsen worked in two steps, first applying potassium hexacyanoferrate(II), which is a component of Giobert's tincture, then Hofmann's second tincture, seemingly applying both indiscriminately to the flesh as well as the hair side. The information Giuliari gives may be perfectly correct; however, we must bear in mind that Bluhme, too, showed a particular interest in the Verona Livy and that the blue colouring of many of its pages may therefore be, at least partially, a consequence of his work, as we know that Giobert's tincture was among his 'remedies'.

Pages treated with reagents: Wherever deemed necessary in the Gaius Palimpsest (Veron. XV) and in the Euclid translation and the philosophical fragments of Veron. XL, fols 315, 318–319, 322–323, 326, 331, 334–336, 338, 341, 343–344.

69 Mere hydrochloric acid as a reagent is not discussed in Albrecht 2012 or 2015.

70 Giuliari 1888, 241–242 [1993, 243–244].

Fig. 2: Veron. XL (38), fol. 334^{v}: philosophical treatise; heavy use of oak gall reagent and Giobert's tincture (image processed by Damianos Kasotakis, EMEL).

Resultant editions: Studemund 1874;[71] Krüger and Studemund 1877. Due to Studemund's early death, the edition of the fragments of the Euclid translation re-

71 This publication is not an edition but merely contains Studemund's apograph of the Gaius text, which according to unanimous scholarly opinion is the best; see e.g. Briguglio 2013, 12, 18–28.

mained unfinished.[72] Studemund's documentation on Euclid was presumably destroyed during the Siege of Breslau in February and April 1945.[73] Studemund also looked at the philosophical text, but we do not know what resulted from this.[74]

April–June 1867: Mommsen studies the Livy palimpsest in Veron. XL.
Reagents used: Free use of reagents with Giuliari's permission. Mommsen does not specify the types of chemicals applied.[75]
Pages treated with reagents: Wherever deemed necessary in the Livy palimpsest (Veron. XV, fols 267–314, 316–317, 320–321, 324, 332–333, 337, 339–340, 342).
Resultant edition: The Livy fragments in Veron. XL, being the oldest textual witness for this author and containing extended passages from the third to the sixth book, were published as an apograph in Mommsen 1868.

1868, 1869, and 1873: Krüger studies the palimpsest of the Codex Iustinianus in Veron. LXII.[76]
Reagents used: Following in Studemund's steps, Krüger uses Giobert's and Hofmann's first tincture throughout Veron. LXII, except on the pages particularly damaged by Bluhme and Maier. Although Krüger denies having applied Giobert's tincture, he uses its main components, potassium hexacyanoferrate(II) and hydrochloric acid, albeit in much smaller proportions.[77]
Pages treated with reagents: Wherever deemed necessary in Veron. LXII.
Resultant edition: Krüger 1874, an apograph of the palimpsest fragments contained in Veron. LXII, not taking into account the *Scholia Veronensia*, which had already been edited in Zachariae von Lingenthal 1850.

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72 See Cantor 1894, 526, n. 1.

73 See *ADB* 1893, vol. 36, 731, s.v. 'Studemund, Wilhelm' (Leopold Cohn) and Fercz 1999, 184. Only a copy of Veron. XL, fol. 338^{v} is preserved in Studemund's own hand in a letter to Giuliari (8 March 1879; in May 2022 inserted in the folder of Veron. XL, fols 233–242; unedited). It was not before 1964 that Geymonat published the *editio princeps* of the Euclid without being aware of Studemund's letter to Giuliari; see esp. Geymonat 1964, 13.

74 See the brief comment based on Giuliari's notes in Veron. MXLIII, fol. 62^{r} in Spagnolo and Marchi 1996, 92: 'Ne prese un saggio Gu. Studemund' ('Wilhelm Studemund took a sample').

75 Mommsen 1868, 157. Mommsen drew on Studemund's chemical preparations; see S22 and p. 35 of this article.

76 Krüger 1874, III.

77 Krüger 1874, VII; see also n. 67 of this article. Apparently, Krüger even sent a small bottle of 'tintura azurra' ('blue tincture'), i.e. Giobert's reagent, to Giuliari as a present; see his letter in Veron. DCCCCLXXXVIII, busta 1 (23 February 1871; unedited).

(**March 1878 and September 1883:** Studemund visits Verona again in 1878, staying for a short time with Krüger.[78]
Reagents used: Studemund implies that he used chemicals only in 1867 and 1868, but not in 1878 and 1883. His comment on his earlier use of Hofmann's tincture is apologetic.[79] Although Giuliari, in his history of the Biblioteca Capitolare, portrays Studemund's use of chemicals as harmless, he was evidently aware of the damage, for as early as 1868, after a heated argument, he temporarily banned Studemund from using them.[80] His apparently fundamentally friendly relationship with Studemund; the very high standing of Mommsen, who procured the chemicals for Studemund and was then already regarded as the world's leading scholar in classical studies; and presumably also concern for his own reputation (for he was the one that had approved the use of the reagents) may have prompted Giuliari to embellish the account in his library history.
Resultant edition: Krüger and Studemund 1884, with Studemund's supplements to his apograph edited in Studemund 1874 on pp. XIX–XXXIX.)

3 Conclusions

First, I note two minor observations on the scholars, which occurred to me when studying the sources, before I come to the general conclusions.

The scholars studying the three Veronese palimpsests in the nineteenth century were all German, with the exception of Mai. This fact probably made access to the Biblioteca Capitolare relatively easy when Verona belonged to the Austro-Hungarian Empire (1815–1866), but access also would have been possible afterwards, when Verona became part of the Kingdom of Italy during the course of the Third Italian War of Independence of 1866, because these researchers were not Austrian.

78 Varvaro 2012b, 284.

79 See S23. On the consequences of the use of potassium thiocyanate (Hofmann's first tincture), see Albrecht 2012, 160: 'If more than one agent was used on one spot [as was the case in the Gaius], the result was disastrous and the text was quite often rendered illegible'.

80 See Studemund's letter to Mommsen (26 June 1868; edited in Varvaro 2012b, 312–313, n. 104). Varvaro 2012b, 313 cites a letter from Krüger to Mommsen (9 April 1868), in which he reports on a failed chemical test by Studemund, which Giuliari pointed out to him. This test, however, must have taken place in Veron. LXII, not in Veron. XV. Krüger's letter can thus be regarded only as an indirect indication that Giuliari discovered the devastating effect of Studemund's reagents in the Gaius.

Additionally, these scholars were probably all Protestant, with the exception of Mai and Herrmann,[81] and although one might suspect this would have been an issue, especially since the library was owned and managed by the Catholic cathedral chapter, this fact is hardly mentioned in the sources.[82] Apparently, it was not decisive for gaining access to the manuscripts.

Since the three Veron. XV, XL, and LXII are among the most important palimpsests in terms of content and already drew the focus of classical scholars during the golden decade of palimpsest research between 1814 and 1824, they are also among the manuscripts most severely damaged by reagents. It is advisable to consider the use of chemicals in all three palimpsests together because the scholars of the time did not always limit their studies to one manuscript and because occasionally several scholars were working with the same reagents at the same time. This scenario links with the fact that, right from the beginning, research on our palimpsests was driven by a strong Prussian team spirit and intensive scholarly exchange on their content and the 'remedies' needed to unveil them among members and friends of the Königlich Preußische Akademie der Wissenschaften. The Gaius project was among the first large and – at the time – modern research ventures that the academy had started to fund after the end of the Napoleonic Wars; it also became one of the key stepping stones on the academy's path to its leading position over the course of the nineteenth century.[83] Yet despite this impressive beginning and more than two hundred years of research, the texts contained in the three palimpsests have been only broadly deciphered so far, as many undeciphered passages remain and the *editio princeps* of the philosophical treatise of Veron. XL is only nearing completion.[84]

The rich written sources on the use of reagents mostly come from the circle of the users themselves. They should be seen against the fact that no other means of improving the readability of erased texts existed at the time. Among themselves, the scholars freely discussed their experiences with the various chemicals in pri-

81 On Herrmann's Catholicism, see his letter to Giuliari in Veron. DCCCCLXXXVII, fasc. XI, busta 8 (17 February 1867; unedited; in Italian).

82 One exception is Studemund's letter to Mommsen (22 April 1866; edited in Varvaro 2012b, 304): 'Was nun nicht erlaubt wird, werde ich heimlich tun, da ich in dem verborgenhalten von reagenz und streichpinsel dank der unliberalität hiesiger pfaffen einige übung habe' ('Now, what is not allowed, I will do secretly, since I have some practice in concealing reagent and paintbrush thanks to the illiberality of local clergymen').

83 On the academy's new policy regarding large research ventures after the Napoleonic Wars, see Harnack 1900, 665–680; see also S15.

84 Gysembergh, Lecerf and Zingg forthcoming; for a first summary of this recently identified new text, see Gysembergh and Zingg 2023.

vate letters. In printed publications they also recorded their use but were often at pains to emphasise the harmlessness of the agents they employed; however, the palimpsests themselves already bore sad witness to the reagents' great destructive power.

In addition to political and scientific pressure in the form of letters of recommendation and reports by professors of chemistry, a particular librarian's general stance regarding reagents and the personal relationships between librarians and researchers, which arose naturally during the – sometimes repeated – stays of several months, played a decisive role. In the first decade after the discovery of the Gaius Palimpsest in 1816, permission was granted only reluctantly and after negotiation, with researchers sometimes using their reagents surreptitiously and without permission. Thereafter, the use of reagents seems to have been prohibited, at least in the three manuscripts Veron. XV, XL, and LXII, and access to these codices was generally made more difficult. Although access restrictions in Italian libraries in those times may have been due to a certain laziness of the staff, it has to be admitted that in the case of the Biblioteca Capitolare, it was to the benefit of the palimpsests and probably also motivated by the already obvious chemical damage.[85] It was not until Carlo Giuliari, the outstanding figure among the Veronese librarians of the nineteenth century, took office in 1856 that more favourable working conditions were again created, which admittedly also brought the opportunity to use chemicals.[86]

The history of research on the three Veronese palimpsests in the nineteenth century is therefore also an account of the serious material damage they incurred, which, although not intentional, was accepted lightly and consciously, as Giuliari already critically remarked towards the end of his life in his history of the Biblioteca Capitolare:

> But in the course of the years, one had to note with great regret a completely different effect, even one contrary to what one had thought: if the *Codice Capitolare* [i.e. the Gaius] gradually darkened and then, at least on certain pages, turned into black in a way that no longer allowed a new reading, thus extinguishing all hope of a renewed examination, it seems to me excessive to give a severe and coarse rebuke for this to the Prussian scholars or to the Veronese chapter. Every scholar will find that in this fact a fatal law was repeated, namely, that

85 On the library staff of the time, see e.g. Timpanaro 1980, 231–232, 238–239. Von Savigny already remarked in a letter to Göschen after his visit to the Biblioteca Capitolare (19 November 1825; edited in Varvaro 2014a, 409): 'Der Gajus sieht nun jezt freylich in sehr vielen Stellen so aus, als ob man mit Sorgfalt ein Tintenfaß darüber gegossen hätte' ('The Gajus now certainly looks in very many places as if an inkwell had been carefully poured over it').

86 On Giuliari, see in general the proceedings of the conference dedicated to him in Marchi 1994 and, in particular, on his poor sensitivity to conservation issues, see Varanini 1994, 141–142.

> every difficult and altogether useful undertaking demands its martyrs – and an illustrious martyr of palaeography is what I am wont to call our *Codice*.[87]

In short, however, although this method led to spectacular scholarly results, it is to be regretted from today's point of view. Because these are largely texts that have not been preserved elsewhere, the task was difficult from the beginning, and, today – even with great improvements such as multispectral photography – the destruction caused by the reagents still makes their reading difficult.[88]

The information on the use of reagents contained in the written sources that have been presented in this article is comparatively rich. Nevertheless, it is limited in some respects. Further research, especially the chemical analysis of the inks and reagents present on the palimpsest pages, could probably complete and correct this first attempt at a systematic archaeology of the destruction of Veron. XV, XL, and LXII.

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87 'Se col trascorrer degli anni ebbesi a ravvisare con troppo dolore, un effetto ben diverso, contrario anzi a quello che si pensava: se il Codice Capitolare oscuravasi a poco a poco, e poscia, in alcune pagine sopratutto, annerivasi per forma da non consentire più nuova lettura, da togliere ogni speranza di recensione novella, parmi soverchio apporne severo biasimo e crudo, così ai dotti Prussiani, come al Capitolo Veronese. Ogni savio troverà in questo fatto ripetutasi una legge fatale, che qualsivoglia arduo e insieme utile imprendimento richiede i suoi martiri: e martire illustre della Paleografia amo appellare il nostro Codice' (Giuliari 1888, 193 [1993, 195]). On Giuliari's history of the library, see Varanini 1994, 129–134.

88 On the issue see e.g. Rabin et al. 2015, 34–36.

Abbreviations

ADB = *Allgemeine Deutsche Biographie*, 56 vols, Leipzig: Duncker & Humblot, 1875–1912.
EMEL = Early Manuscripts Electronic Library.
NDB = *Neue Deutsche Biographie*, 27 vols, Berlin: Duncker & Humblot, 1953–.

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Appendix: A selection of the most important nineteenth-century sources on reagent use in palimpsests cited in this article

All translations are mine.

S1 von Schröter 1824–1826, 23/24, 324:

> Jetzt hat man freilich viel wirksamere Mittel [...] und ist mit ihrer Anwendung nicht so aengstlich wie frueher. Sie koennen zwar, waehrend sie die erste Schrift wieder hervorheben die zweite vernichten, wie es Herrn Professor Peyron bei der Handschrift des Julius Valerius ging, unter welchem die von ihm herausgegebnen Bruchstuecke des Codex Theodosianus lagen; aber theils ist dies nicht immer der Erfolg, theils wird niemand Bedenken tragen einen oft gedruckten Kirchenvater u. dergl. zu opfern, um ein Werk des Alterthums zu gewinnen. Laecherlich ist es, wenn Knittel [...] den Gebrauch chemischer Mittel schlechthin fuer unstatthaft erklaert und den Augen des Lesers eine Sehkraft zumuthet, zu welchen die bisherigen Menschenaugen nun einmal nicht geschaffen sind.
>
> Now, of course, one has much more effective remedies [i.e. than the oak gall tincture] [...] and is not so anxious about their use as before. It is true that they can destroy the second manuscript while they are bringing out the first, as happened to Professor Peyron with the manuscript of Julius Valerius, under which the fragments of the Codex Theodosianus, which he edited, were lying; but, on the one hand, this is not always the outcome and, on the other, no one will have any qualms about sacrificing a frequently printed church father and the like in order to gain a work of antiquity. It is ridiculous when Knittel [...] declares the use of chemical means to be absolutely unacceptable and expects the reader's eyes to have a sight the hitherto existing human eyes are not made for.

S2 Göschen 1819, 311:

> Ueberdies war es mit dem einmaligen Ueberstreichen noch nicht gethan, sondern wir mußten fortdauernd mit dem Pinsel in der Hand lesen, um während des Lesens die Züge aufs Neue mit Galläpfelauflösung oder auch nur mit bloßem Wasser anzufrischen.
>
> Moreover, it was not enough to smear over once, but we had to read while always having the brush in our hand, in order to refresh the lines anew with oak gall solution or even with mere water while reading.

S3 Peyron 1824, vol. 2, 3–4:

> Nam cum scriptorium atramentum constet sulphato ferri, atque galla infusa, ferrum autem progressu temporis ab aëris efficacia oxydetur [...], tum si oxydatio minima esse contingat, facile ferrum affici potest, atque exsuscitari a liquore gallae, neutiquam vero si maxima. Pa-

ria dicantur de Prussiato Ammoniacae, quod utpote minimam acidi Prussici quantitatem in se continens, haud potest ferrum a pertinacissima oxydatione expedire.

For since writing ink consists of iron sulphate [= iron(II) sulphate ($FeSO_4$)] and a solution of oak galls, but the iron oxidises in the course of time by the agency of the air […], the iron, if the oxidation happens to be minimal, can be easily affected and made to react by the solution of oak galls, but by no means when the oxidation is very strong. Similar things are said of the prussiate of ammonia [= potassium amide (KNH_2)?], which, if it does not contain a very small amount of hydrogen cyanide [HCN], cannot free iron from very persistent oxidation.

S4 Peyron 1824, vol. 2, 4:

Adibam itaque collegam meum Giobert Chemiae Professorem, virum, in quo nescias, utrum magis suspicias eximiam scientiam, an urbanitatem ames. Nec mora; ipse medicamentum parat. Membranas primum aqua communi lavat; tum intingit in Acidum Muriaticum, quod unicum potest librare [*sic*] ferrum a maximo oxydationis gradu; illas subinde mergit in Prussiatum Potassae, quod ferro vel caesium, vel viridem colorem inducit pro vario membranarum genere; tandem eas iterum iterumque proluit aqua, ne noxia Acidi Muriatici gutta foliis adhaereat. Huic efficacissimae methodo, quam postea vidimus propositam iam fuisse a Cl^o Blagden in *Philosophical Transactions*, 1787. *part.* 2, illud in primis commodum acceptum refero, quod cum superior scriptura nigrum colorem servet, inferior autem caesium aut viridem assumat, facilius altera ab altera distinguitur.

I therefore approached my colleague Giobert, professor of chemistry, a man about whom I do not know whether you should admire more the outstanding knowledge or love the fine behaviour. Immediately he prepares a remedy himself. First he washes the pages of parchment with ordinary water; then he dips them in hydrochloric acid [$HCl_{(aq)}$], which is the only one capable of freeing the iron from the highest degree of oxidation; then he immediately dips them in [dissolved] prussiate of potash [= potassium hexacyanoferrate(II) ($K_4[Fe(CN)_6]$)], which gives the iron either a blue-grey or a greenish colouring, depending on the type of parchment; finally he washes them again and again with water, so that no harmful drop of hydrochloric acid sticks to the leaves. It is to this very efficient method, which, as we have seen later, had already been described by Charles Blagden in *Philosophical Transactions*, 1787, part. 2 [= Blagden 1787], that I credit that, while the upper writing retains its black colour, the lower, on the contrary, assumes a blue-grey or greenish one, and the one can be quite easily distinguished from the other.

S5 Blume 1836, vol. 4, 188–189:

Giobert's Tinctur soll nach seiner Vorschrift zusammengesezt werden aus 6 Teilen Wasser, l Teil acidum muriaticum Zooticum, 1/8 prussiat de potasse (Kali Zooticum), allein diese Verhältnisse können nach Umständen und vorsichtiger Probe etwas verändert werden. Bei dem Gebrauche ist vor Allem jedes Reiben zu vermeiden. Peyron hat ganze Blätter in die Tinctur getaucht, und sie gleich darauf in Wasser gelegt; ich habe mit einem Pinsel aufgetunkt, und die Stelle nach wenigen Secunden durch Aufdrücken eines Tuches getroknet, weil die Tinctur nicht Zeit erhalten darf, das Pergament zu färben, nachdem sie in die Ueberreste der al-

ten Schrift eingedrungen ist. Auch durch die Verbindung mit Galläpfeltinctur wird das gefährliche Färben des Pergaments erschwert; doch hüte man sich auch dann noch die Operation zu oft auf derselben Stelle zu wiederholen. Im Laufe einiger Jahre scheint freilich Alles nachzudunkeln.

Giobert's tincture should be composed of 6 parts water, 1 part hydrochloric acid, 1/8 prussiate of potash according to his instructions, but these proportions can be changed somewhat with respect to the circumstances and upon careful trial. Above all, any rubbing should be avoided during use. Peyron dipped whole sheets into the tincture and immediately afterwards put them into water; I dipped with a brush and after a few seconds dried the area by pressing on a cloth, because the tincture must not be given time to dye the parchment after it has penetrated the remains of the old writing. The dangerous staining of the parchment is also prevented by combining it with oak gall tincture; but even then one should be careful not to repeat the operation too often on the same spot. However, in the course of a few years, everything seems to darken.

S6 Letter from Friedrich Bluhme to Amedeo Peyron (17 August 1821; Turin, Biblioteca Nazionale Universitaria, Fondo Peyron 226.14, fols 1^{r}–2^{v}, here fol. 1^{v}; unedited):

J'espère que la seconde édition de Gajus vous prouvera, combien je vous dois de m'avoir communiqué l'invention de Mr. Giobert, et combien je pouvois me féliciter de communiquer la même invention aux Mrs. bibliothécaires de Mantoue et de Modène.

I hope that the second edition of the Gaius will show you how much I owe you for having communicated Mr Giobert's invention to me, and how fortunate I was to have been able to communicate the same invention to Messrs librarians of Mantua and Modena.

S7 Letter from Cozza-Luzi to Peyron (19 June 1869; edited in Pesce 1997, 332, no. 242):

Mi sarà cosa gratissima il conoscer meglio il composto de' suoi due acidi innocui allo scoprimento delle dilavate e rase scritture, ed il loro processo e metodo di applicazione. Io ho usato con felice esito l'apparato di acido muriatico e prussiato di potassa nel lavare il cod. palinsesto de' Profeti della Biblioteca di Grottaferrata. Mi dica se vi sia modo di togliere il colore turchino che resta sulle pergamene dopo letto l'antico scritto.

It would be very pleasant for me to know better the composition of your two harmless acids for the discovery of washed-off and erased writings, as well as their preparation and method of application. I have used with happy results a preparation of hydrochloric acid and prussiate of potash when washing the palimpsest codex of the prophets of the library of Grottaferrata [shelf mark E. B. VII]. Please tell me if there is a way to remove the blue colour which remains on the parchment pages after the reading of the ancient script.

S8 Letter from Cozza-Luzi to Peyron (16 November 1869; edited in Pesce 1997, 337, no. 246):

Le sue gentili indicazioni sull'apparato chimico sui palimpsesti saran giovevoli a me e ad altri, ai quali li comunico, bramando dalla sua bella scoperta i maggiori e migliori risultati, per cui debba dimostrarle la riconoscenza anche degli altri per la sua compiacenza.

Your kind advice on the chemical preparation for the palimpsests will be useful to me and to others to whom I communicate it, whereby I hope for the greatest and best results from your beautiful discovery. For this I must express my thanks and also those of the others to you for your kindness.

S9 Letter from Bekker to the Berlin Königlich Preußische Akademie der Wissenschaften (June 1817; edited in Varvaro 2012a, 153–156):

a) Von der Anwendung eines Reagens durfte um so weniger die Rede sein als, ungeachtet der sichtlich veranderten Farbe des Blattes, niemand gemerkt hatte daß Niebuhr dergleichen angewandt, selbst der Archiprete Eucherio nicht, der damals während der Abwesenheit des Bibliothekars, ganz zufälliger Weise, wie es scheint, die Aufsicht geführt hatte: denn der maaß die ganze Entdeckung einem *certo lume fosforico* bei, das N. fleißig in Handen gehabt. Daher haben wir denn die erste Woche unsers hiesigen Aufenthalts, die noch obenein durch Pfingstferien geschmälert wurde, nichts anders thun können als jenes von N. abgeschriebene 97te Blatt des Codex XIII abermals und vollständig abschreiben: was auch gelungen ist, weil die von ihm sehr reichlich aufgetragene Galläpfeltinctur kräftig nachgewirkt hat, so daß für uns manches sichtbar ist, das es für ihn nicht gewesen zu sein scheint.
b) Die alcalinischen Mittel werden als corrosiv geschaut, und wirklich sind einige Stellen, wo N. solche anversucht hat, höflich entstellt.

a) There could be all the less talk of the use of a reagent [i.e. at the beginning of Bekker's visit in Verona in 1817], since, notwithstanding the visibly changed colour of the leaf, no one had noticed that Niebuhr had used such, not even the *Archiprete* Eucherio, who at that time, during the absence of the librarian, quite by chance, as it seems, had been in charge: for he attributed the whole discovery to a 'certain phosphoric light', which N. had diligently had in his hands. Therefore, during the first week of our stay here, which was further curtailed by the Whitsun holidays, we were able to do nothing other than copy the 97th leaf of Codex XIII copied by N. once again and completely. This was a success, not least because the oak gall tincture he applied very generously has had a strong effect, so that many things are visible to us that do not seem to have been visible to him.
b) The alkaline remedies are considered to be corrosive, and indeed some places where N. has tried these out are quite disfigured.

S10 Letter from Niebuhr to von Savigny (4 September 1816; edited in Vischer 1981, 66):

Die besten Reagentien waren zu Verona nicht zu erhalten: ich musste mir selbst schleunig, so unvollkommen wie es gerieth, eine Galläpfelinfusion bereiten, welche so viel leistete, daß sich von den besseren Mitteln (Hydrosulphur von Pottasche u. Prussiat von Pottasche) *alles* hoffen lässt.

The best reagents were not to be obtained in Verona: I had to prepare myself quickly, as imperfectly as it turned out, an infusion of oak galls, which did so much that *everything* can be hoped for from the better agents (hydrogen sulphide of potash [KSH] and prussiate of potash).

S11 Göschen 1819, 311–312:

Versuche die wir mit *Hydrosulfure de potasse* und mit *Hydrosulfure d'ammoniac* an andern Pergamentblättern machten, fielen ganz befriedigend aus, und wir standen daher schon im Begriff, bei dem Domcapitel um die Erlaubniß einzukommen, auch dieser Reagentien uns bedienen zu dürfen; aber wir hielten doch noch für nöthig, jene Versuche zuvor an unserm Codex selbst im Kleinen zu wiederholen, und da versagten sie uns ganz und gar: die ältere Schrift wurde nicht lesbarer als sie es schon durch die Galläpfelauflösung geworden war, und die neue Schrift litt darunter, dergestalt daß wir uns genöthiget sahen, diese anderen Reagentien ganz bei Seite zu setzen.

Experiments we [Göschen and Bekker] made with hydrogen sulphide of potash and with ammonium hydrogen sulphide [[NH_4]SH] on other parchment leaves turned out quite satisfactorily, and we were therefore already on the point of applying to the cathedral chapter for permission to use these reagents as well; but we still thought it necessary to repeat these experiments on our codex itself [i.e. on Veron. XV] on a small scale, and there they failed completely: the older script became no more legible than it had already become through the oak gall solution, and the new script suffered from this, to such an extent that we saw ourselves compelled to set aside these other reagents altogether.

S12 Bevilacqua Lazise 1817, 21:

Avevali da prima accertati il Sig. Prof. Stromeyer di Gottinga d'aver conosciuto col mezzo di replicate, ed esatte esperienze, che qualora gli antichi caratteri d'un Palimpsesto siano difficili a leggersi per essere svaniti od ingialliti, la soluzione di noce di galla è pienamente efficace ad annerirli di nuovo, e che quando anche fossero essi cancellati col lavacro, o rasi dal ferro sì fattamente, che nessuna traccia visibile rimanesse di loro, l'idrosolfuro di ammoniaca avvalorato all'uopo dalla soluzione suddetta di noce, è il miglior mezzo di ravvivarli. Dall'esame del Palimpsesto s'avviddero però quei Dotti, che questa sola soluzione bastava a ravvivarne i caratteri.

Professor Stromeyer from Göttingen had assured them [Göschen and Bekker] in advance that he had found out by repeated and exact experiments that if the ancient letters of a palimpsest were difficult to read because they were faded or yellowed, the oak gall solution was fully efficient in turning them black again, and that even if they had been erased in a water bath or erased with an iron in such a way that no visible trace of them remains, the ammonium hydrogen sulphide, enriched if necessary with the above-mentioned oak gall solution, was the best means of reviving them. From the examination of the palimpsest, however, it appeared to the said scholars that this solution alone was sufficient to revive the letters.

S13 Göschen 1820, XIV–XV:

> Praeterea eam esse codicis XIII. condicionem statim intelligebamus, ut in eo enucleando, nisi chemicis remediis adhibitis, frustra consumeremus operam. Igitur ut gallae infuso, quod nobis quidem omnium remediorum unum se probavit, uti liceret, a Reverendissimo Capitulo venia petenda erat.
>
> Furthermore, we immediately realised that the condition of Codex XIII was such that we would struggle in vain to study it exhaustively if chemical aids were not consulted. Therefore, permission had to be obtained from the Reverend Chapter to use the oak gall solution, which proved to be the only suitable means, at least to us.

S14 Letter from von Savigny to Göschen (14 June 1817; edited in Vano 2008, 145, n. 13):

> Gott gebe nur, daß Sie die Erlaubniß zur Chemie bekommen haben, im schlimmsten Fall müßten Sie es durch Mailänder Behörde durchzusetzen suchen. Nicht wahr, wenn Sie die Erlaubniß bekommen, fangen Sie doch damit an, gleich alle Seiten zu bestreichen, damit Sie noch überall die Vortheile des Nachdunkelns genießen?
>
> God grant only that you have obtained permission for the chemistry! In the worst case you would have to try to enforce it through Milanese authorities. If you get the permission, you should immediately start smearing all the pages, so that you can still enjoy the advantages of darkening everywhere. Will you?

S15 von Schröter 1824–1826, 25/26, 298–299:

> Was nun fuer die gelehrte Ausstattung dieser ersten Ausgabe des Gajus gethan ist, haben wir schon bei frueheren Gelegenheiten durch die Bemerkung andeuten duerfen, daß alle spaeteren Herausgeber von Palimpsesten an ihr gelernt haben. Man kann diese Ausgabe im allgemeinen nur als ein unvergleichliches Muster deutschen Fleißes, deutscher Sorgfalt und Gelehrsamkeit, aber auch eines seltenen Scharfsinnes und hoher Liebe zur Wissenschaft charakterisiren. Das ganze Reich der philologischen und juristischen Literatur hat nichts Aehnliches aufzuweisen. Die Deutschen moegen sich dieser Arbeit ruehmen, kein anderes Volk waere im Stande gewesen sie zu liefern. Und bei aller dieser Vortrefflichkeit die einfache Groeße des Herausgebers, der jeden Schimmer von sich weisend seinen ganzen Reichthum unter fremden Namen auftreten laeßt, mit Selbstverleugnung ueberall nur der Sache dient!
>
> What has been done for the scholarly apparatus of this first edition of Gaius we have already had occasion to indicate by remarking that all later editors of palimpsests have learned from it. In general, this edition can only be characterised as an incomparable model of German diligence, German care and erudition, but also of a rare acumen and high love of erudition. The entire realm of philological and legal literature has nothing similar to offer. The Germans may boast of this work; no other nation would have been able to produce it. And with all this excellence, the simple greatness of the editor, who, refusing every glory to fall upon himself, allows it to appear under someone else's name [the Königlich Preußische Akademie der Wissenschaften is listed as editor on the title page and not Göschen], serving only the cause with self-denial everywhere!

S16 Göschen 1820, XVII–XVIII:

> Perfecta enim editio repetitam requirit codicis XIII. collationem: de cuius fructu ideo potissimum optima spes concipienda est, quia illius infusi, quo ad instaurandos antiquae scripturae ductus imbuimus, effectus temporis diuturnitate mirifice augetur, unde probabile est, multa, quae oculis percipere nobis nondum licuerit, nunc facili negotio posse agnosci.
>
> The completed edition [Göschen means the one at hand, his own] namely requires a renewed collation of Codex XIII. In its result one must place the greatest hopes above all because the effect of that solution with which we have impregnated the traces of the old script for its restoration is being miraculously reinforced over time, for which reason it is probable that much that was not yet possible for us to grasp with our eyes can now be recognised with easy effort.

S17 Letter from Niebuhr to Bluhme (17 September 1822; edited in Vischer 1981, 791):

> Für alles was Sie im Gaius herausbringen gebührt Ihnen unser aller Dank, und ist Ihnen sicher: was Sie nicht mehr herausbringen können ist ein Unglück, aber nicht Ihre Schuld: wenn es nur *nie bekannt wird* welchen Schaden die Giobertsche Tinctur angerichtet hat.
>
> For everything you bring to light in the Gaius you deserve the thanks of all of us, and you can be sure: what you can no longer bring to light is a misfortune, but not your fault: if only it *never becomes known* what damage Giobert's tincture has done.

S18 Blume 1824–1836, vol. 1, 262:

> Ich glaube aber behaupten zu können, dass ich meine Arbeit mit möglichster Ausdauer durchgeführt habe, und dass daher eine künftige Revision des Gaius verschoben werden mus, bis die Chemie uns ein neues noch wirksameres Mittel erfunden hat.
>
> I believe I can claim, however, that I have carried out my work with the greatest possible perseverance, and that a future revision of Gaius must therefore be postponed until chemistry has invented for us a new, even more effective remedy.

S19 Studemund 1874, XVII:

> In 'exterioribus' paginis kalio sulphurato usus sum, in 'interioribus' auctore Augusto Guilelmo Hofmann Berolinensi eo remedio, quod in annalibus philol. a. 1868 pag. 546 not. 1 accuratius descripsi: hoc igitur qui uti uolet, kalii sulphocyanati (aut ammonii sulphocyanati) grana aqua diluat admixtis paucis guttis acidi muriatici. Illud partim luteolum partim liuidulum colorem relinquit, estque dum madet non bene olens sed admodum asperum; hoc dum dilabitur, litterae emergere uidentur pallidulusque earum color quasi laeta et subrubea incrementa capit, ubi exaruit, uestigio nullo relicto pristina caligo ductibus offunditur. Quibus in remediis adhibendis id unum uidendum est ne parum aquae admisceas: quod ubi neglexeris, fragilis et tabescens membrana subita ruina collabetur sustinerique nullo modo poterit sed foedas aget rimas. Quodsi qua pagina nimis tenuis ad tactum uel remediis Bluhmia-

nis nimis maculata esse uidebatur, neque ulla apparebat spes fore ut meis medicamentis litterae Gaianae nudae et uenustae omni Hieronymianae scripturae uelo tamquam ueste detracta recuperarentur, ad Giuliarii uoluntatem me accomodaui, qui uenenis eas solas membranas denuo temptari uoluit, quae adhibendae medicinae uel necessitatem commonerent uel commendarent utilitatem.

On the 'outer' pages I used potassium sulphate [K_2SO_4]; on the 'inner' pages, on the recommendation of August Wilhelm Hofmann from Berlin, I used the means that I described in more detail in the *Philologische Jahrbücher* 1868, p. 546, n. 1: whoever wants to use it should dissolve grains of potassium sulphocyanate [= potassium thiocyanate (KSCN)] (or ammonium sulphocyanate [= ammonium thiocyanate (NH_4SCN)]) in spring water, adding a few drops of hydrochloric acid. The former [the potassium sulphate] leaves behind a partly yellowish partly bluish colour and, as long as it is moist, does not smell good but rather strong; while the latter [i.e. Hofmann's tincture] evaporates, the letters seem to emerge and their somewhat pale colour takes on a fresh and reddish tinge; as soon as it has dried up, the old mist lies over the lettering without a trace remaining. In using these means, the only thing to keep in mind is not to add too little water: if you neglect this, the brittle and worn parchment will be destroyed by immediate damage and will not be able to resist in any way, but will draw ugly wrinkles. But if a page seemed too weak to be touched, or too stained by Bluhme's remedies, and there was no longer any hope that by my means the bare letters of Gaius and the lovely writings of Jerome could be recovered after discarding every covering, as it were, like a garment, I submitted myself to Giuliari's will, who wanted that only those pages of parchment should be treated anew that either admonished the necessity of applying the tincture or recommended its usefulness.

S20 Ehrle 1909, 246:

Ebenso glücklich löste das Komitee seine weitere Aufgabe, auf die staatliche Bewilligung einer entsprechenden Summe hinzuwirken zur Rettung der Handschriften mittelloser Kapitelsbibliotheken. Von den verschiedenen Ländern, welche seit Jahrzehnten alljährlich Scharen ihrer Gelehrten zur Ausbeutung zumal der italienischen Bibliotheken entsenden, fanden sich wenigstens die Regierungen von Oesterreich-Ungarn und Preußen bereit, in anerkennenswerter Betätigung ausgleichender Gerechtigkeit dem Komitee zu dem besagten Zwecke eine beträchtliche Summe zur Verfügung zu stellen und so die Internationalität der wissenschaftlichen Interessen nicht nur im Nehmen, sondern auch im Geben zu betätigen. Diese Gelder kamen zum ersten Mal zur Photographierung der berühmten Gaiushandschrift von Verona, zu deren Ausbesserung und phototypischen Vervielfältigung zur Anwendung. [...] Eine weitere Veroneser Handschrift, die der wichtigen Fragmente de jure Fisci und des Codex Justinianus, (cod. LXII, ol. 60) wurde von S. Eminenz Kardinal Baccellieri schon vor geraumer Zeit der vatikanischen Bibliothek zu ähnlicher Behandlung anvertraut.

The committee [which had been appointed at the Conference of St Gallen] was equally successful in its further task of working towards the state granting of an appropriate sum to save the manuscripts of destitute chapter libraries. Of the various countries which for decades have annually sent swarms of their scholars to exploit the Italian libraries, at least the governments of Austria-Hungary and Prussia were, in a commendable exercise of balancing

justice, ready to make a considerable sum available to the committee for the aforementioned purpose and, in doing so, to exert the internationality of scholarly interests not only in taking, but also in giving. These funds were used for the first time to photograph the famous Gaius manuscript of Verona, to restore it and to reproduce it phototypically. […] Another Veronese manuscript, that of the important fragments de jure Fisci [which, however, is actually the manuscript Veron. I appendice, fr. IV] and of the Codex Justinianus (cod. LXII, ol. 60), was already entrusted by His Eminence Cardinal Baccellieri to the Vatican Library for similar treatment some time ago.

S21 Krüger 1898, 826:

Ce réactif n'est pas inconnu ; il a été déjà recommandé par Studemund (*Gai institutiones Cod. Veronensis apogr.*, p. xvii ; cf. *Philologische Jahrbücher*, 1868, p. 546, n. 1). Le premier qui en ait recommandé l'emploi est le chimiste berlinois feu W. Hoffmann. Studemund pense que l'emploi en est surtout recommandable sur la face interne du parchemin ; cette observation peut s'appliquer au Gaius de Vérone ; quant à moi, je n'ai point constaté de différence. La teinture s'étend avec un petit pinceau soit mot par mot, soit sur une demi-ligne ou même sur une ligne entière, suivant la grandeur de l'écriture. Le bain des feuilles entières, souvent pratiqué autrefois et qui ne réussit guère jamais, doit être absolument proscrit ici, parce que la réaction d'un rouge vif passe très promptement. Aussitôt lu le passage, on le sèche avec de bon papier buvard ; dans les endroits difficiles j'ai pu, sans affaiblir la réaction, répéter coup sur coup l'application de la teinture. Par ce procédé, j'ai pu lire presque sans lacunes les fragments berlinois de Papinien … Mon expérience personnelle ne me permet point de partager la prévention de quelques bibliothécaires contre l'acide muriatique, à condition qu'il soit fortement dilué. La peau n'est point atteinte, comme en témoignent les feuilles du Gaius de Vérone et du Code Théodosien de Turin, qui ont été traitées avec la teinture de Gioberti plus forte. – La composition exacte en est : Eau 15 parties, Ferrocyanure de potassium 1, Acide muriatique 1. Si l'emploi par Blume de ce réactif a rendu illisible le Gaius de Vérone, la faute en est à une mauvaise composition ou à une mauvaise application de la teinture.

This reagent is not unknown; it was already recommended by Studemund (*Gai institutiones Cod. Veronensis apogr.*, p. xvii; see *Philologische Jahrbücher*, 1868, p. 546, n. 1). The first to recommend its use was the late Berlin chemist W. Hofmann. Studemund thinks that the use is especially recommended on the inner side of the parchment; this observation may refer to the Gaius of Verona; as far as I am concerned, I have not noticed any difference. The tincture is applied with a small brush either word by word or on half a line or even on a whole line, depending on the size of the writing. The bathing of whole sheets, once often practised and hardly ever with success, must be strictly forbidden in this case, because the reaction, consisting in a vivid red, takes place very quickly. As soon as one has read the passage, one dries it with a good piece of blotting paper; in difficult places I have been able to repeat the application of the tincture time and again without weakening the reaction. Through this procedure I have been able to read the Berlin fragments of Papinian almost without any gaps … My personal experience does not allow me at all to share the reservations of certain librarians about hydrochloric acid, on condition that it is strongly diluted. The skin is not attacked at all, as witnessed by the leaves of the Gaius of Verona and the Codex Theodosianus of Turin, which were treated with Giobert's stronger tincture. – The exact composition is: 15 parts

water, 1 part potassium ferrocyanide, 1 part hydrochloric acid. If Bluhme's use of this reagent has rendered the Gaius of Verona illegible, the fault lies in poor composition or poor application of the tincture.

S22 Giuliari 1888, 248 [1993, 250]:

[...] usando prima il *prussiato di potassa*, poi bene asciugati i fogli, li toccava leggermente con la soluzione di *ammoniaca*, secondo il metodo adoperato sulle pagine interiori del Gajo dallo Studemund: ne risultò una bellissima tintura *bleu*, efficace a ravvivare lo spento carattere, senza portar guasto alla membrana.

[...] by first using prussiate of potash, then, after the leaves had been dried well, he [Mommsen] touched them lightly with an ammonia solution according to Studemund's method used on the inner pages of the Gaius. This resulted in a very beautiful blue colouring, efficient in reviving the extinguished letters without harming the parchment.

S23 Studemund in Krüger and Studemund 1884, VI–VII:

Ex remediis chemicis, quibus ipse olim annis 1867 et 1868 usus eram, paucis locis codicem leuiter fatigauerat kalium sulphocyanatum mixtum paucis guttis acidi muriatici; nec tamen commissae iniuriae urit me angitue conscientia: sane nusquam grauiores labes contraxit codex in eis locis, quos hoc remedio olim temptaueram; huius enim ope tamquam uelo detracto nudatur antiqua scriptura, eademque intra exiguum tempus denuo operitur et in ueteres tenebras demergitur. Contra non pauci ex eis locis, ad quos legendos olim lentiore ui kalii sulphurati usus eram, anno 1878 et anno 1883 facilius ac plenius legi potuerunt quam anno 1868.

Of the chemical remedies that I myself had once used in 1867 and 1868, potassium sulphocyanate mixed with a few drops of hydrochloric acid had slightly exhausted the codex in a few places; and yet no bad conscience burns or torments me for having done wrong: certainly, the codex has not suffered any worse damage in the places that I had once treated with this remedy. Because with its help the old script is uncovered as if by pulling back a veil, and after a short time it is covered anew and plunged into the old darkness. On the other hand, quite a few of the passages for the reading of which I had once made use of the more inert effect of potassium sulphate could be read more easily and more completely in the years 1878 and 1883 than in 1868.