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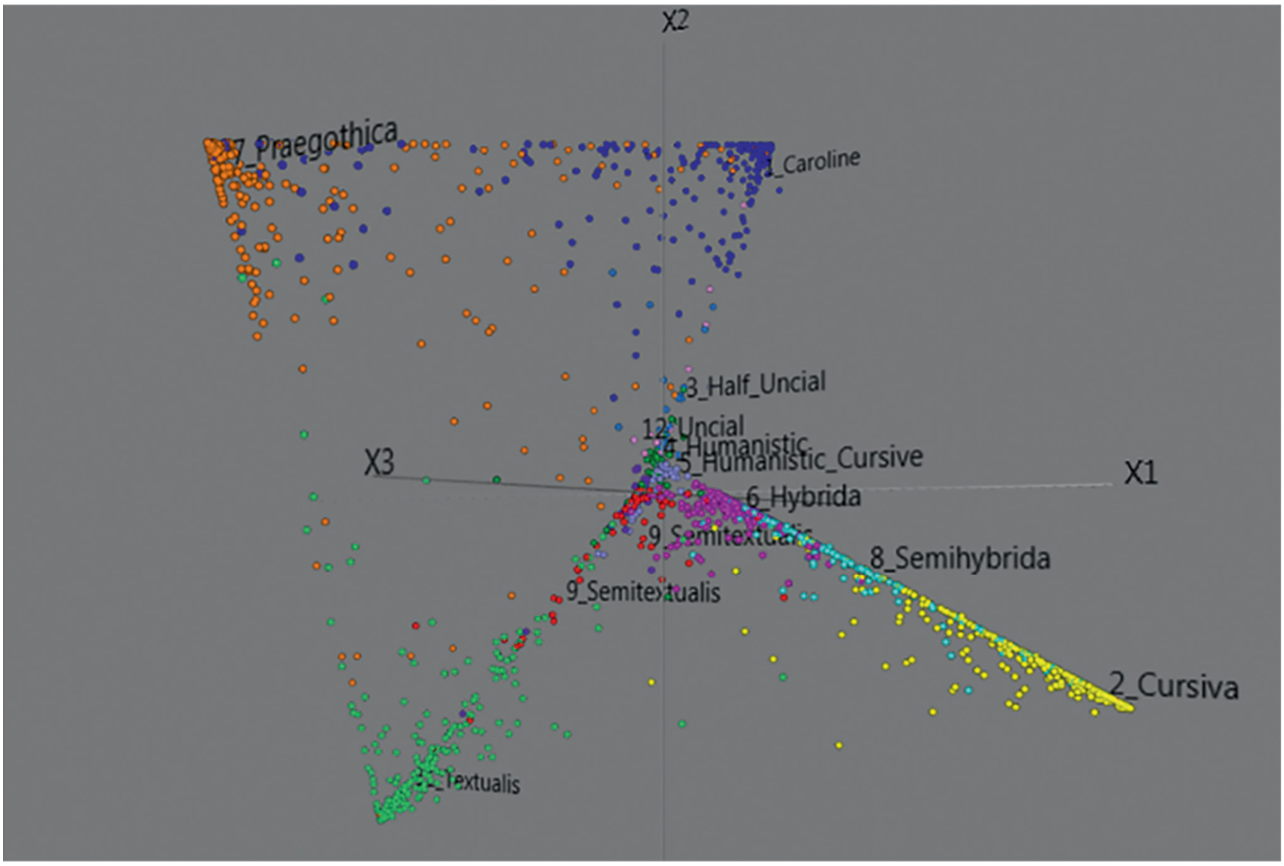

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Edited by Oliver Hahn, Volker Märgner, Ira Rabin, and H. Siegfried Stiehl

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Article

When Erased Iron Gall Characters Misbehave

Keith T. Knox | Kihei, Hawaii

Fig. 1: EurekaVision cultural heritage imaging system, in use at the Staatsbibliothek zu Berlin (Berlin State Library, Prussian Cultural Heritage Collection).

Abstract

Iron gall ink that has been erased from parchment, leaves stains which are the residues of compounds of tannic acid with vitriol, or metallic sulfates. For years, this erased writing has been read by scholars by inspecting the parchment under ultraviolet illumination. This results in increased contrast that enables the erased writing to be read. This is the normal behavior of erased iron gall ink on parchment. When the residue from the erased ink does not behave in this normal manner, other methods need to be developed to reveal the erased text. This paper describes three methods that were developed to reveal erased characters that behave in uniquely different ways.

1. Multispectral Imaging of Parchment Manuscripts

The multispectral imaging system used to capture the images for all of the projects, described in this paper, was developed by MegaVision (‘Archival and Cultural Heritage Imaging’). One of their imaging systems is shown in Fig. 1. In that image, several LEDs of different wavelengths have turned on at the same time to generate white light for positioning the manuscript. During image capture, LEDs are turned on individually to illuminate the manuscript with only one wavelength of light, at a time. The camera has a 50 mega-pixel, panchromatic sensor that records the response of the manuscript leaf to each wavelength of light. The diffusers ensure a reasonably uniform spread of the light across the manuscript. The LEDs and camera are under computer control, so all of the changes in illumination and camera settings are executed automatically.

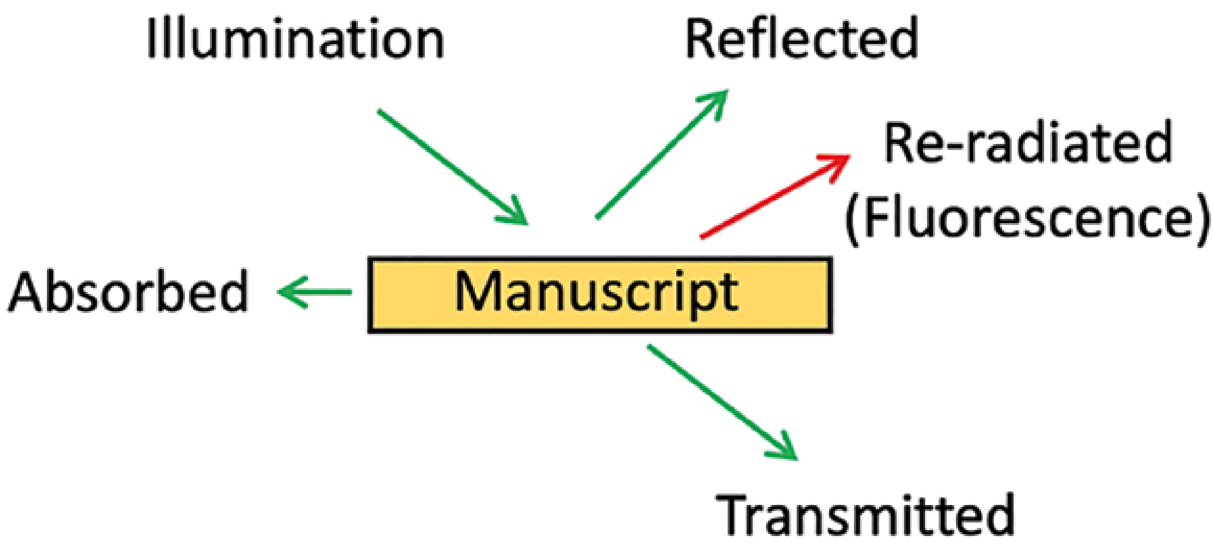

Fig. 2: The light interacts with the parchment in one, or more, of four different ways, reflection, transmission, absorption, or fluorescence.

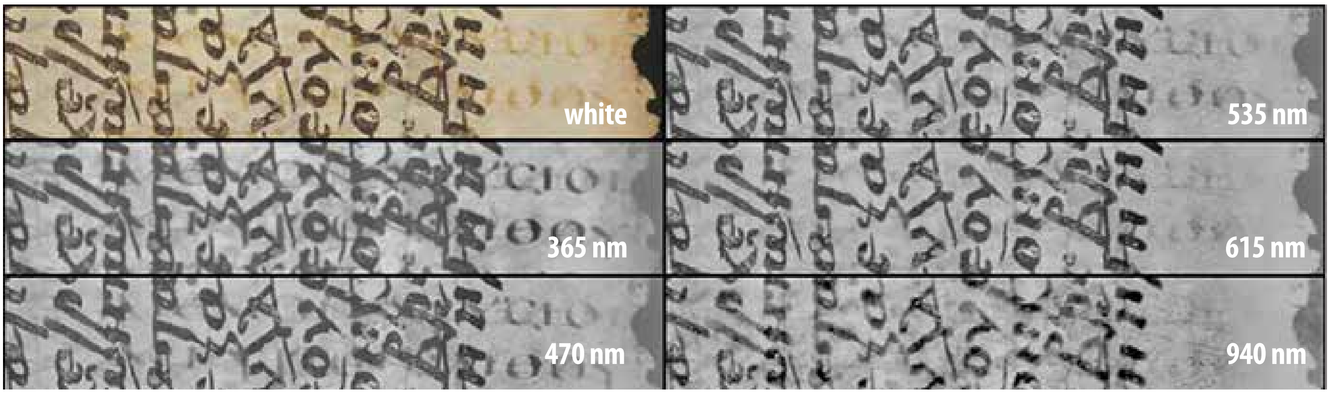

Fig. 3: Erased iron gall ink that has been overwritten. The erased stains are most visible when illuminated with blue or ultraviolet light.

Three types of optical images are captured, as shown in Fig. 2. One is simple reflectance of the light from the parchment surface. The light reflected from the parchment will be at exactly the same wavelength as the illumination. Light of any wavelength, from ultraviolet, through the visible, and into the infrared, can be reflected from the surface.

When ultraviolet light is used to illuminate the parchment leaf, the light is absorbed by the parchment, then re-radiated outward, in all directions, at longer wavelengths, typically in the visible region of the spectrum. For example, the ultraviolet light might be absorbed and re-radiated as blue light. This process is called fluorescence. Filters on the camera can be used to determine the colors of the light that are contained in the fluorescence.

Lastly, images are taken of light that is transmitted through the parchment leaf. The leaf is illuminated from a light sheet that sits below the leaf. The light travels through the parchment and out the top surface to the camera above. The longer the wavelength of the illumination, the deeper into the parchment the light will go. As a result, the best wavelengths for transmitted-light images are the infrared wavelengths, with visible light also working, depending on the thickness of the parchment. Ultraviolet light does not penetrate deeply enough to transmit through the parchment.

These three different types of images are useful in distinguishing different inks, or in enhancing the regions of erased ink. When the goal is to recover the erased text and make it legible for a scholar to read, the different images can be combined in ways that enhance the desired writings. This study will focus on the response of iron gall ink to multispectral illumination. There are some responses that are well understood, and others that are not. All of them can be used to enhance the erased text (Easton et al. 2010).

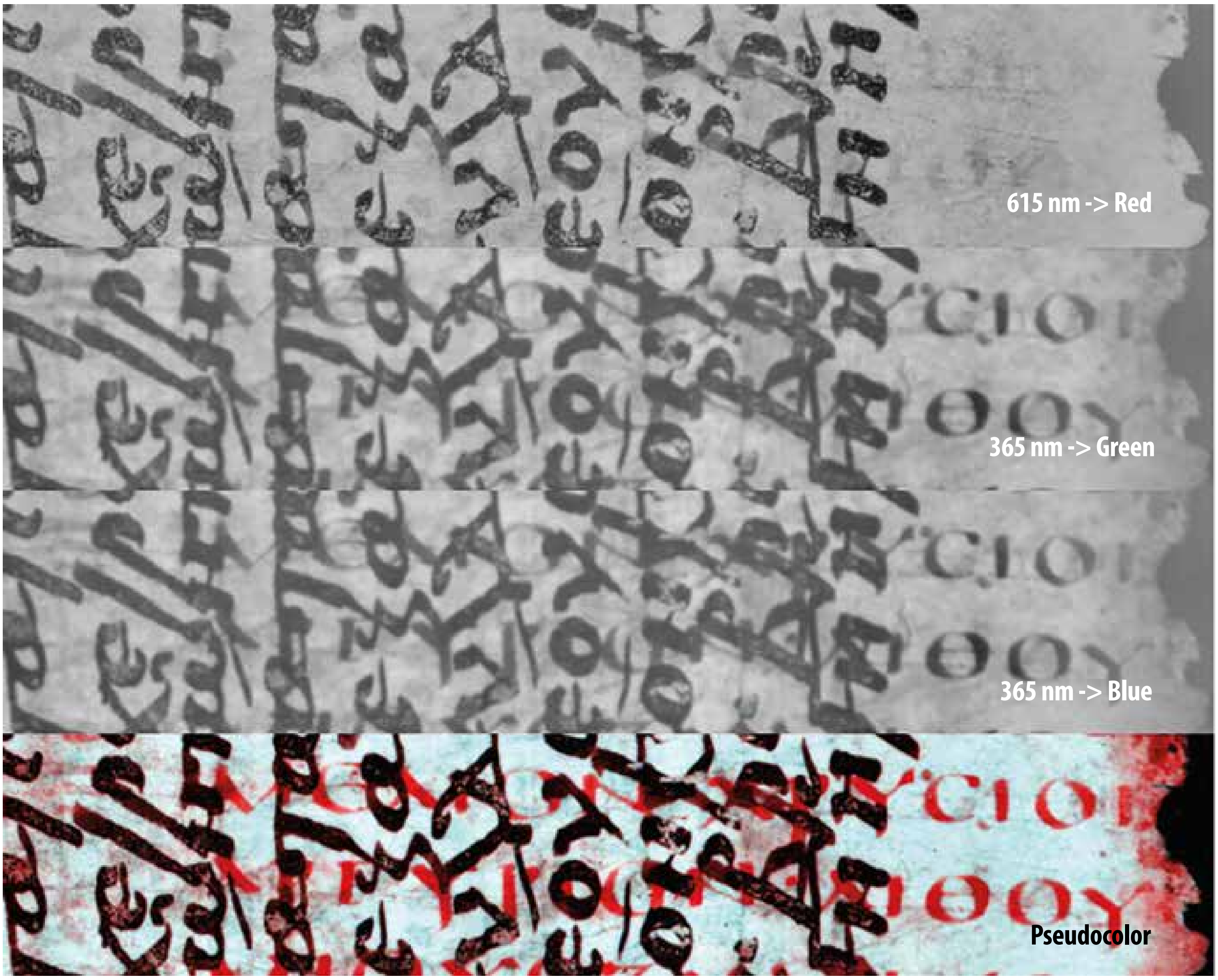

Fig. 4: Greek NF MG 99, fol. 3v–4r. A pseudocolor image is created from a visible image, in which the erased text cannot be seen, and a fluorescence image in which both texts are visible.

Fig. 5: The pseudocolor image (bottom) compared to the natural light image (top). The erased text is much easier to read in the pseudocolor image.

Fig. 6: The Ethiopic overwritten manuscript Petermann II Nachtrag 24 from the Berlin State Library.

2. Normal Optical Behavior

Iron gall ink was made by combining iron salts, such as iron sulfate, with tannic acids extracted from plants, such as galls on trees ('Iron Gall Ink' 2019). When dried, the ink turns a dark color on the parchment. The chemicals from the ink, the tannins, soak into the parchment underneath the characters. To erase the writing, the page can be either washed to remove the ink, or scraped to remove the ink and the top layer of the parchment. In either case, the tannins remain in the parchment in the exact shape of the characters that were removed.

After erasure, with time, the stains left behind darken. Although they become more visible, they can still be difficult to read and are not always clearly shaped (Fig. 3). Their color tends to be a faint reddish-brown. With visible reflectance images, these slight color differences can be detected. Being in the red region of the spectrum, they are more visible under blue light. In the infrared region, they almost completely disappear. In the blue region, they have a high contrast against the parchment.

Under ultraviolet illumination, the erased iron gall characters become very distinct. This is due to the natural fluorescence of the parchment under ultraviolet illumination. The tannins in the parchment, located in the regions of the characters, suppress the fluorescence of the parchment (Rabin 2018), leading to an increased contrast of the characters against the parchment. This increased contrast can even result in sharper edges of the characters, as the faint stains suppress fluorescence more strongly than their color differences are distinguishable. This leads to a simple method to enhance the erased text (Knox 2008). As shown in Fig. 4, the red or infrared image is inserted into the 'red' channel of a pseudocolor image, while the ultraviolet image is inserted into the green and blue channels of the same pseudocolor image. Since the erased text is bright in the red channel and dark in green and blue channels, it shows up as bright red in the pseudocolor image. The overwriting, on the other hand, is dark in all three channels, so it is seen as a neutral dark color. This color difference makes the erased text stand out against the parchment and the overwriting.

When the pseudocolor image is compared to the original natural light image, the results are striking (Fig. 5). In the natural light image, the erased text is faint and barely visible and the characters are not very sharply defined. In the region of the overwriting, the erased characters can be read only with great difficulty.

On the other hand, in the pseudocolor image, the erased text is clearly visible, even in the region of the overwriting. The high contrast of the erased text in the ultraviolet, or fluorescence, image leads to the high contrast of the edges of the erased text in the pseudocolor image. The color contrast of the erased text, combined with the black & white contrast of the fluorescence image, gives the erased text in the pseudocolor image a higher contrast than it has in any of the individual single-wavelength images.

3. When Erased Characters Fluoresce

As we have seen already, the normal optical behavior of the stains left behind by erased iron gall ink is to suppress the fluorescence of the parchment, thereby increasing the contrast of the stains against the parchment. When the stains darken

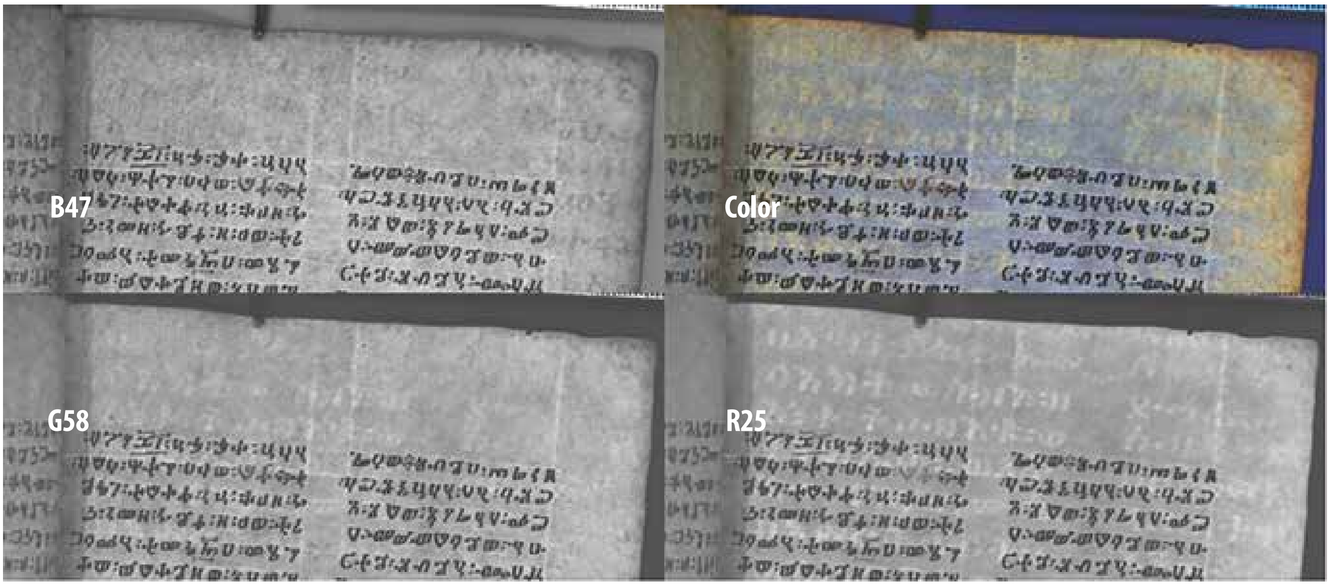

Fig. 7: The fluorescence of the erased text is different through the three color filters, B47 (blue), G58 (green) and R25 (red). The color fluorescence image is made from the three filtered-images.

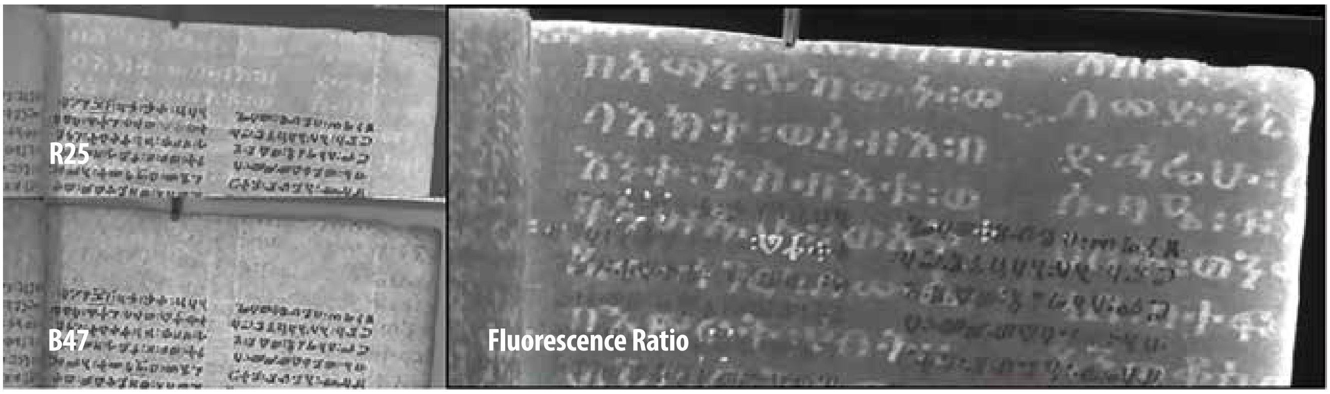

Fig. 8: By dividing the red-filtered image (R25) by the blue-filtered image (B47), the erased characters are significantly enhanced in the ratio image, shown on the right.

under ultraviolet illumination in this manner, a pseudocolor image can be used to enhance the legibility of the erased characters.

There have been a few times that we have seen cases where the stains do not suppress the parchment fluorescence, but instead fluoresce themselves. It is quite possible that these are not the result of erased iron gall ink, but we do not have sufficient information whether or not this is the case. In any event, the normal processes of combining the infrared and ultraviolet images does not enhance the erased text.

One such case was encountered in the imaging of the Petermann II Nachtrag 24 manuscript that is located in the Staatsbibliothek zu Berlin (Berlin State Library, Prussian Cultural Heritage Collection) (*Orient Digital* 2019). This is an Ethiopic overwritten manuscript written in Ge’ez, see Fig. 6. Because the erased text fluoresces, it is important to look at the colors of the fluorescence. This is accomplished at the camera by filtering the fluorescent light coming from the manuscript. In Fig. 7 are shown the filtered images of the fluorescence. The three filters used are red, green, and blue Wratten filters, namely, B47, G58 and R25 (*Orient Digital* 2019).

When the images through the three filters are combined in a color image, seen in Fig. 7, one can see that the characters are fluorescing in yellow. From the three individual images, one can see that the characters in the blue-filtered image are dark, while they are bright in the green-filtered image and very bright in the red-filtered image. This is a reasonable expectation from yellow fluorescence. Why these erased characters are fluorescing is not understood, but it is clearly a result of the residues that were left in the parchment after the ink was removed.

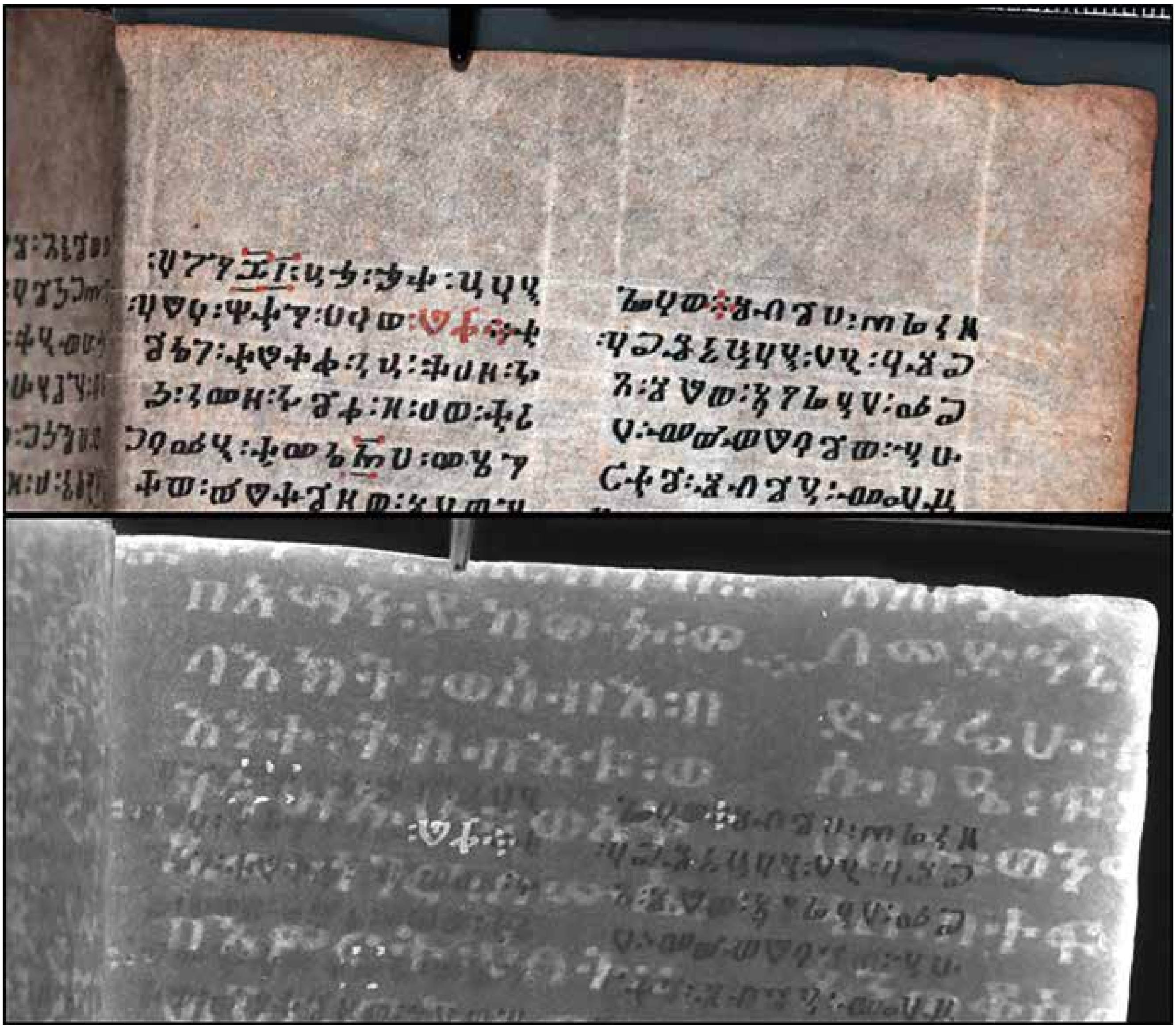

Fig. 9: The fluorescence ratio image (bottom) dramatically reveals the erased characters that fluoresce under ultraviolet illumination, but are barely visible to the eye in natural light (top).

Because the erased characters in the fluorescent images are not all dark, there is an opportunity to further enhance the erased text by properly combining the fluorescence results. Since the digital images are stored in the computer as arrays of numbers, where smaller numbers represent darker values and larger numbers represent brighter values, one can combine the values from different images mathematically. In Fig. 8 is shown the result of dividing the red-filtered image by the blue-filtered image. The result is to dramatically increase the values of the erased text, making them brighter in the resultant fluorescence ratio image.

Although the fluorescence of the erased characters in this manuscript is not understood, the color of the fluorescence can be used to significantly enhance the legibility of the erased text. In Fig. 9, the fluorescence ratio image is compared to the same leaf under natural light. Erased characters, that are not visible to the eye, are distinctly revealed in the fluorescence ratio image.

4. When Characters Erode the Parchment

Iron gall ink, made from tannic acid, can be harsh on parchment. Since parchment is made from skin, there are two sides to a leaf, the hair side and the flesh side. The hair side is fairly resistant to the ink, but the flesh side can be eroded away by the harshness of the ink. This erosion takes the exact shape of the character that was erased. The result is a cavity in the parchment in the shape of the missing erased character. The stains, that would have been left behind by the

Fig. 10: Georgian NF 13, folio 59r. The reflectance response of flesh side to visible and infrared illumination. The image labeled 940 nm TX is an infrared transmission image.

tannins in the parchment, have fallen away leaving behind a small cavity with no tannin stains. This condition happens frequently on the flesh side of the parchment leaves.

On the hair side of a piece of parchment, the stains from the erased text respond well to ultraviolet light, yielding enhanced characters. Conversely, on the flesh side, the parchment surface often is eroded by the ink and the stains from the tannins are frequently no longer there. In their place, are small cavities that contain no tannin stains, and therefore do not respond to ultraviolet illumination.

The cavities that result from the eroded characters make the parchment a little thinner, right at the locations of the characters. As a result, when light is shown through the leaf, less light is scattered in the region of the characters, allowing more light to be transmitted through the parchment. This results in bright figures in the shape of the missing characters.

The response of a flesh-side page of a palimpsest from the library of Saint Catherine's Monastery can be seen in Fig. 10. In the color image, dark shapes can be just discerned in horizontal lines across the leaf. Nothing much is seen in reflectance images until the illumination enters the red and infrared region, where the characters turn dark. However, in infrared transmission, the erased text shows up as bright characters, as more light makes its way through the parchment.

Although the erased characters in the 940 nm transmission image look good, they can be improved by dividing the transmission image by the 940 nm reflectance image. Since the erased characters in the reflectance image are darker than the parchment, the division will enhance the bright characters in the transmission image. In addition, the overwriting on leaf is also suppressed by the division. The result of this transmission ratio can be seen in Fig. 11.

When compared to the natural light image, see Fig. 12, the transmission ratio image can reveal erased characters that do not respond to ultraviolet illumination. While we have seen this effect on several manuscripts, we do not see it every time, and we cannot predict when it will occur.

5. When Erased Characters Partially Erode the Parchment

The erosion of the parchment on the flesh side by the remains of the iron gall ink occurs frequently, but not always uniformly. In one project, working on the Jubilees manuscript at the Ambrosiana library in Milan, Italy, we found that the erosion was spotty. On the same leaf, some characters eroded and others nearby remained as tannin stains in the parchment. In other cases, parts of the same character eroded while other parts of the same character did not.

This feature can be seen in the response of one page of the Testament of Moses, folio 109, seen in Fig. 13. In the natural light image, erased characters are visible as stains in some parts of a text line and not visible in other parts of the same line. Even some characters are partially visible and partially not visible. In the blue reflectance image (470 nm), which is similar to an ultraviolet fluorescence image, some parts of the characters are visible. Conversely, in the 940 nm transmission image, the parts of the characters not visible in the blue reflectance image, show up as white characters in the transmission image.

This partial erosion and partial stain led to the development of what we called a Ruby image, which is a ratio of an ultraviolet fluorescence image by a transmission image. To utilize the full variation of the fluorescence and transmission

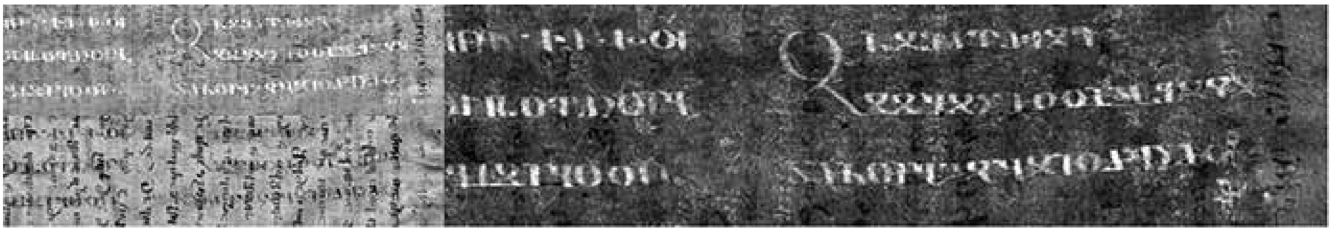

Fig. 11: The transmission ratio image (right) is obtained by dividing the 940 nm transmission image (top) by the 940 nm reflectance image (bottom).

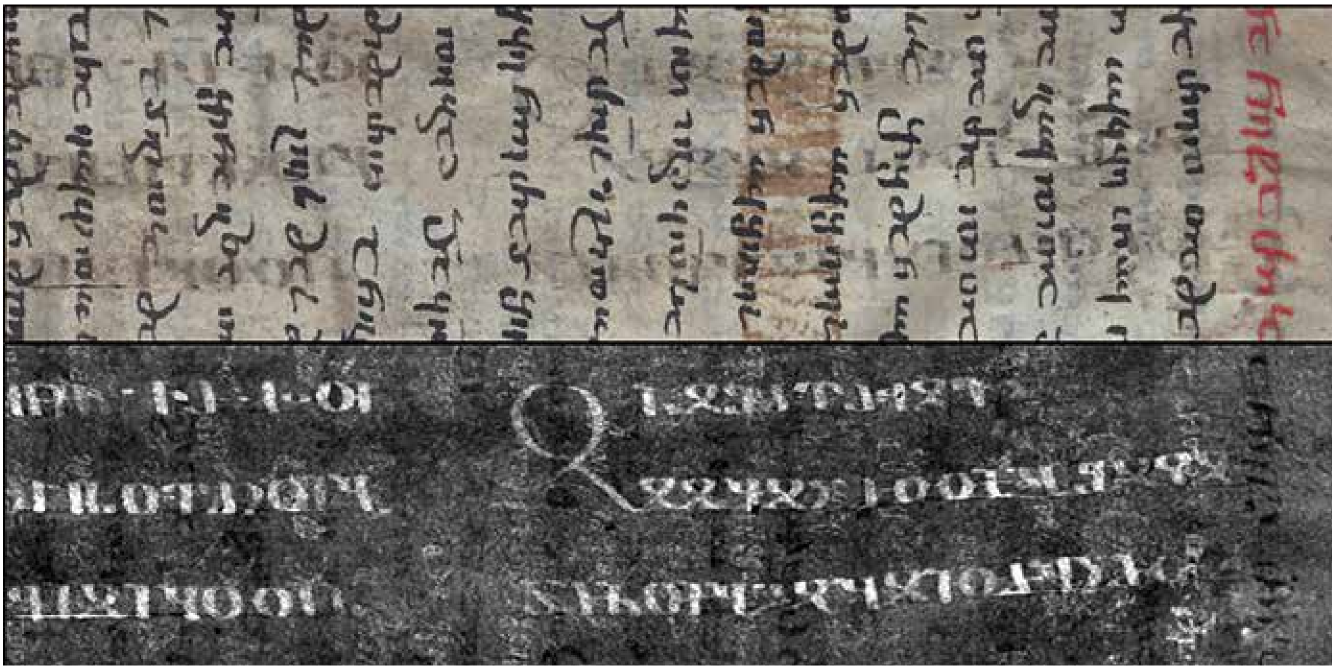

Fig. 12: The transmission ratio image (bottom) reveals many characters that are not visible in the natural light image (top).

responses, color images were made of each before taking the ratio. Fig. 14 shows the ratio of these two images.

By taking a ratio of the fluorescence image and the transmission image, each image fills in the parts of the characters that were missing from the other image. The result is that the ruby image has complete characters and complete text lines. A comparison of the ruby image with the natural light image is shown in Fig. 15.

6. Conclusions

The first tool to use in revealing erased iron gall ink characters is to view the manuscript under ultraviolet illumination. The fluorescing of the parchment, aided by the suppression of the fluorescence by the ink stains, enhances the erased characters. These characters can be further enhanced by combining individual reflectance and fluorescence images together in a pseudocolor image.

Utilizing the suppression of the fluorescence by the tannin stains does not always work. Sometimes, instead, the character residues, themselves, fluoresce. In this case, the color of the fluorescence can be used to enhance the erased characters by dividing two filtered images of the fluorescence. In particular, dividing two images where the erased characters respond differently, but the parchment response is the same. This enhances the contrast of the erased text in comparison to the background parchment around it.

Other times, often on the flesh side of the parchment, the ink may have eroded away some of the parchment, leaving it thinner underneath the writing. This erosion can result in parchment in which there are no stains remaining from the erased text. The lack of tannin stains in the parchment means that the erased characters do not respond to ultraviolet illumination, either in suppression of fluorescence or in fluorescing themselves. This erosion

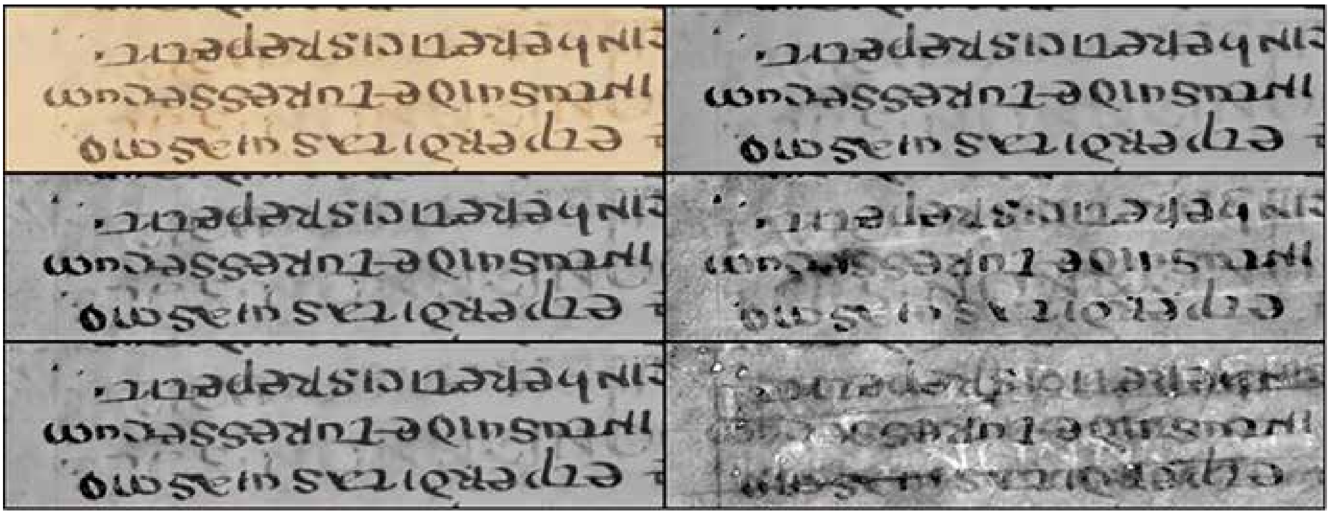

Fig. 13: The natural light image shows traces of the erased text. The reflectance images show some of the characters, but not all. The transmission image shows the parts of the characters not seen in the reflectance images.

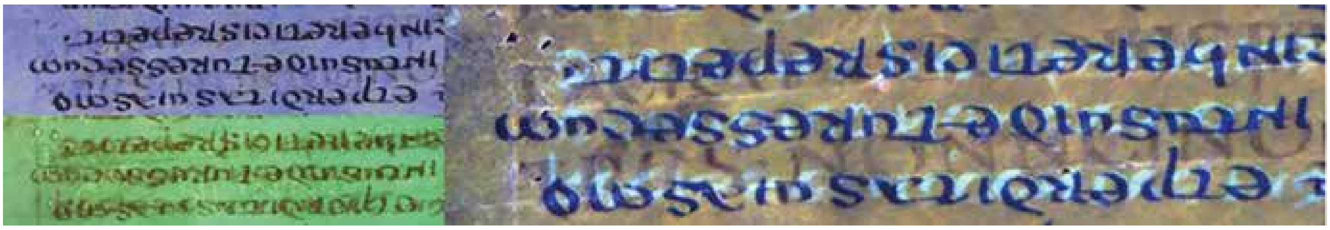

Fig. 14: The ruby image (right) is obtained by dividing a color transmission image (top) by a color fluorescence image (bottom).

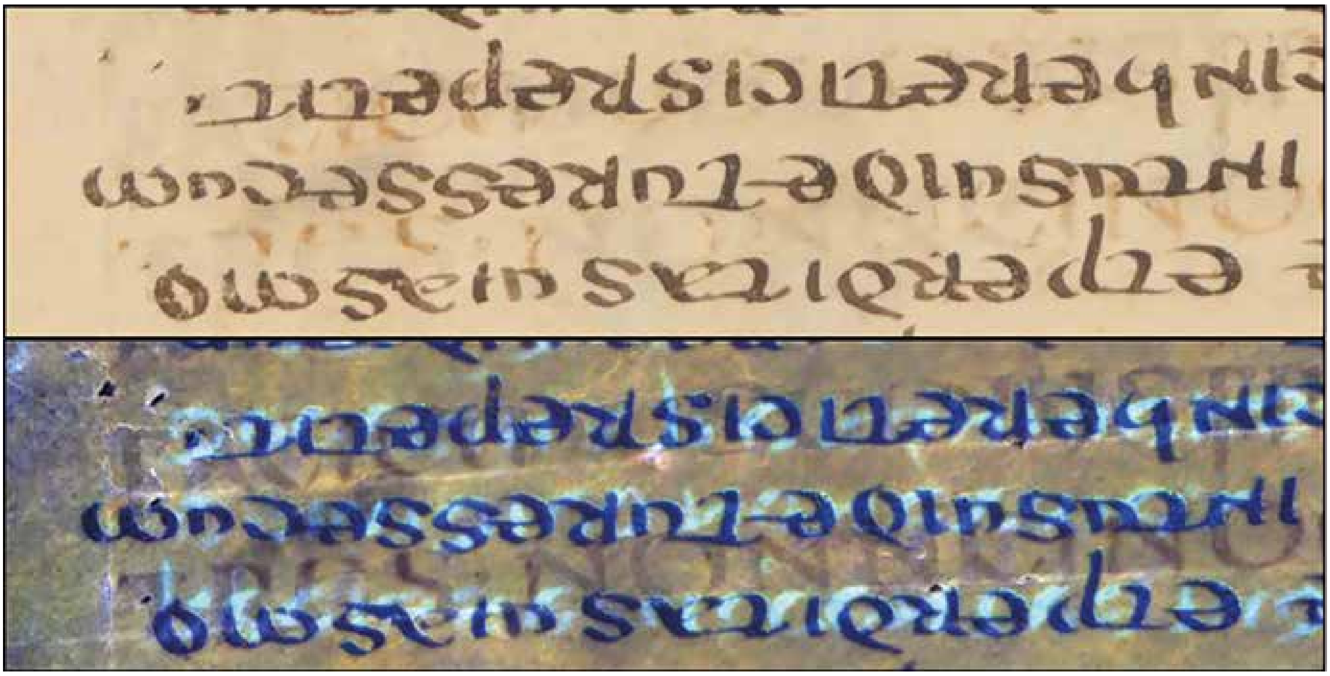

Fig. 15: The natural light image (top) in comparison with the ruby image (bottom).

phenomenon, though, does make the parchment thinner, meaning that more light can be transmitted through the parchment revealing the missing erased characters. At the same time, the infrared reflectance image partially reveals the missing characters as darker than the parchment, rather than lighter as in the transmission image. This may be due to less light being reflected by the parchment, since there is less parchment in the region of the missing characters. As a result, the ratio of infrared transmission image by the infrared reflectance image reveals and enhances the missing text.

In this paper, we have shown four different image processing methods, three of which that were developed over the last decade to handle unique cases where the erased iron gall ink writings do not behave in the normal manner. The three methods are based on combining different types of images captured in the multispectral imaging of the manuscript, depending on which types of images contain the information about the text. We do not believe that these are the only viable methods available, nor the only ways in which erased characters behave. Based on our past experience, we can almost guarantee that additional ways will be found in which erased iron gall ink will misbehave.

7. Acknowledgments

The author would like to acknowledge his colleagues of the past two decades, without whose help these techniques may not have been developed. On the Archimedes project (2000–2010), where the pseudocolor technique was developed, thanks are due to image processing colleagues, Roger Easton, Jr. and William Christens-Barry. The transmission ratio method was developed as part of the Sinai Palimpsests Project (2011-2016), which benefitted from the Director of the Early Manuscripts Electronic Library, Michael Phelps, camera operator Damianos Kasotakis and image processor, David Kelbe. The Petermann palimpsest project (2016), was conducted to help the scholars, Loren Stuckenbruck and Ted Erho. It was greatly aided by Ira Rabin, who loaned us the equipment and made available a member of her staff, Ivan Shevchuk. Lastly, the author's thanks also go to Todd Hanneken who made it possible to work on the Jubilees palimpsest at the Ambrosiana library in Milan, Italy.

REFERENCES

'Archival and Cultural Heritage Imaging' (2019), in *MegaVision* Website <http://www.mega-vision.com/cultural_heritage.html>.

Easton, Roger L. Jr., K. T. Knox, W. A. Christens-Barry, K. Boydston, M. B. Toth, D. Emery, and W. Noel (2010), 'Standardized system for multispectral imaging of palimpsests', *Proceedings of SPIE*, vol. 7531: *Computer Vision and Image Analysis of Art*, (San Jose, CA: SPIE). doi: 10.1117/12.839116

'Iron Gall Ink' (2019), in *Wikipedia*, <https://en.wikipedia.org/wiki/Iron_gall_ink> (last accessed November 2019).

Knox, K. T. (2008), 'Enhancement of overwritten text in the Archimedes Palimpsest', Proceedings of SPIE, vol. 6810: *Computer Image Analysis in the Study of Art*, (San Jose, CA: SPIE). doi:10.1117/12.766679

Orient Digital – Datenbank der orientalischen Handschriften der Staatsbibliothek zu Berlin http://orient-digital.staatsbibliothek-berlin.de/receive/SBBMSBook_islamhs_00025151?lang=en (last accessed November 2019).

Rabin, Ira (2018), Private communication.

'Wratten Number' (2019), in *Wikipedia* <https://en.wikipedia.org/wiki/Wratten_number> (last accessed November 2019).

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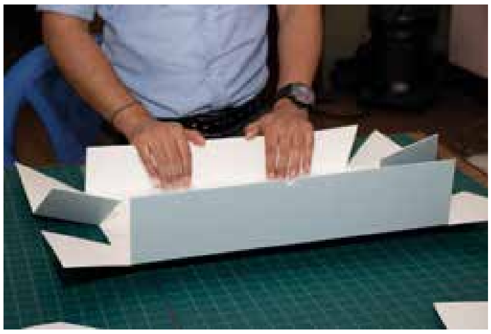

manuscript cultures (mc)

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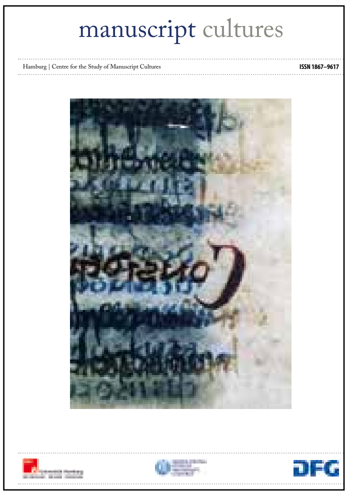

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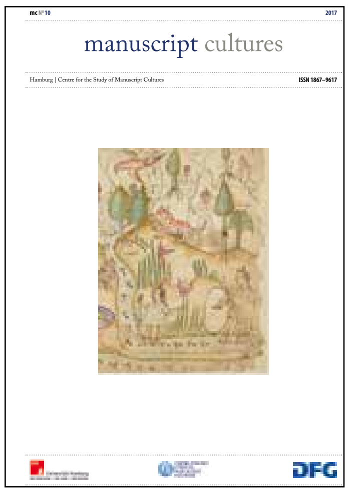

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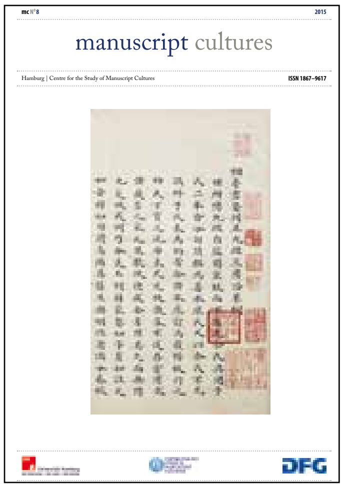

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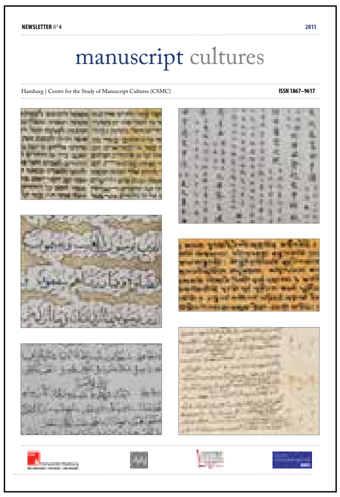

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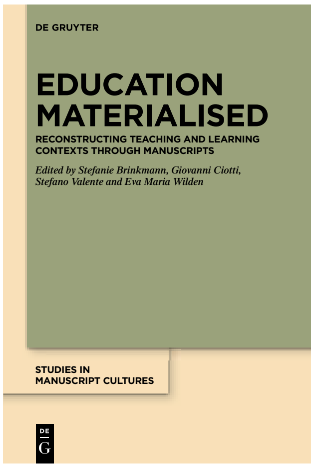

23 – *Education Materialised: Reconstructing Teaching and Learning Contexts through Manuscripts,* edited by Stefanie Brinkmann, Giovanni Ciotti, Stefano Valente and Eva Maria Wilden

Manuscripts have played a crucial role in the educational practices of virtually all cultures that have a history of using them. As learning and teaching tools, manuscripts become primary witnesses for reconstructing and studying didactic and research activities and methodologies from elementary levels to the most advanced.
The present volume investigates the relation between manuscripts and educational practices focusing on four particular research topics: educational settings: teachers, students and their manuscripts; organising knowledge: syllabi; exegetical practices: annotations; modifying tradition: adaptations.
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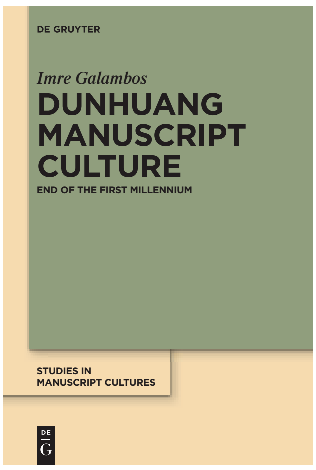

22 – *Dunhuang Manuscript Culture: End of the First Millennium*, by Imre Galambos

Dunhuang Manuscript Culture explores the world of Chinese manuscripts from ninth–tenth century Dunhuang, an oasis city along the network of pre-modern routes known today collectively as the Silk Roads. The manuscripts have been discovered in 1900 in a sealed-off side-chamber of a Buddhist cave temple, where they had lain undisturbed for for almost nine hundred years. The discovery comprised tens of thousands of texts, written in over twenty different languages and scripts, including Chinese, Tibetan, Old Uighur, Khotanese, Sogdian and Sanskrit. This study centres around four groups of manuscripts from the mid-ninth to the late tenth centuries, a period when the region was an independent kingdom ruled by local families. The central argument is that the manuscripts attest to the unique cultural diversity of the region during this period, exhibiting – alongside obvious Chinese elements – the heavy influence of Central Asian cultures. As a result, it was much less 'Chinese' than commonly portrayed in modern scholarship. The book makes a contribution to the study of cultural and linguistic interaction along the Silk Roads.

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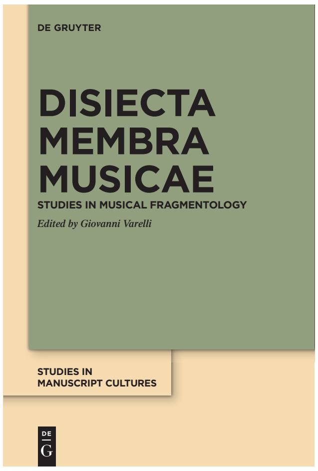
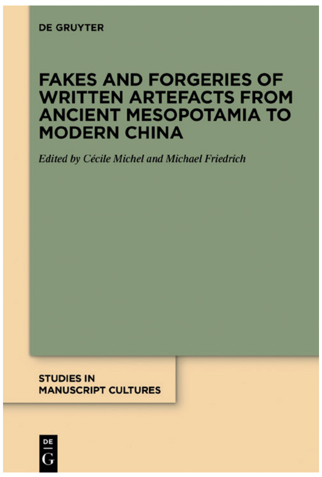
New release



21 – *Disiecta Membra Musicae: Studies in Musical Fragmentology*, edited by Giovanni Varelli

Although fragments from music manuscripts have occupied a place of considerable importance since the very early days of modern musicology, a collective, up-to-date, and comprehensive discussion of the various techniques and approaches for their study was lacking. On-line resources have also become increasingly crucial for the identification, study, and textual/musical reconstruction of fragmentary sources. *Disiecta Membra Musicae. Studies in Musical Fragmentology* aims at reviewing the state of the art in the study of medieval music fragments in Europe, the variety of methodologies for studying the repertory and its transmission, musical palaeography, codicology, liturgy, historical and cultural contexts, etc. This collection of essays provides an opportunity to reflect also on broader issues, such as the role of fragments in last century's musicology, how fragmentary material shaped our conception of the written transmission of early European music, and how new fragments are being discovered in the digital age. Known fragments and new technology, new discoveries and traditional methodology alternate in this collection of essays, whose topics range from plainchant to *ars nova* and fifteenth- to sixteenth-century polyphony.

New release



20 – *Fakes and Forgeries of Written Artefacts from Ancient Mesopotamia to Modern China,* edited by Cécile Michel and Michael Friedrich

Fakes and forgeries are objects of fascination. This volume contains a serie of thirteen articles devoted to fakes and forgeries of written artefacts from th beginnings of writing in Mesopotamia to modern China. The studies empha sise the subtle distinctions conveyed by an established vocabulary relating t the reproduction of ancient artefacts and production of artefacts claiming t be ancient: from copies, replicas and imitations to fakes and forgeries. Fake are often a response to a demand from the public or scholarly milieu, or eve both. The motives behind their production may be economic, political, reli gious or personal – aspiring to fame or simply playing a joke. Fakes may be revealed by combining the study of their contents, codicological, epigraphi and palaeographic analyses, and scientific investigations. However, certain fa mous unsolved cases still continue to defy technology today, no matter ho advanced it is. Nowadays, one can find fakes in museums and private collec tions alike; they abound on the antique market, mixed with real artefacts tha have often been looted. The scientific community's attitude to such objects calls for ethical reflection.

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