

AN ONLINE DIGITAL FACSIMILE OF THE LUGO CODEX

BY

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To my parents, George and Margarita

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PREFACE

At the time of this writing, the performance of medieval song has entered what might be described as a “popularity plateau.” While ensembles of high caliber continue to bring to life the sung repertoire of the fourteenth century and earlier, the medieval rage of the 1970s and ‘80s—and certainly the “Chant Craze” of the 1990s—has subsided, and medieval song has been relegated once again to the first unit of the standard music history curriculum in universities and conservatories. Save those rare instances where medieval music is still actively pursued as a “legitimate” repertoire—such as those fortunate schools that have early music departments or institutes—most singers who are interested in medieval solo song often do not venture beyond the repertoire’s “most likely suspects:” the same several dozen *Cantigas de Santa Maria*, the more-than-overdone Martin Codax cycle, the solo *lais* of Machaut, and the same two or three dozen troubadour *chansons*. While this description of the situation may be a somewhat gross generalization, it would appear to be the case that most students of medieval monody are unaware of the variety of song that is available to them. It might be easy enough to lay blame on the use and re-use of the same “masterwork” examples in music history textbooks (though, notably, there are new editions of standard history texts that incorporate fresh examples of repertoire).

However, as digital archival and retrieval technology advances, and as more and more repositories of early repertoire are made easily available online, it is possible—indeed to be hoped—that voice students and teachers will become increasingly aware of the variety of extant medieval song. Such is particularly true when referring to the corpus of plainchant, since by seeing the myriad variants of chants in their original sources, a

singer can broaden his or her vision of chant repertoire and most importantly, of chant performance, beyond the square notes of the *Liber Usualis*.

If there is one possible obstacle to the widespread dissemination of very early vocal music, it is the seemingly daunting nature of its notation to students steeped in modern five-line staff notation. One strategy for initiating students into medieval notation can be to provide abundant source material that is diastematic, meaning that the notes are spaced on the page in approximate proportion to their intervals (from the Greek *dia-*, across; *stema*, an interval or gap). With this material, students can practice the transition from modern musical writing to neumatic notational systems, facilitating their future forays into medieval repertoire.

The present project proposes to make such a collection of plainchant with diastematic notation available to anyone with Internet access, in a format that is easy to access and browse, and with search tools that facilitate the study and eventual performance of this music in either ritual or concert settings. Likewise, this project hopes to provide singers with an additional sense of the variety of chant traditions. This sense will help reinforce the notion of regional traditions of chant and early monophonic song, and it can illustrate to students of singing the continuum from which the modern “national styles of singing” emerged.

AN ONLINE DIGITAL FACSIMILE OF THE LUGO CODEX

Galicia, in northwest Spain, conserves only two complete medieval music codices: the *Codex Calixtinus* and the *Lugo Codex*. The former has been well-documented, and its music has often been performed; it remains one of the most important sources of the early Franco-Iberian polyphonic tradition. The *Lugo Codex*, on the other hand, is a chant manuscript that has been largely ignored by scholars and performers, despite assertions of its importance by several Spanish and international musicologists.

The doctoral project described by this document is a digital photographic facsimile of the Lugo Codex, which is presented on the World Wide Web. The final digital media product, available publicly as a website at www.lugocodex.org and through the Indiana University Library system's online catalogue, IUCAT, at the permalink URL <http://opus.music.indiana.edu/s/lugocodex/index.php>, features an interface that consists of a database-driven search engine, allowing the user to search for text within an index of chant titles. The search results are linked to a collection of digital images of the manuscript in various resolutions. The project also includes a technical description of the technology employed in creating the facsimile and the website, as well as an overview of the techniques of digital restoration as they apply to sources of chant and specifically to the Lugo Codex. The goal of this project is to make this manuscript available to performers and scholars of chant who have access to the Internet through any graphics-capable browser and to serve for singer-scholars as an introductory case study of digital restoration of chant manuscripts.

TABLE OF CONTENTS

Acknowledgments	V
Preface	VII
Figures	xiii
Tables	xv
CHAPTER 1	
A HISTORY OF THE LUGO CODEX	1
The Lugo Cathedral	3
Origins of the Lugo Codex	5
CHAPTER 2	
CODICOLOGICAL NOTES	10
Sources and Materials	10
Lugo Codex: Physical Description	11
Binding and Fascicular Organization	13
Paleographic Details	17
Marginal Notes by Other Hands	20
CHAPTER 3	
THE LUGO CODEX PROJECT WEBSITE	21
Site Overview	21
Home Page	22
The Codex: History and Description	23

Search the Manuscript	24
Browse the Manuscript	27
Digital Restoration	29
History of the Lugo Cathedral	30
Links	31
About the Project	32
Contact	33
CHAPTER 4	
METHODOLOGY	34
Digital Image Capture	34
Color and Scale Specifications	37
File Security and Backup	38
File Naming Convention and Primary Image Processing	39
Image Processing and Color Matching	41
Image Resizing Protocol for Online Viewing and Retrieval	43
Searchable Database	46
Site Pages: Design, Style and Coding	48
Server Longevity and Security	49
CHAPTER 5	
FUNCTIONALITY, CONTENT DELIVERY AND USER EXPERIENCE	50
Internal Structure of the User Interface	50
User Interaction	54
Mobile Platform Compatibility	56

Virtual Restoration Protocols	57
CONCLUSION	62
BIBLIOGRAPHY	64
APPENDIX 1	
Database Entry-fields of the Lugo Codex Project Concordant with the Cantus Database and the Digital Scriptorium Project	67
APPENDIX 2	
CSS (Cascading Style Sheet) for the Lugo Codex Project Site	71
APPENDIX 3	
Technical Specifications	74
Capture and Imaging Software: Technical Specifications	77
APPENDIX 4	
Internet Sources and Digital Archive Models	81
APPENDIX 5	
The <i>Abecedario</i> of Inocencio Portabales, vol 1. ff. 254r–379r	83

Figures

Table 1. Fascicles of the Lugo Breviary as described by Portabales (<i>Abecedario</i> , ff. 257v–258r.).....	13
Table 2. Interleaved folia in the Lugo Codex.	15
Figure 1. A screen shot of the Lugo Codex project home page, www.lugocodex.org	22
Figure 2. A screen shot of the Lugo Codex project “History and Description” page.....	23
Figure 3. A screen shot of the Lugo Codex project “Search” page.	24
Figure 4. A screen shot of the Lugo Codex project “Search” page displaying the summarized and expanded results of a search. Search terms are highlighted in yellow within the metadata.	26
Figure 5. A screen shot of the “Browse” page of the Lugo Codex website, with default first image.	27
Figure 6. A screen shot of the “Browse” page of the Lugo Codex website, with an image selected directly from dropdown menu or inputted into the “Folio” field.....	28
Figure 7. A screen shot of the “Browse” page of the Lugo Codex website, with the “medium” image selected.	28
Figure 8. A screen shot of the Lugo Codex project “Digital Restoration” page.	29
Figure 9. A screen shot of the Lugo Codex project “Lugo Cathedral” page.	30
Figure 10. A screen shot of the Lugo Codex project “Lugo Cathedral” page.	31
Figure 11. A screen shot of the Lugo Codex project “About” page.	32
Figure 13. Schema of the portable digital studio, including (from left) lighting sources, copy stand, camera / image capture device, manuscript being digitized, standardized target (target and manuscript both placed upon a neutral-grey base material).	35

Figure 14. Code for <i>rename.pl</i> Perl script. Guerin, W. 2010, Perl source code (Version 5.18) perl.org.....	44
Figure 15. Code for <i>resize.pl</i> Perl script. Guerin, W. 2010, Perl source code (Version 5.18) perl.org.....	45
Figure 16. Fields (columns) for the MySQL database table <i>lugo_chant</i>	51
Figure 17. Fields (columns) for the MySQL database table <i>lugo_genres</i>	52
Figure 18. Fields (columns) for the MySQL database table <i>lugo_office</i>	53
Figure 19. Folio A verso: original image file (left) and altered with Invert command (right).	58
Figure 20. Folio 109r, Curves control showing neutral gray pixels darkened to almost black.....	60
Figure 21. Folio 109r, unretouched (left) and through a green filter to enhance readability of the text (right).	61

Tables

Table 1. Fascicles of the Lugo Breviary as described by Portabales (<i>Abecedario</i> , ff. 257v–258r.)	13
Table 2. Interleaved folia in the Lugo Codex.	15

CHAPTER 1

A HISTORY OF THE LUGO CODEX

Also known as the Lugo Missal or Lugo Breviary, the *Lugo Codex* is a bound manuscript conserved in the *Catedral de Santa Maria* in Lugo, Spain. It is not a Missal in the technical sense of a complete book for celebrating the Mass; rather, it is a guide to the cantorial activities for the hours of the Divine Office. As such, it bears the inscription “Incipit Breviar[i]us de omnibus san[c]tis” and may therefore more accurately be called a breviary.¹ (The two terms, “Codex” and “Breviary,” will be used interchangeably in this document to describe the same object.) The manuscript contains an abundance of notated antiphons, most elements for a number of Propers for several masses, and collects for numerous saints who do not have individual offices.²

Scholarly references to this manuscript are scarce, and a full codicological study of it has not yet been undertaken. The Spanish musicologist José Lopez-Calo, in his 1982 book *La música medieval en Galicia*, called for a more thorough treatment of the work.³ José Janini’s catalogue of Spanish liturgical manuscripts, gives a brief catalogue listing of the codex; this citation is mentioned by López-Calo.⁴ In a short article from 1993 by Xosé Fernández Fernández in the Galician historical journal *Lycensia*, the manuscript’s

¹ Xosé Fernández Fernández, “O misal lucense, singular texto litúrxico do arquivo da catedral,” *Lycensia* 6 (1993): 71.

² *Ibid.*, 73.

³ “... [the manuscript] deserves a detailed study. Until someone undertakes this task, and since this is a practically unknown codex, I present a list of its contents...” José López Calo, *La música medieval en Galicia* (La Coruña: Fundación Pedro Barrié de la Maza, 1982), 57.

⁴ José Janini, *Manuscritos litúrgicos de las bibliotecas de España*, vol. 1, *Castilla y Navarra* (Burgos: Publicaciones de la Facultad de Teología del Norte de España, 1977), 145.

contents and history are briefly described.⁵ Aside from these citations, the only other scholarly reference to this codex appears in the 2010 doctoral thesis of Manuel Rey Olleros, where Rey undertakes a comparative study of the musical notation in various Galician manuscripts, including the Lugo Breviary, to shed light on the cult of St. James based on medieval liturgical books of the region (the study includes a detailed textual and musical comparison of St. James pieces in the Lugo and Calixtinus codices).⁶ Therefore it is the goal of this project, via the Internet presentation of the manuscript contents of the codex, to take the necessary first steps in the study of this uniquely Galician chant resource. In doing so, I hope to add accessible material to the medieval solo song repertoire, particularly to the corpus of available Iberian/Hispanic chant sources.

⁵ Fernández Fernández, “O misal lucense,” 71–84.

⁶ Manuel Rey Olleros, *Reminiscencias del culto al apóstol Santiago, a partir del Códice Calixtino, en los libros litúrgicos de los siglos XII al XIV en la antigua provincia eclesiástica de Santiago* (Doctoral Thesis: Santiago de Compostela: Universidade Servizo de Publicacións e Intercambio Científico, 2009), 158–162 and Appendix I, 15–43.

The Lugo Cathedral

The Cathedral of Saint Mary of Lugo stands at the site of what may have been the walled city's earliest Christian church. The current location of the cathedral, near the gate known as the *Portal do Postigo* ("Wicket Gate") or *Portal de Santiago*, was in early Roman times most likely a temple related to the cult of Celeste or Juno Caelestis.⁷ Although there is a lacuna in the city's ecclesiastic history up until the takeover of Lugo by the Suevi in 460 CE,⁸ records state that a structure from circa 750-760 CE—likely commissioned by the African expatriate bishop Odoarius as a part of the reconstruction project of Lugo undertaken during his tenure as bishop⁹—was damaged by the fighting during the insurrection of Count Rodrigo Ovárez against Alfonso VI.¹⁰ In 1127, Ovárez made a donation to attempt repairs to the cathedral, and it is assumed that around that time plans were made for the construction of a new cathedral. Although the exact start date of construction is unclear,¹¹ this later edifice was still not completed by 1200. It was finished on or around 1273, having been designed by Raimundo of Monforte de Lemos, and ostensibly completed by Raimundo's own son, the famed Master Mateo (renowned

⁷ Manuel Risco, *España Sagrada*, Tomo XL, *Antigüedades de la ciudad y sta. Iglesia de Lugo*. (Madrid: Viuda e hijo de Marín, 1796), 19 & 23. Juno Caelestis was the Roman assimilation of the Carthaginian chief goddess Tanit, a virginal (i.e. not married) female deity. It would not be too risky to imagine that Odoarius' dedication of the Christian temple to the Virgin Mary would be a successful enterprise, given the history of the location.

⁸ Idem, 48–49.

⁹ Idem: 89, 281, and 369.

¹⁰ Juan Pallares y Gaioso, *Argos Divina* (Santiago: Benito Antonio Frayz, 1700), 125.

¹¹ Pallares y Gaioso (ibid.) writes that it was in the year 1159, year 1167 of the Roman era, though the copy which I accessed contained a handwritten note in the marginalia that read: "It should be the year 1089, and the era 1127" ("*Debe ser el año 1089, y la era 1127*"); the same hand as wrote the note has written the numbers above the printed dates as well. To further add to the confusion, Ramón Yzquierdo Perrin, *Las Catedrales de Galicia*. (León: Edilesa, 2005), 105, mentions twice the year 1129, where Pallares y Gaioso only has the year 1127. It is unclear why Perrin uses this date since neither of his two sources—Risco and Pallares y Gaioso—cite the later date.

for his stone-orchestra sculpture of the *Pórtico de la Gloria* on the vaults of the cathedral at Santiago de Compostela.¹² The Lugo cathedral underwent renovations, enlargements, and additions throughout the fourteenth through eighteenth centuries,¹³ and as it stands today the building is an amalgam of architectural styles spanning the Romanesque to the Rococo.

In terms of hagiographic architecture, the cathedral dedicates two chapels respectively to the patroness and patron saint of Lugo, the Virgin Mary and Saint Froilán (Froilanus). The Lugo Virgin, widely referred to as “The Virgin of the Large Eyes” and to whom historian Juan Pallares y Gaioso dedicated *Argos Divina* (his historical volume on the cathedral), is also mentioned in Cantiga No. 77 of Alfonso X’s *Cantigas de Santa Maria*. In addition to the Propers for the various feasts of Mary (Birthday, Assumption, Annunciation) the Codex contains a complete Office dedicated to the Virgin. Patron Saint Froilán’s feast, on October 4, occupies folia 353–359 (inclusive) of the Breviary.

¹² Pallares y Gaioso, *Argos Divina*, 125, and Ramón Yzquierdo Perrin, *Las Catedrales de Galicia*, 105. However, Yzquierdo Perrin notes that Pallares’ assertion that Raimundo was from Monforte is likely the result of a misreading of the (French) master’s birthplace.

¹³ Yzquierdo Perrin, *Las Catedrales de Galicia*, 105.

Origins of the Lugo Codex

The earliest folia of the codex offer two important data in judging whether the codex resided in Lugo since the document's creation and also whether it was written in Galicia, another part of the peninsula, or copied from a manuscript elsewhere in Europe. The first information is a series of inscriptions in rough *precortesana* script copied on the verso of the overleaf (termed the *hoja de honor*, "the page of honor," by Inocencio Portabales; in this project, numbered "folio a, verso") which read as follows:

In patientia brã possidebitis animas
vestras
Inventio
Fran^{co} brema
campo
lybo he de sa ta marya de lugo
este lyb ro he de sa ta marya de lugo
mandamos e ordenamos q todos los canones
Sacm a [...] reyna [...]stro ma ihor
Este ly
Este lybro
He de santa marya de lu

(book is from sai[n]t mary of lugo
this bo ok is from sai[n]t mary of lugo
We command and order that all the canons
Most holy [...] queen [of ca]stro maihor
This bo[ok]
This book
Is from Saint Mary of lu)

My interpretation of the third line is based on the codicological notes taken by Inocencio Portabales;¹⁴ this third line, and also the fourth line, are very unclear. However, the repeated lines "This book is from (i.e. belongs to) Saint Mary of Lugo," in the manner

¹⁴ Inocencio Portabales Nogueira, *Abecedario de la S.I.C.B. de Lugo* (Lugo Cathedral Archive, shelf 60) pages 258v–259r.

of an improvised *ex libris*, are the closest we have to an attribution of place. As mentioned above, the script is a rough form of the gothic Iberian documentary script known as *precortesana*, which—being a transitional script between the *letra de albalaes* and the mid-14 c. *cortesana*—dates the writing to between 1325–1375, or as late as 1400. This would concur with Portabales’s estimate of the binding and compilation of the various fascicles of the codex.¹⁵

The second detail which adds information to the provenance of this manuscript is the *kalendarium* which lists not only the dates of saints’ feasts and other ferial days, but also provides daylight and nighttime durations in hours. The Lugo Codex *kalendarium* lists 18 daylight-hours for the month of June (LUc MS, Breviary, f. dv), which contains the longest days in the year (*nox habet horae VI. dies XV.3.*). However, this does not correspond to the actual daylight-hours for June in Lugo, located at 43.01°N, which are 15.2 hours for 24 June (summer solstice). Neither does this correlate to any of the other likely locations associated with the possible lineage of this manuscript, for example St. Martin de Tours (at 47.38°N, 15.7 summer solstice daylight-hours), or Cluny (46.43°N, with 15.6 daylight-hours). It does correspond with a more northern location, such as the northern areas of England, Ireland or parts of Scotland, or perhaps Northern Germany or Denmark (between 55°–57°N latitude). At a very long stretch this *kalendarium* could list the daylight-hours for a location such as Salisbury, England (51.07°N, with June daylight lengths of 16.5–17 hours).¹⁶ This latter calculation would concur with the December

¹⁵ Portabales, 258r; though see below regarding Portabales’s opinion regarding the *monacal* script.

¹⁶ All daylight-hour calculations have been derived using the astronomical calculator *Daylight Hours Explorer* (<http://astro.unl.edu/classaction/animations/coordsmotion/daylighthoursexplorer.html>, accessed 13 August 2012 16:35 GMT). All latitudinal coordinates were derived utilizing the online Google Maps service (<http://maps.google.com>, accessed 13 August 2012 16:22 GMT).

daytime hour listing given in the Lugo Codex as 6 daylight-hours in this darkest month of the year.

These two data point to a breviary that was quite likely acquired and compiled specifically for use at the Lugo Cathedral, but with possible origins much farther to the north. Even if the entire breviary is not the product of this more distant scriptorium, it is more than likely that the astronomical information in the *kalendarium*, at the very least, must have originated quite a distance to the north of Lugo. However, this would not preclude the possibility that the musical material may have been compiled or added to in a scriptorium somewhere closer to Lugo and its cathedral. A more thorough musicological and liturgical study—outside of the intention and scope of this doctoral project—may reveal details regarding the provenance of the manuscript contents.

The most recent history of the Breviary is documented by Inocencio Portabales in his notes on the manuscript in the *Abecedario*. The preliminary entries in these notes explain that in the Capitulary Meeting of 1913, “the church fabric (warden) Don Antonio Cedrón stated that he had received from the Illustrious Bishop [Manuel] Basulto [Jiménez] a breviary manuscript that is a true jewel, since by what can be discerned from the notes in the margins¹⁷ and from the testimony of specialists, is from the twelfth century, or at most from the thirteenth.” The note continues: “According to His Illustrious Excellency [the Bishop], it was delivered to him by an unknown person in Valladolid, without knowing how it came to be there, although it is calculated that it must have been sent there with the motive of an exposition held in that city, and by some error or

¹⁷ The “notes in the margins” referred to here by Inocencio Portabales are probably the notes made by Joaquin Antonio del Camino Orella in the first quarter of the 19th century (see below).

omission which it is hoped shall not be repeated, it was not returned to the Holy Church to which it belongs.” In addition to this, it was agreed that the manuscript “should be deposited in the safe in a case lined with cork that was ordered for this purpose.”¹⁸

Portabales maintained that while the last two directives remained unfulfilled at the time of his writing—two years after the Capitulary Meeting—it was probably for the better, as “the archive can be dried out more easily and avoids the corrosive action of the humidity which reigns in the safe; besides, it is closer at hand for study.”¹⁹ He also observed that the bishop and a Mr. Murillo, Notary General of the Cathedral, had attended the Catechist’s Congress in Valladolid in June of 1913 and there “an unknown person, who we may trace to a Don Luciano Sánchez or Sarabia... [gave them] the aforementioned Breviary without request of anything in return, calling it the Missal of the Lugo Capitulary, and saying it was of great value, but without giving any indication of its provenance.”²⁰

Portabales noted that this mention of the Codex is the first in the cathedral’s recorded Capitulary Records, which commence in 1549. In addition, he observed that no mention of the Lugo Codex, Missal, or Breviary is made anywhere else in the capitular records, even though breviaries were acquired or compiled at twelve other points in the cathedral’s history between 1557 and 1867.²¹ However, one further signpost points to the likelihood of the manuscript still having resided at the Lugo Cathedral: a marginal note at the foot of folio 158r, attributed to Joaquin Antonio del Camino Orella (d. 1824), says: “It

¹⁸ Portabales, *Abecedario*, 256r.

¹⁹ Ibid.

²⁰ Idem, 256v.

²¹ Ibid.

is surprising that all of these [things] were incorporated into *this Breviary of the Lugo Church*, written in the 12th or at most the 13th century” (emphasis mine).

It would appear, then, that until the early nineteenth century, the primary evidence of the Breviary’s association with the Cathedral is the handwritten inscription on the inside of its overleaf. It is possible, though not entirely likely, that the prominence of certain offices closely associated with the Lugo Cathedral (namely, the Office for the Virgin Mary and the Office for Corpus Christi, respectively located at the end of the first section and beginning of the second section of the Codex), might give some indication of the relationship of the manuscript to the cathedral. Such a hypothesis, however, lies outside of the scope of this initial web project, but would be the type of research that I hope to facilitate by increased access to the manuscript via an online digital facsimile.

CHAPTER 2

CODICOLOGICAL NOTES

Sources and Materials

Given the nature of the project, there is one primary source, the *Breviario [o Misal] de la Catedral de Santa Maria de Lugo*. The RISM uniform siglum is given as *E-LUc*, MS, no shelf mark, although the manuscript is physically kept on shelf number 60 of the archive of the Catedral de Santa Maria, Lugo (Galicia), Spain. The same shelf holds 8 volumes of notes collected and taken down by Inocencio Portabales Nogueira in 1915, titled *Abecedario de la S.I.C.B. de Lugo*; the notes pertaining to the Breviary are found in Vol. 1 of the *Abecedario*, pages 255r–379r (given here as Appendix 5).

Lugo Codex: Physical Description

Most of the following codicological observations are drawn from Portabales' 1915 *Abecedario*, ff. 257r–260r. Where I have noted a discrepancy or have additional data to provide, I have made parenthetical insertions.

The codex itself is approximately 27cm long, 18cm wide, and just over 10cm thick; it weighs approximately 3kg (when weighed in 2008, the MS came in at just around 2920g). It has two hard covers, each made of an oak-wood core; the same are affixed to the codex by a total of 8 leather strips (5 in the front, and three in the back cover; the former enter the wood binding in pairs). The outer binding is of dark, smooth leather, folded over and glued directly to the wood binding. Previously, four equidistant reinforcing strips seem to have been attached crosswise across the codex's spine, held in place by short, lost-head brass tacks (three at the end of each strip). Six of these tacks still remain: five in the front cover, one in the back. Portabales surmised that the reinforcing strips were most likely of parchment or vellum and that they also served to affix the leather binding to the wood boards.²² Only the bottom hinges remain of the two clasps that would have kept the codex closed, and these are still attached to the back cover.

The leather of the front cover of the codex is unattached to the wood core, and shows signs of severe wear and possible vermin damage. Portabales describes “several knife cuts, as though someone had been slicing on top of the cover with a blade”²³ but I was able to discern no more than one such cut-mark, beginning at the top of the lacuna which lies about 5cm above the bottom center of the front cover and running

²² “...[e]n otros tiempos estuvo clavada a las tapas por cuatro trozos de pergamino equidistanciados por encima del lomo del Breviario y sujetos a las tapas por tres clavos en cada lado... Portabales, 257r.

²³ Ibid.

approximately 7.5cm diagonally upwards and towards the left corner. What is abundant on the front cover is a multitude of very fine creases, many of which could certainly be mistaken for cut-marks.

Binding and Fascicular Organization

The parchment folia of the manuscript each measure approximately 25cm long by 17cm wide. The same are bound into fascicles of three, five, eight, nine, ten or twelve leaves, which have been sewn together with a fine, white twisted hemp thread.

On ff. 257v–258r of the 1915 *Abecedario*, Portabales provides a chart showing the collection of fascicles according to leaves, which is accurate in count and description:

Table 1. Fascicles of the Lugo Breviary as described by Portabales (*Abecedario*, ff. 257v–258r.)

Fascicle	:	Leaves	Fascicle	:	Leaves	Fascicle	:	Leaves	
1.....		9	14.....		12	27.....		10	
2.....		8	15.....		10	28.....		12	
3.....		8	16.....		10	29.....		12	
4.....		10	17.....		10	30.....		10	
5.....		10	18.....		10	31.....		10	
6.....		12	19.....		10	32.....		10	
7.....		12	20.....		8	33.....		10	
8.....		12	21.....		12	34.....		5	
9.....		12	22.....		4	35.....		9	
10.....		12	23.....		3	36.....		3	
11.....		12	24.....		8	37.....		8	
12.....		10	25.....		3	38.....		8	
13.....		12	26.....		10	39.....		8	
		139	+		110	+		115	= 364
			40.....		8	40.....		12	
			40.....		8	40.....		12	
			40.....		8	40.....		9	
			40.....		6				
		364	+		30	+		33	= 427

The first fascicle, which contains the *calendarium*, is not numbered with roman numerals. The numeration of folia in the Lugo Codex—which appears to be from at least the nineteenth century—does not begin until the second fascicle, which gives the first chants and states the *incipit* for the Breviary. Numeration continues until f. 177r (inclusive) in the original handwriting presumed to be that of Joaquin Antonio del

Camino Orella; from this point onwards, numeration of the folia continues until the end of the Codex in the handwriting of Inocencio Portabales. The following note is written into the margin of f. 177r, and clarifies this numeration:

Note.

As of this date, foliation in Arabic numerals appears only up to folio 177 as can be seen at the top of this leaf, and the numbering appears to be from the end of the 18th or beginning of the 19th century, possibly being the work of San Sebastian native Don Joaquin Antonio de Camino Orella, canon of this church from 1 February 1799 until the beginning of April 1824, learned member of the chapter and author of the marginal notes which appear on folia 153 and 158. To facilitate the use and study of this valuable codex I will resume numbering the folia as I continue with the work begun this last December.

Lugo, Saturday, 11 March 1916

Inocencio Portabales

Archpriest²⁴

It is worth noting that Portabales's total of leaves for the codex is 427, whereas his own continuation of the numeration begun, presumably, in the late eighteenth century concludes at f. 418. This is because the original numeration was begun with the second fascicle; the first fascicle—containing nine folia—brings the total to 427.

Portabales mentions that several of the folia contained in the codex are narrower than others; this usually is not a uniform width difference and is most pronounced in corners of certain folia (for example, ff. 212–219, f. 230). He also notes that several interleaved folia appear to have been sewn directly onto the front of a fascicle rather than

²⁴ Nota. Nada mas que hasta el folio 177 con que aparece encabezada esta hoja, llegaba en el día de la fecha la numeración arábica tal cual se ve, y que nos parece ser de fines del siglo XVIII o principios del XIX, habiendo quizá sido obra del donostiarra Don Joaquín Antonio del Camino Orella, canónigo de esta Iglesia desde 1º de Febrero de 1799 hasta primeros de Abril de 1824, capitular instruido y autor de las notas marginales que aparecen en los folios 153 y 158. Para facilitar el manejo y el estudio de este preciado codice la continuaremos según vayamos avanzando en nuestros trabajos empezados en Diciembre ultimo. Lugo, sábado, 11 de Marzo de 1916

Inocencio Portabales

Arcipreste

folded and sewn in as part of the fascicle. Interleaved folia can be found at the following locations:

Table 2. Interleaved folia in the Lugo Codex.

Fascicle	Number of Folia	Observations
1	9 ff	Folio E is sewn in with the seam is between E verso and F recto.
22	4 ff	Folio 213 is sewn into the front of the fascicle with the seam facing 212 verso.
22/23	3~4 ff	Folio 215 is sewn into the middle of the fascicle with the seam facing 216 recto.
24/25	3~4 ff	Folio 217 is sewn into the front of the fascicle with the seam facing 218 recto.
34	5 ff	Folio 319 is sewn into the back of the fascicle with the seam facing 320 recto.
35	9 ff	Folio 328 is sewn into the back of the fascicle with the seam facing 327 verso.
36	3 ff	Folio 339 is sewn in with the seam facing 340 recto (sewn into the back of the fascicle).
46	9 ff	Folio 400 is sewn in with the seam towards 399 verso (this is at the front of the last fascicle, indicating a “piled-on” sewing).

Portabales also notes that Fascicle 12, which contains ff. 109–116, would originally have been a *sexternion*, or fascicle made of six folded leaves to equal 12 folia, but at some point it had two pages removed leaving only 10 in the existing fascicle.²⁵ At the top of folio 116, a hand—possibly from the 15th or 16th centuries, given the spelling of the word “hojas”—has written: “aqui faltan ojos[*sic*].” A marginal note below the principal text on this page, signed by Portabales, reads: “Two pages are missing here, since this fascicle is a *sexternion* yet following the stitching there are only four leaves

²⁵ Portabales, 309v.

rather than the six that would be required. As a result, instead of folio 116 it should be folio 118 and so forth. March 6, 1916 / Inocencio Portabales.”²⁶

Throughout the body of the codex the margins are uniformly the following approximate measurements:

Top margin: 2cm

Left margin: 2.5cm

Right margin: 3.5cm

Bottom margin: 6cm

This includes those folia, described above, that are slightly narrower than the majority of those in the codex.

²⁶ *LUc*, Breviary Codex (no shelfmark), f. 116r.

Paleographic Details

The text is written using fairly pale black-brown ink, which has faded considerably in many areas. The musical notation, where present, is written with darker black ink that has in general retained its saturation. The single clef line, rubrics, and initials (simple or decorated) in the musical texts are written using a deep carmine red as well as a cobalt blue ink, together or in alternation. Red is used consistently throughout the MS in rubrics that label saint's feasts or other solemn festivities, as well as those that indicate the various parts of the Office or the genre of chant within the office, as well as its respective subdivisions (responses, etc.).

Portabales first mentions the presence of several scribal hands on f. 294r of his *Abecedario*, where he likewise mentions the uniform use of what he refers to as “Monachal” script (*letra monacal*), which he describes as a derivative of roman script.²⁷ However, it is more accurately described as a gothic book script, and indeed, *monacal* is generally used in Spanish to denote scripts from the Gothic family. The script used throughout the Lugo Codex appears to be a modified Gothic book *textura* script, and employs abbreviations generously.

Portabales notes that a different scribal hand seems to have continued the manuscript at f. 188v, continuing thus until f. 193v. However, his observation is limited to an examination of the script, and he does not mention the musical signs.²⁸ What appears to have changed is the scribal hand for the text underlying the chants, which in ff. 188v–193v seem to be somewhat similar to that used for the lessons and other text and

²⁷ Portabales, 294r.

²⁸ Idem, 317v.

rubrics. (In the previous sections of the Breviary, the script underlying the chants was slightly shorter and more rounded than the rubrics and lessons.) There appear to be no changes between the two hands which wrote the musical signs, save perhaps for a slight difference in the angle of the *virga* or the tilted *podatus* (both of which are slightly more angled towards the right in the earlier hand, and more vertical in the later folia).

At f. 216r and until f. 219r, Portabales observes what he feels is a change in scribal hand, at the point in the Breviary that corresponds to the feast of All Saints. He takes special note of a different ink color, folio size and cut, as well as the fact that the initials in this section are all in red, and not alternating red and blue ink as in other sections.²⁹ At f. 219v, however, the same scribal traits are present as before, including the presence of initials in alternating blue and red ink.

At first glance, f. 228v seems to be of particular interest regarding the question of scribal hands, and Portabales remarks that it was written by “quite a different hand” than the preceding pages; he includes the next two folia, 229 and 230, in his assessment.³⁰ However, it is quite difficult to confirm this: aside from the use of a more deep-black ink (but unfortunately a more unstable one, since it appears to have crept across the vellum), the page appears to have not been marked with evenly-spaced dry point lines which would normally provide the scribe with guides for writing; as a result, the script appears larger in size than preceding pages, and slightly more crowded. However, ff. 229-230 (inclusive) display other traits found throughout the rest of the Breviary, such as the use of black majuscule initials decorated with red highlights along the vertical pen-strokes.

²⁹ Idem, 318v–319r.

³⁰ Idem, 319v.

One feature that is present in most of the manuscript with the exception of ff. 229–230, is the use of alternately-colored red and blue initials to indicate the beginning of a different lesson or chant for the office.³¹ Within lessons, smaller red capitals indicate new sentences; within the chants they designate alternating sections (responds, verses, or psalms) within antiphons and responsories.

³¹ *Idem*, 292v.

Marginal Notes by Other Hands

The codex contains a moderate number of marginal notes, which can be divided into two chronological categories: notes from the time closer to the manuscript's assembly and principal period of use, and notes added by modern hands, between the 19th and 20th centuries. The first category principally concerns the liturgical content of the codex, as these notes are mainly addenda, commentaries or reminders that might have been added by the cantors that employed the book for chanting the office. The second type includes information that was of importance to the principal investigators of the manuscript in the mid-19th and early 20th centuries. As the present database is concerned with indexing the chants, the marginal notes can currently be located visually by using browse function. Information regarding Latin and Spanish marginal notes and transcriptions of the same can also be found in the facsimile of the Capitular Records notebook or *Abecedario* of Inocencio Portabales (in Spanish only), referenced throughout this project and included as Appendix 5.

CHAPTER 3

THE LUGO CODEX PROJECT WEBSITE

Site Overview

The Lugo Codex Project has been designed as a user-interactive digital media website.

To this end, the formatting and page style has been kept as simple as practicable while keeping the prominence of key features such as site navigation, manuscript searching and browsing, and information about the manuscript.

Home Page

Visitors enter the site through its main URL, www.lugocodex.org, which then redirects to a principal site URL located on the Jacobs School of Music library servers. At the time of this writing, that URL is <http://opus.music.indiana.edu/s/lugocodex/>. Users arrive at the project home page (figure 1) to find the following links displayed in a top-side navigation bar, each of which direct the user to a subsidiary page within the site: “The Codex: History and Description,” “Search the MS,” “Browse the MS,” “Digital Restoration,” “Lugo Cathedral,” and “Links.” These allow the user immediate access to any of the main features of the site, as outlined below. There are also links to a “Contact” page, to return to the Home page, and “About the Project,” which will include a URL to the completed DM project document (once approved) via academic document delivery services (Academia.edu, ResearchGate.net).

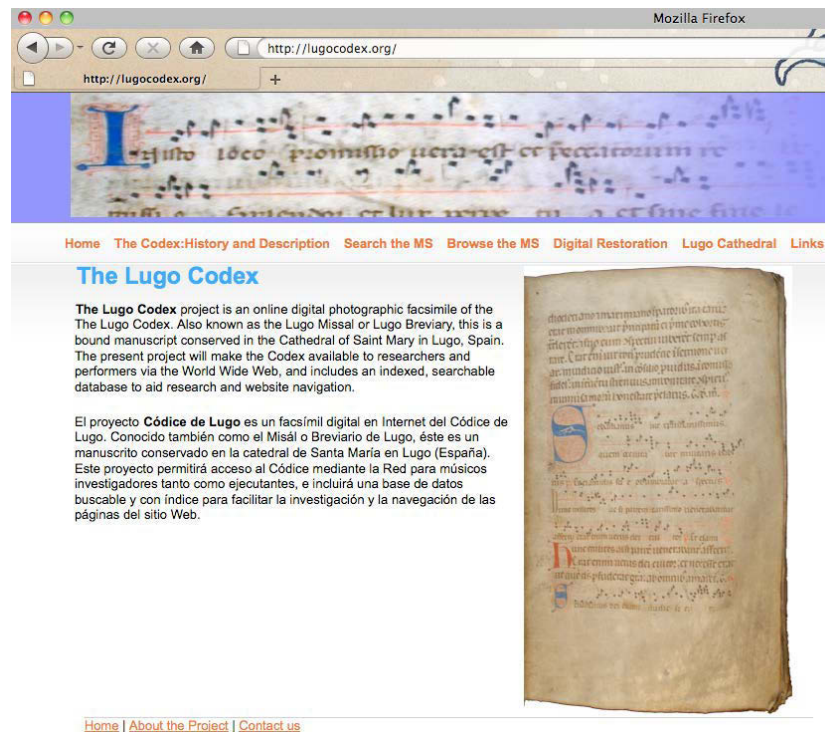


Figure 1. A screen shot of the Lugo Codex project home page, www.lugocodex.org.

The Codex: History and Description

The page titled “History and Description” is a short summary of the Codex’s history and a very brief overview of its general contents. The only information provided on this page includes the estimated provenance of the manuscript and important dates and milestones associating the Breviary with the Lugo Cathedral.

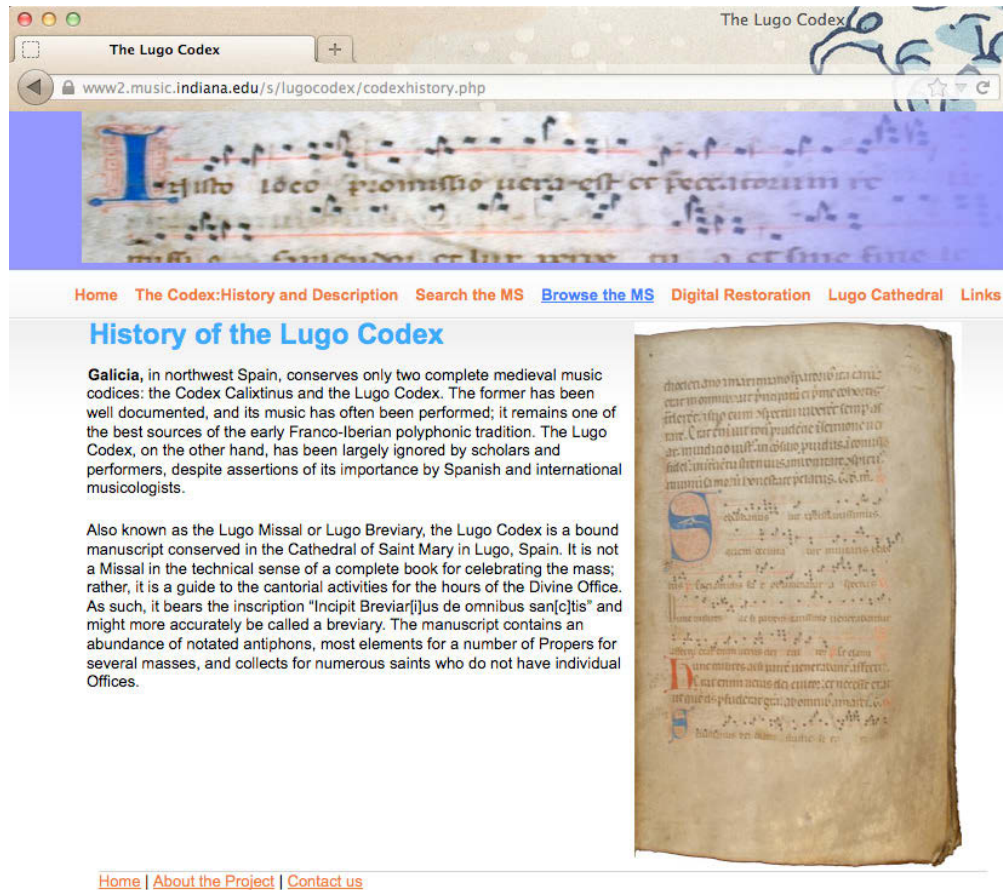


Figure 2. A screen shot of the Lugo Codex project “History and Description” page.

Search the Manuscript

The Search page of the website is the primary research portal for the project. On this page, users are able to input search terms and specify parameters for the search they wish to conduct.

The screenshot shows the Lugo Codex project's search interface. At the top, there's a navigation bar with links: Home, The Codex:History and Description, Search the MS, Browse the MS, Digital Restoration, Lugo Cathedral, and Links. Below this is a search area with three text input fields for search terms, each followed by a dropdown menu for Boolean operators (AND, OR). Below these are dropdown menus for Feast Name, Office, and Genre. Further down are dropdown menus for Position, Mode, and Differentia. A section for Concordances (multiple selections allowed) lists four options: C: C - Paris, Bibliothèque Nationale, lat. 17436; G: Durham, Cathedral Chapter Library, B. iii. 11; B: Bamberg, Staatsbibliothek, lit. 23; and E: Ivrea, Biblioteca Capitolare, 106. At the bottom, there are radio buttons for sorting by Folio, Mode, Differentia, Feast Name, Incipit, Office, or Genre. Two buttons, 'Submit Query' and 'Reset Form', are located at the bottom of the search area. The footer contains links for Home, About the Project, and Contact us.

Figure 3. A screen shot of the Lugo Codex project “Search” page.

The user can enter up to three separate search terms into text fields, connecting them with the standard Boolean operators “AND” or “OR.” The user can limit the results by feast name, office, genre, position, mode, differentia,³² as well one or more concordances, by means of dropdown menus. It is possible to sort the results of the

³² *Differentiae*, also known as *diffinitiones*, refer to the various cadence formulae applied to the end of psalms in order to correspond to the starting pitch of the antiphon to which the psalms were joined, since the tones on which the psalms were sung would have varied throughout the cycle of the liturgical year.

search according to folio, mode, differentia, feast name, incipit, office, or genre by means of a radio button selection.³³

A list of results then appears, with one row for each chant matched in the database. Although all data are retrieved from the database, by default only a summary consisting of incipit, office, and folio number (as well as a thumbnail image of the first folio on which the chant appears) is displayed for each record. However, the user can click an “Expand” link whereby all available metadata about the chant are revealed. The “Expand” link becomes a “Hide” link when the record is expanded, and clicking “Hide” allows the user to return to the summary list. Clicking on the thumbnail image generates a modular, interstitial window where the user can select one of three size views of the appropriate page. Users can navigate forward and backward in the facsimile by using a set of navigation buttons (such as in the case where a chant runs over more than one page). When the user is done viewing the manuscript page(s) in the interstitial layer, a simple click outside the image causes the layer to disappear.

³³ The section titled “User Interaction” in Chapter 5 gives a complete description of how the interface operates between “front end” and “back end” of the page.

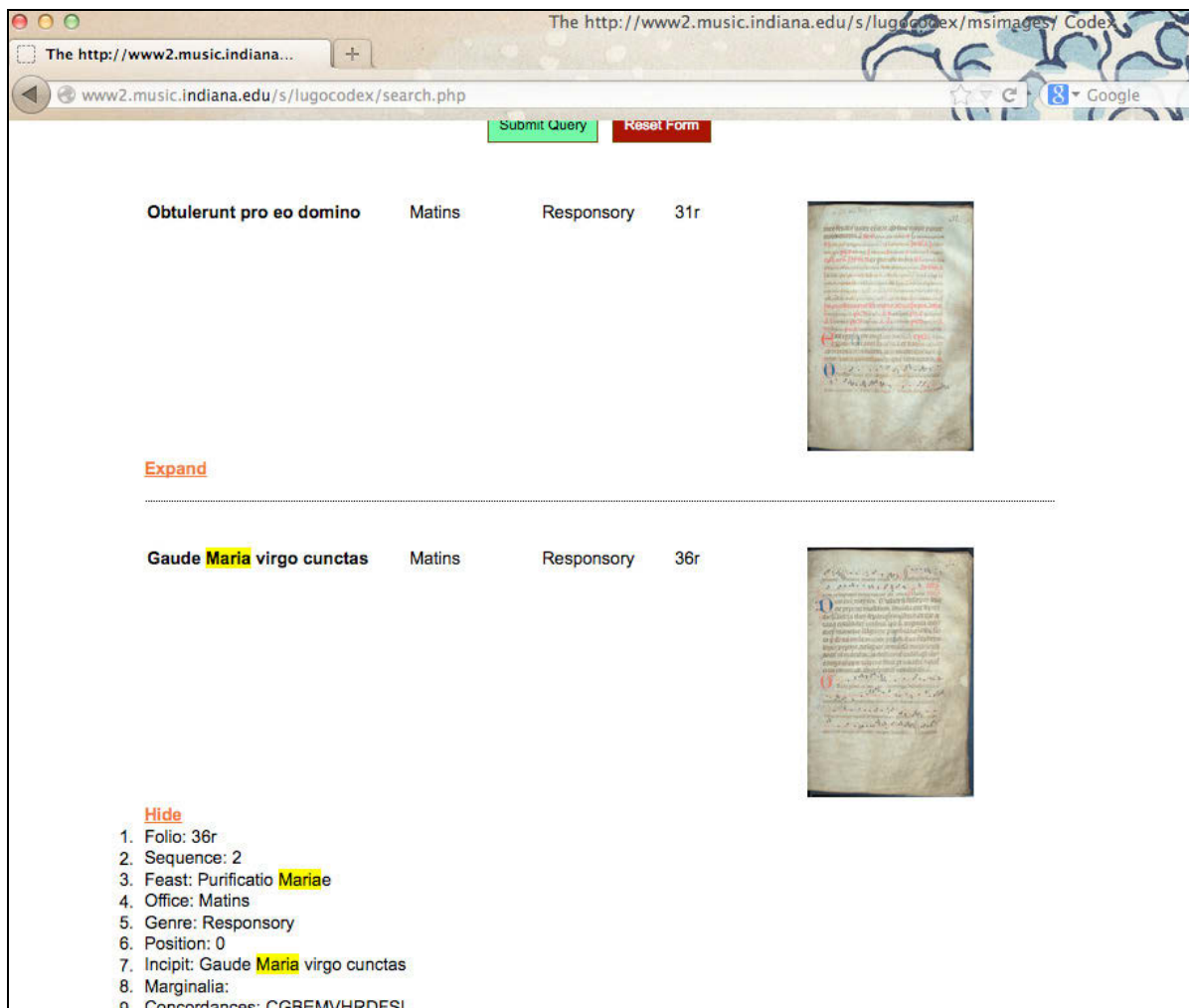


Figure 4. A screen shot of the Lugo Codex project “Search” page displaying the summarized and expanded results of a search. Search terms are highlighted in yellow within the metadata.

Browse the Manuscript

The “Browse” page provides a viewer function similar to an electronic book, and allows the user to select for display any page in the codex from a drop-down menu. By default, the page opens to the front cover of the codex, which is the first image in the collection. Additionally, the user can enter a folio number directly into a duly titled text field, or navigate through the codex backwards and forwards one image at a time using a set of navigation buttons. In each case, the codex image appears at the appropriate location, with a default size of “small,” corresponding to 512 x 768 pixels. The user can also select from two larger sizes, “medium” (1024 x 1536 pixels) or “large” (2045 x 3072 pixels)³⁴ using the links provided.

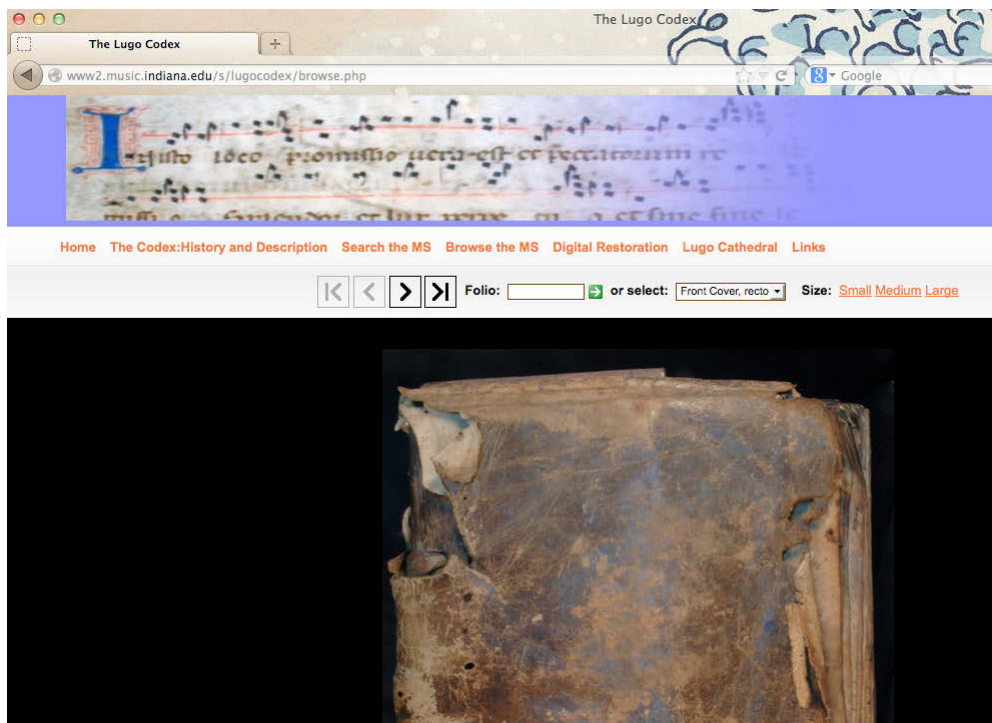


Figure 5. A screen shot of the “Browse” page of the Lugo Codex website, with default first image.

³⁴ While height of the images remains constant within the categories of “small,” “medium,” and “large,” there is a variance of up to ± 3 pixels in image width.

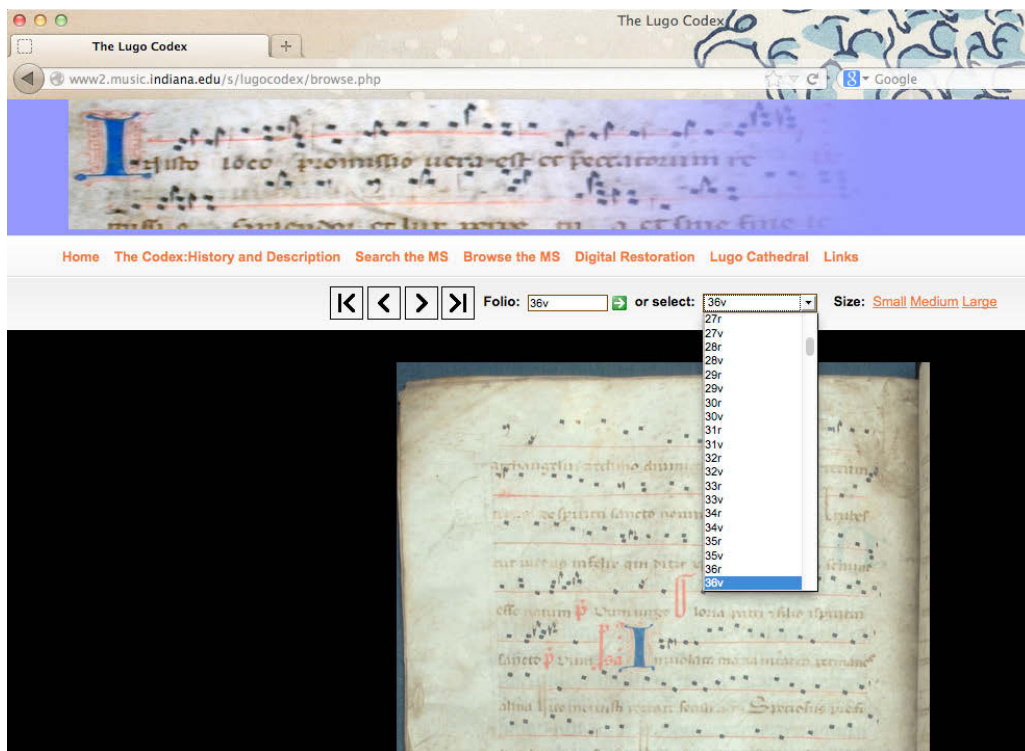


Figure 6. A screen shot of the “Browse” page of the Lugo Codex website, with an image selected directly from dropdown menu or inputted into the “Folio” field.

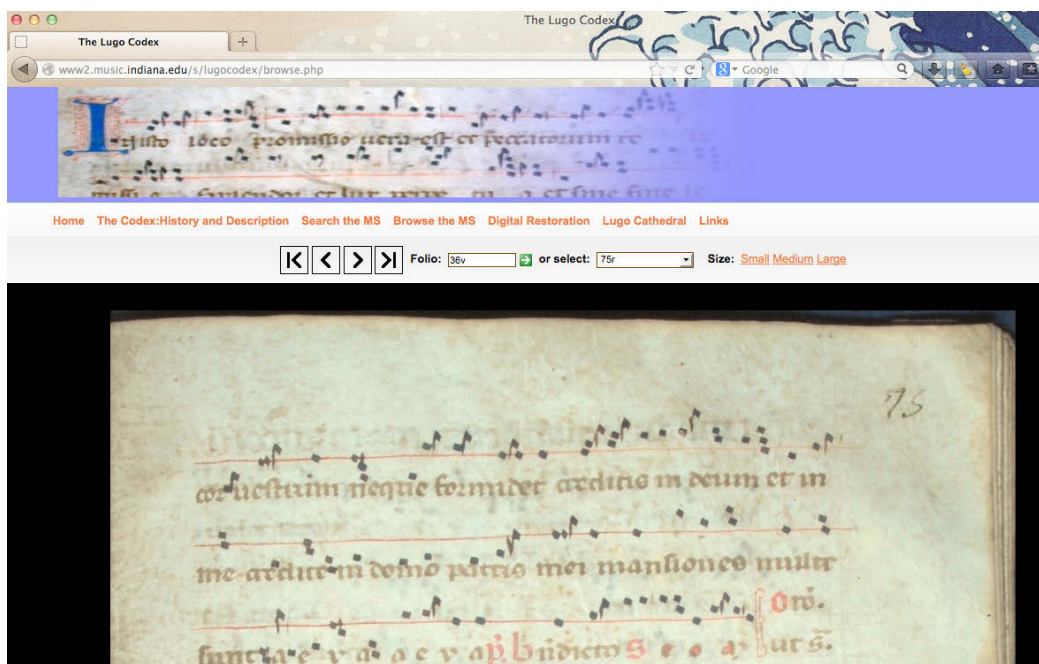


Figure 7. A screen shot of the “Browse” page of the Lugo Codex website, with the “medium” image selected.

Digital Restoration

This page contains an invitation to entry-level digital restoration for students seeking to work more extensively with digital facsimiles of music manuscripts. Rather than acting as a primer for digital restoration techniques, the page briefly describes digital restoration applied to selections from the *Lugo Codex* guided by the work done at the Digital Image Archive of Medieval Music (DIAMM). This page is primarily pedagogical, and guides users to the DIAMM site in order to avail of the instructions available there (including an impressive autodidactic guide titled “The Digital Restoration Workbook”). It is my hope that the techniques used for this project—accessible to anyone with knowledge of photo editing programs such as Adobe Photoshop—will serve as an introduction to a skill that will prove useful to students of medieval music performance and scholarship, as well as those entering into related fields such as musicology, medieval studies, and art history.

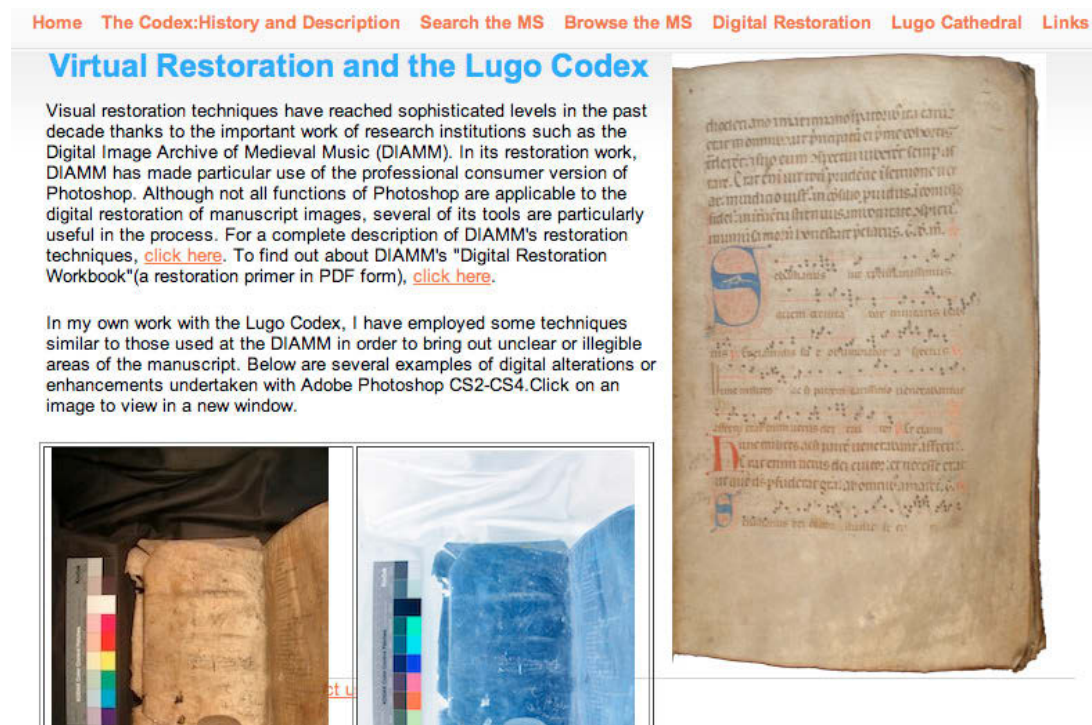


Figure 8. A screen shot of the Lugo Codex project “Digital Restoration” page.

History of the Lugo Cathedral

This page features only a very brief introductory paragraph regarding the Lugo Cathedral, and is primarily for the purpose of providing contextual information. Users are directed to the official Lugo Cathedral page via a URL.

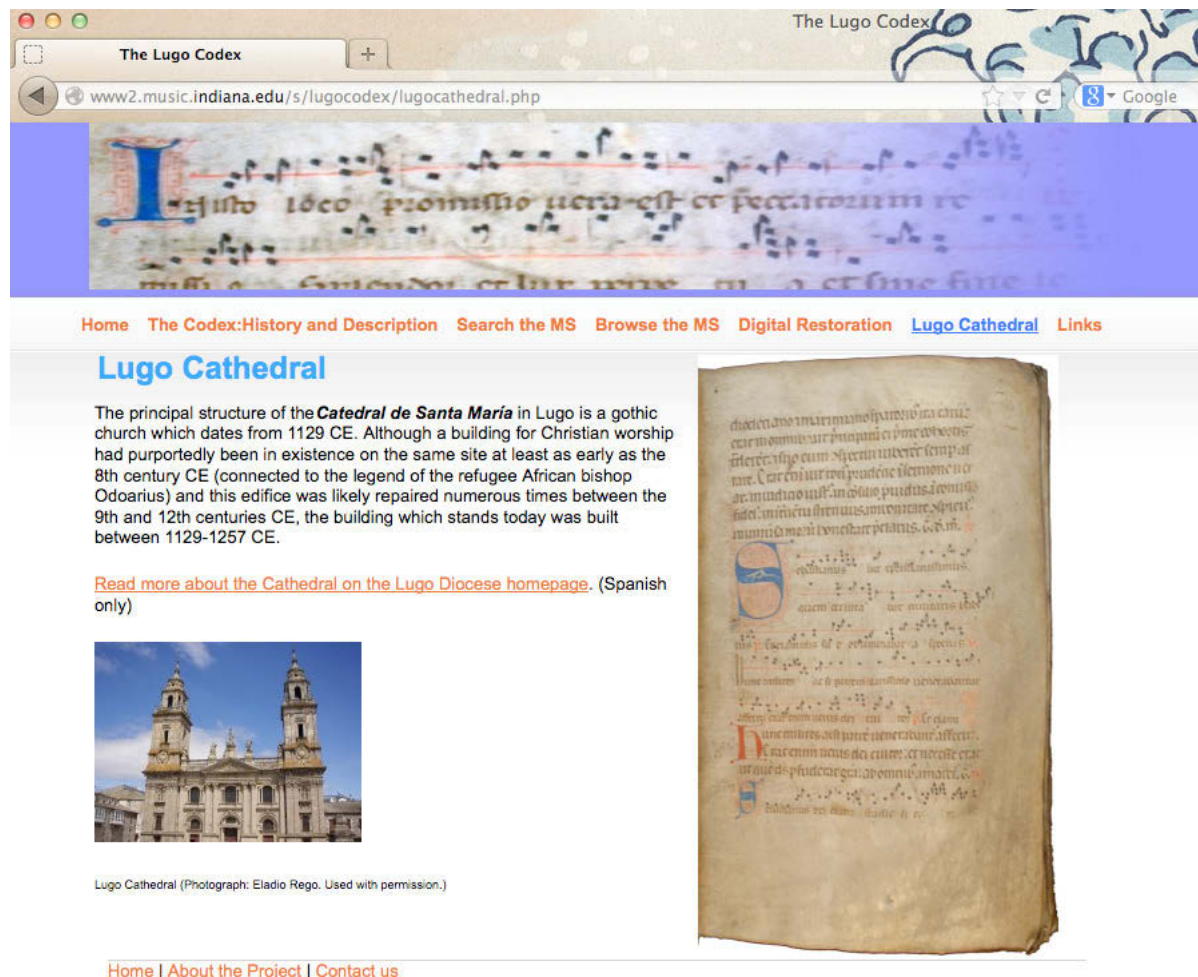


Figure 9. A screen shot of the Lugo Codex project “Lugo Cathedral” page.

Links

This page features links to supporting institutions, including: The Digital Scriptorium project, the Cantus Database, Oxford's DIAMM, Indiana University's Cook Music Library, the Center for History of Music Theory and Literature (CHMTL), and the Lugo Archdiocese and cathedral's World Wide Web home page.

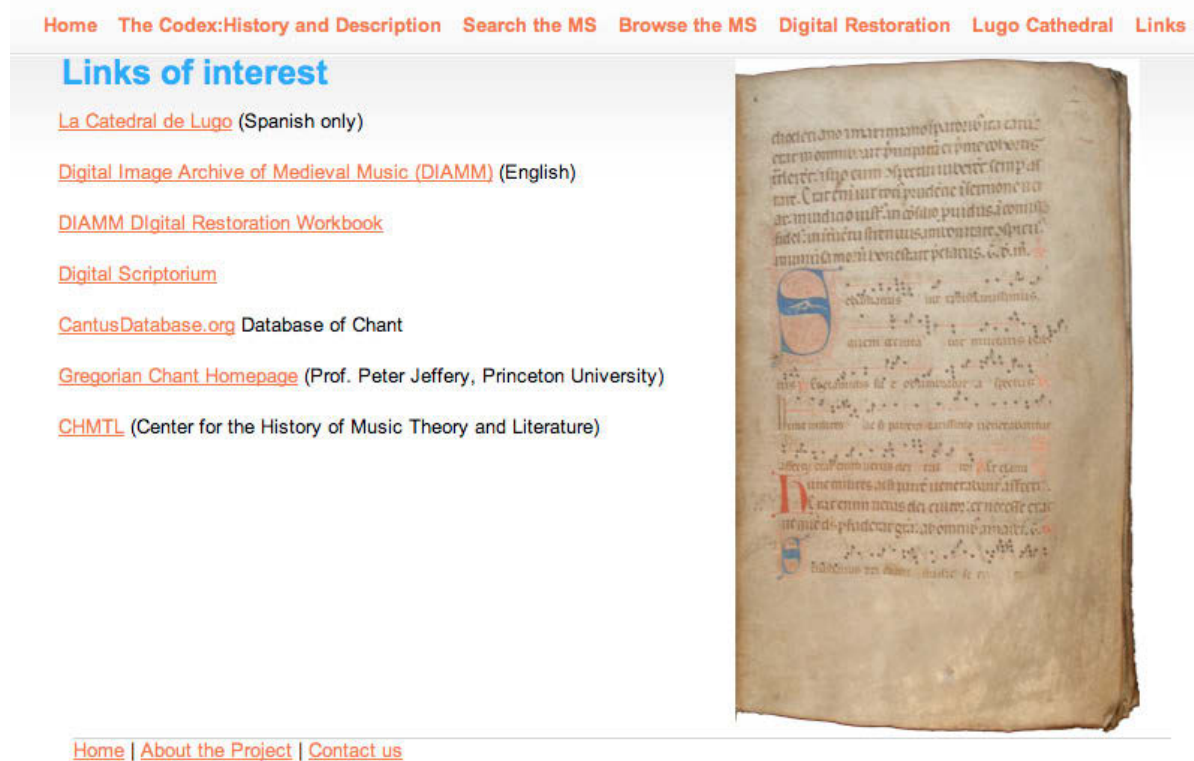


Figure 10. A screen shot of the Lugo Codex project “Lugo Cathedral” page.

About the Project

This page, reachable by a link at the bottom of the site pages, includes a brief synopsis of the aims and methodology of the project, basic information on the structure and function of the database, and also includes a link where users can contact the project manager to request a PDF version of the project.

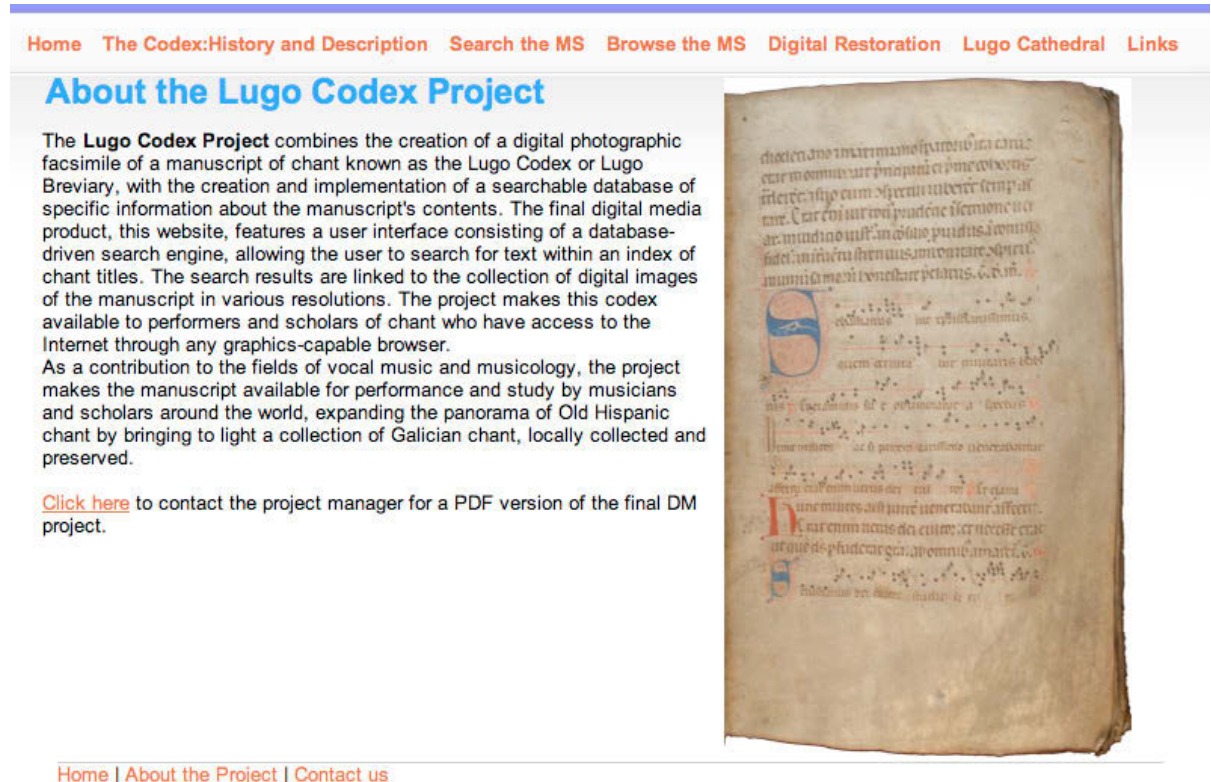


Figure 11. A screen shot of the Lugo Codex project “About” page.

Contact

On this page, users can find up-to-date contact information for the project manager, in order to send feedback or questions. Users are also invited, on this page, to further the research on the Codex by contacting the project manager. Users wishing to download a PDF/eBook version of the codex for further study and research are also invited to write the project manager to receive a download link.

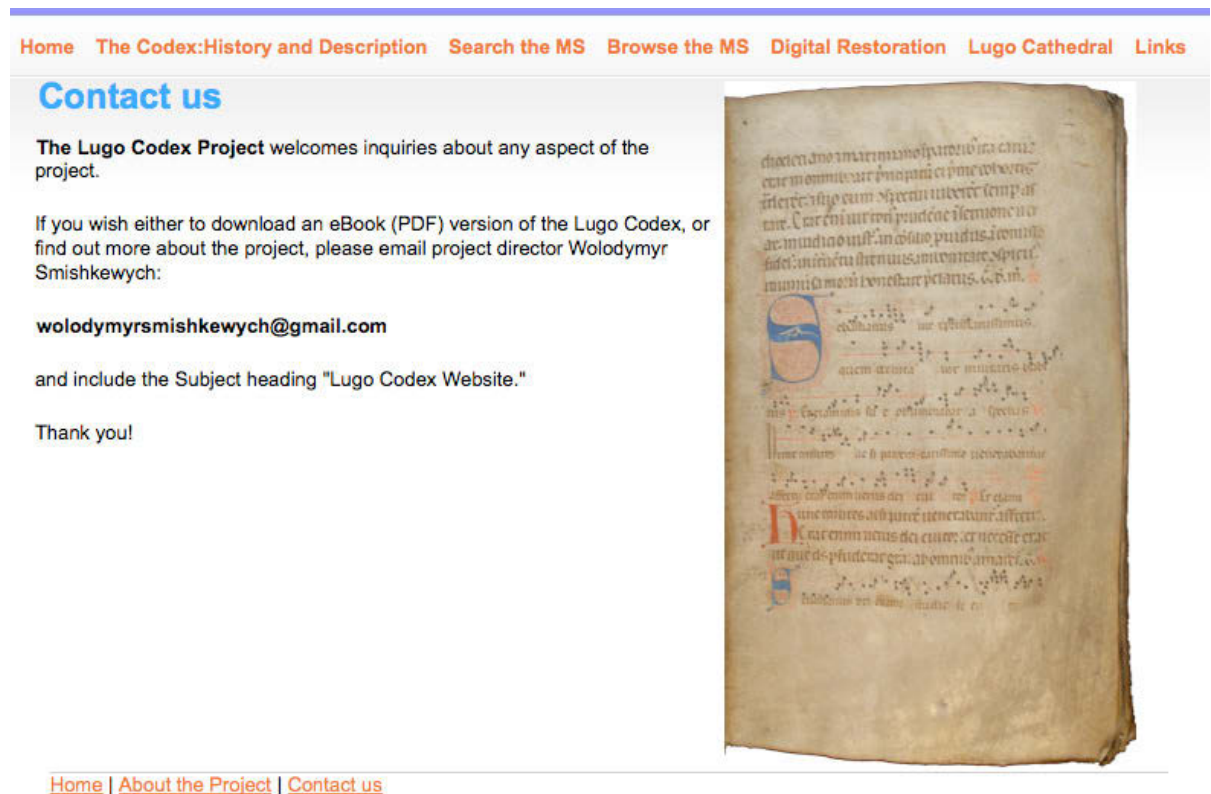


Figure 12. A screen shot of the Lugo Codex project “Contact” page

CHAPTER 4

METHODOLOGY

Digital Image Capture

The first fieldwork period consisted of on-site work at the cathedral archives in Lugo, Spain, where the manuscript was digitally photographed and physically examined. During the capture process details were noted regarding the binding, sewing, and other physical traits that might not be apparent or visible later in the photographs. The entire process took a total of three full days, taken on two days in 2006 (April 6 and 19) and then again in August 2008 to execute a number of higher-resolution retakes of the musical section. After image capture and backup, the image files were prepared, renamed, and ordered (backup and naming protocols described in the sections below).

As noted previously, I modeled my image capture standards after those of the Digital Scriptorium project and DIAMM. Although the DIAMM's own imaging standards represent the optimal technical configuration for digital image capture (using a scanning-back mount on a medium-format custom-built camera, with a capture resolution of 144 megapixels), neither my hosting institutions in Spain nor I had access to such a unit. Moreover, the cost of such equipment was and remains prohibitive (in the vicinity of \$50,000 in 2005). Single-shot (non-scanning) cameras with a capture resolution of ca. 38 megapixels are similarly priced. However, preliminary test photographs of the manuscript, which I made prior to 2006, showed that for web-hosting purposes fully satisfactory results could be achieved using a professional 10.2 megapixel digital camera at highest resolution. The photographs taken with this equipment were successful,

although (as noted below) there were difficulties with the primary images resulting from uneven lighting in the capture area.

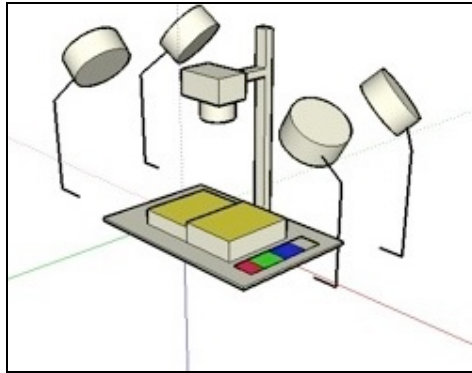


Figure 13. Schema of the portable digital studio, including (from left) lighting sources, copy stand, camera / image capture device, manuscript being digitized, standardized target (target and manuscript both placed upon a neutral-grey base material).

The schema of the digital studio setup shown above in Figure 13 gives a general overview of camera and light position relative to the subject being photographed. Exact placements and distances between the camera lens, lighting sources, and manuscript were all decided on-site, as were any additional arrangements or devices, such as clips or clamps for holding the codex pages open.³⁵ However, one unfortunate oversight was to not include a reflective fill material, such as Mylar[®] foil or bounce screens, in the digital capture field kit. As it happened, there was strong incidental light coming from one side of the room where the manuscript images were being captured, and I was not permitted to move from this location per request of the archivist. As a result of not having access to a material which could have blocked incidental light and at the same time reflected the controlled photographic light source back into the area of the manuscript, some images—

³⁵ For imaging standards as modeled by the DIAMM and Digital Scriptorium, see <http://www.diamm.ac.uk/content/description/capture.html> and https://www1.columbia.edu/sec/cu/libraries/bts/digital_scriptorium/technical/image_contribution/standards.html, respectively.

in particular images of the front pages of the manuscript—show excessive highlights where the external light source shone brightly on the vellum. In addition to this, the external source disrupted my color balance compensation, and some images came out more red than expected, others slightly bluer.

Color and Scale Specifications

All images included standard reference targets for color, gray scale, and size. For this purpose, the Kodak Color Separation Guide and Gray Scale (Small), or Q-13, was used. The Q-13 is a set of two standard targets, each measuring 200 x 60 mm. One is a 20-step gray scale, each succeeding step being darker by (nominally) 0.10 density units than the previous one. The second target is a set of standard color patches (primary colors, white, black). This target also includes a linear scale (imperial and metric) in its margin; and the gray scale steps are each 1 cm wide, providing an implicit linear measure. This protocol is modeled after that employed by DIAMM and the Digital Scriptorium. Both targets were present in each of the primary photographs, but were cropped out during processing in order for presentation on the website. The targets assisted with color matching when it was necessary to make adjustments to specific files as described in the section “Image Processing and Color Matching.”

File Security and Backup

To prevent accidental data loss, the images were captured directly from the camera to the computer's hard drive via a USB connection and immediately saved. Nikon's proprietary software Camera Control Pro was employed for this process. Secondary backups were made to a portable Western Digital external 120GB USB 2.0 hard drive every ten images and to a second external hard drive (a BeyondMicro 300GB USB 2 drive) every half hour. Backups of all image files were also made at the end of each workday, to another BeyondMicro 300GB USB 2.0. Thus, all images were backed up three times, and the original copy remained on the computer's hard drive.

During post-production preparation of the images, a Seagate 1.5TB USB 2.0/eSATA/FireWire external hard drive was used as an additional backup device.

File Naming Convention and Primary Image Processing

The digital images of the manuscript were taken in Nikon Raw Format (.nef) with a file size of circa 16.4 MB and resized to JPG images at a size of 2.3 ~ 4.3 MB. Since the files generated at the camera are automatically assigned file names (labeled numerically according to the date/time stamp), the first step was to select the acceptable takes (in the case of more than one photo taken), and order them according to the foliation of the manuscript.

In order to keep all images in order within the directory while conducting the primary processing, and to provide an index, the files began with a three-digit index number, followed by the identifier “Lugo.” (In the unlikely event that a file should become displaced, this would help identify it using a search function.) Following the index and identifier, a three-digit folio number and the appropriate side of the folio would be indicated, using “r” and “v” for *recto* and *verso*, respectively. The exceptions to this arrangement occurred only at the beginning and end of the file list, where digital photographs of the binding, covers, flyleaves, non-numerated folia (for example, the table of contents) and spine were organized. These images were designated using verbal descriptors such as “front cover,” “wood cover,” “inside cover,” “spine,” and so forth; or by alphabetic letters, beginning with the first flyleaf (in the case of the non-numerated folia). In order to keep the images in sequential order according to the physical arrangement of the codex, the index numeration began at 001 with the very first photograph of the outside, front cover. Each of these organizing elements was separated by an underscore for clarity.

Below are examples of the file naming convention as employed in four distinct sections of the Codex:

Binding elements:	001_Lugo_frontcover_r.JPG
Flyleaves & non-numerated folia	005_Lugo_a_v.JPG
Numerated folia	023_Lugo_001_r.JPG
Final image (spine, no side identifier)	863_Lugo_coverspine.JPG

Image Processing and Color Matching

Because of the inherent challenges of photographing a manuscript in the field, and in particular where one is not always able to specify the optimal conditions for the photography, there exists always a possibility of certain images being captured in a less-than-perfect state. My time in the archives was limited to three separate visits and I was not able to match all of the lighting conditions from one session to the next, because despite utilizing the same equipment, I was often placed in a slightly different location. In each case I was unable to adjust lighting and other variables because I was in a common research area within the diocesan offices. As in the case described above, where several images suffered from extreme highlights and somewhat uneven color matching, post-production retouching and correction were necessary to bring the final images closer to uniformity.

Principally, three adjustments were applied to retouched photographs: rotation, level adjustments (RGB channels as well as saturation, contrast and brightness) and cropping. Every photo in the collection was subject to cropping, and most to rotation, in order to achieve a uniform viewing size and perspective ratio. Photographs taken during the two April 2006 sessions suffered from a distinct reddish cast and needed balancing toward the green/blue end of the spectrum, while the August 2008 photos were taken with a slightly different lighting source than two years prior, and displayed a more green hue. As a result, these photographs needed to be warmed towards the red end of the spectrum. For several photographs, contrast and saturation were retouched: the images affected by excessive reflected light were also “burned in” at those areas of extreme highlights; some of the 2006 images also required increased color saturation.

The adjustments of the principal viewing images were all accomplished using Aperture, Apple's proprietary image editing software. After all adjustments were completed, the cropped images were exported from Aperture as versions uniformly sized to fit within 2048 x 3072 pixels; this ensured that regardless of the actual cropping size during processing, the final image would not vary from this maximum size and perspective ratio. (This assisted the automated resizing and renaming processes, described in the section below.) During the adjustment and resize processes, daily backups were made of all master images and processed versions to the 1.5TB Seagate USB 2.0 hard drive.

The site is optimally viewed with a minimum screen size of 800 x 600 pixels resolution or larger with the capability for millions of colors. Since the project is designed exclusively for online viewing, image-matching problems that arise in a color-separation printing process are not of concern. Nevertheless, since the process of capturing the image is performed with reflective light, image-matching on a computer screen is always problematic because a computer screen employs transmissive light. Although the resulting colors will not be exactly the same as those seen by the eye under parallel conditions, by comparing the color swatches on the target strip included in the original, full-size image files of the Codex, the colors of the digital image as viewed on the screen should match the original as closely as possible.

Image Resizing Protocol for Online Viewing and Retrieval

After the primary ordering and color-balancing of images as described in the section above, the image files were simultaneously resized and renamed using ImageMagick, a graphics application which operates from the computer's command line. Using a Perl-language module (PerlMagick), two Perl scripts (**rename.pl** and **resize.pl**) provided by project consultant and programmer William Guerin³⁶ were used to manipulate the image files.

The Perl script **rename.pl** took the file names as initially formatted (e.g. 023_Lugo_001_r.JPG) and identified the image number, folio, and folio side. Converting these values to variable strings, it removed the ordering number, then renamed the new file copy with the values: page, side, size, and added the suffix “.jpg” after each. It then placed renamed files in a directory called /renamed/ (figure 14).

³⁶ The information in the section that follows, as well as the section titled “Database Specifications” was facilitated to a great extent by informal correspondence with project consultant and computer programmer, William Guerin. I am indebted to him for his assistance with the technical aspects of this project, as well as his generosity of time in explaining the coding process and the functionality of the code itself. Several parts of the section below have been cited from a short, three-page memo (William Guerin, Bloomington, to Wolodymyr Smishkewych, Limerick, 21 June 2011, Word document titled *Lugo Tech Summary*, personal correspondence).

```
#!/usr/bin/perl

use IO::File;

opendir(DIR, ".");

while ($dir = readdir(DIR)){

    if ($dir =~ m/^0*(\d+)_{[rv]}$_{(.+)\.jpg$/){

        $page = $1;
        $side = $2;
        $size = $3;

        $newFileName = $page . $side . $size . ".jpg";
        $command = "cp $dir ./renamed/$newFileName";

        system ($command) or print "Bad command: $command\n";

    }

}

closedir(DIR);
```

Figure 14. Code for *rename.pl* Perl script. Guerin, W. 2010, Perl source code (Version 5.18) perl.org.

After renaming, images were resized using the **resize.pl** script (figure 15, below). Working once more through the PerlMagick interface, this script employed the **convert** command to take the renamed images in the /renamed/ directory, and once again converted the identifying elements in the file name (page and side) into variable strings, removing any leading zeroes in the process. After resizing the original (large size) image file to the required large, medium, small, and thumbnail sizes, it labeled each image file in turn with its respective page and side and with the appropriate size label and an underscore before replacing the “.jpg” suffix (figure 15). Thus, an original file /023_Lugo_001_r.JPG/ would result in the renamed and resized files:

/1r_thumb.jpg/ /1r_small.jpg/ /1r_medium.jpg/ /1r_large.jpg/

All of the image sizes for these derivative files are in accord with those of the Digital Scriptorium project. Once the images were resized and labeled accordingly, they were stored in a directory titled /msimages/, located at the root level of the home directory.

```

#!/usr/bin/perl

use IO::File;

opendir(DIR, ".");

while ($dir = readdir(DIR)){

    if ($dir =~ m/^\d+_Lugo_(\d+_rv?)\.jpg$/){

        $page = $1;

        $newFileName = $page . $side . "_large.jpg";

        print "Doing page $page \n";

        $command = "convert -size 2048x3072 " . $dir . " -resize 2048x3072 ./resized/" . $page .
        "_large.jpg";

        system ($command) or print "Bad command: $command\n";

        $command = "convert -size 1024x1536 " . $dir . " -resize 1024x1536 ./resized/" . $page .
        "_medium.jpg";

        system ($command) or print "Bad command: $command\n";

        $command = "convert -size 512x768 " . $dir . " -resize 512x768 ./resized/" . $page .
        "_small.jpg";

        system ($command) or print "Bad command: $command\n";

        $command = "convert -size 128x192 " . $dir . " -resize 128x192 ./resized/" . $page .
        "_thumb.jpg";

        system ($command) or print "Bad command: $command\n";

    }

}

closedir(DIR);

#/large/ all images JPG files at 2048 x 3072 pixels, at 72 ppi
#/medium/ all images JPG files at 1024 x 1536 pixels, at 72 ppi
#/small/ all images JPG files at 512 x 768 pixels, at 72 ppi
#/thumbs/ all images JPG files at 128 x 192 pixels, at 72 ppi

```

Figure 15. Code for *resize.pl* Perl script. Guerin, W. 2010, Perl source code (Version 5.18) perl.org.

Searchable Database

The search function in the *Lugo Codex* project is a text-based keyword search, using a simple Boolean match.³⁷ The database operates using MySQL and PHP, two applications recognized for their stability and functionality within the Apache server architecture. MySQL deals with the database structure, while PHP acts as a “gateway,” in effect restricting outside access to the files but also reading the file from the system and adding the necessary HTTP headers before sending it to the client. The results display in HTML, which can be read on any browser with HTML capability.

To take advantage of MySQL’s speed and streamlined search engine, I employ a relational database structure for the data. Keeping data in smaller interrelated tables reduces search times and increases efficiency. Images are linked to the data and recalled by the search engine for display. (Chapter 5, below, titled “Functionality, Content Delivery, and User Experience,” provides a functional description of the software used to link the database contents with the repository of images.)

In order to be used both as a stand-alone project and as a data set able to be incorporated into the Cantus and Digital Scriptorium (DS) databases, the database for my project contains the fields listed in Appendix 1. This database merges the entry-field lists of the Cantus and DS databases to allow the data to be exported to these two external projects at a future date.

The original concept for the image repository that would form the backbone of this project was to rely upon two programs, Fedora and the METS Navigator. The former, an open-source program covered under the Educational Community License 1.0

³⁷ See the Cantus database for a similar search interface: <http://bach.music.uwo.ca/cantus/>

(ECL), is generally used for managing and delivering digital content. The latter, METS Navigator, is standard software used for metadata encoding and transmission and assist navigation within the facsimile images, particularly within the context of images related to specific search engine results.

However, during the compilation of data and metadata, and during the construction of the database, a simple, accessible, and likewise elegant solution proved readily at hand. Using Filemaker Pro (versions 7 and 11) to construct an interface for data collection and entry, the values that would comprise the database were then exported as simple CSV (comma-separated value) files, which were then uploaded into the tables for the MySQL database that lies at the nucleus of the search engine with which the user interacts (user interface and functionality described in Chapter 5, below). In spring of 2013, an update to the administrative portion of the website allowed me to take files exported from Filemaker Pro 11 as XML (Extensible Markup Language) and upload them directly into the MySQL database. This means that all future updates of the database contents will be a simple, one-step process involving a single file upload.

Site Pages: Design, Style and Coding

The original creation of the site pages was done on an Apple PowerBook G4 running Mac OS X 10.4.9, and later on a MacBook Pro G4 Intel Core 2 Duo running Mac OS 10.6.6. Site authoring on the PowerBook was done with the design program Dreamweaver 8, and with Dreamweaver CS4 on the MacBook Pro. During production and testing, all files were resident on the computer's "Sites" folder (which operates using Apache server architecture), with daily backups performed onto three external hard drives: for the PowerBook, two BeyondMicro 300GB USB 2.0 and one Western Digital 120GB USB 2.0; for the MacBook, an iOmega eGo Helium 2 TB USB 2.0 drive and a Seagate FreeAgent XTreme 1.5 TB drive using an eSATA connection.

The site incorporates Cascading Style Sheets (CSS) in order to maintain uniformity of presentation throughout the site. The code for the style sheet is detailed in Appendix 2.

Server Longevity and Security

Indiana University's Cook Music Library has agreed to serve my project on the World Wide Web on its own servers. This will guarantee longevity, security, and stability on a par with Indiana University's own web infrastructure and the evolving technologies of the Cook Music Library. The Cook Music Library servers thus house the search engine, database files, and the browsing images of the project. As a result, the *Lugo Codex* digital facsimile in effect becomes a digital holding of the Cook Music Library, which has agreed to house the project as long as the technology supporting it is viable. If at some point in the future the Cook Music Library's technology updates should prove incompatible with the Lugo Codex project, the entire project can be moved to my own private servers (secure, shared server space, currently maintained by Midphase.com), or to the digital repository of the University of Limerick, Ireland (where I am currently employed; the University of Limerick has agreed to act as a repository for the project for the foreseeable future).

CHAPTER 5

FUNCTIONALITY, CONTENT DELIVERY AND USER EXPERIENCE

Internal Structure of the User Interface

In the case of a digital facsimile website such as the Lugo Codex project, the main challenge confronting the user of such a site is the disassociation of the object (in this case, the manuscript images) from the information drawn from the object to make it useful (a listing of contents, texts of first lines, and so on). In a physical score or manuscript, this information is one and the same, but in a Web platform, the objects (e.g., images and data tables) reside in a different location from one another. Although this may be as simple as a different directory located on the same server, the Lugo Codex website does not function as a photo gallery collecting and serving images only—though its browse function somewhat fulfills this feature. The site is designed to handle user queries that may involve multiple parameters of an open nature (i.e. keywords) or of a limited nature (selection from a list of offices or concordant manuscripts).

In order to accomplish this task efficiently and in a user-friendly way, the Lugo Codex site exists at two levels, or “tiers.” The first tier, the site’s “front end,” is the principal user interface and provides search and browse functionality. The “back end” consists of an image repository, database tables and the related engines for storing, searching, and serving the data and images.

The first tier or “front end,” which is hosted on an Apache server application running on a Linux-based web server, uses a suite of typical web technologies to interface with the user. For uniformity of design output, the site employs CSS (Cascading Style Sheets). Data output and page content has been coded using XHTML Transitional

1.0 due to its advantages over standard HTML, such as the capability to employ style sheets and adjust the markup for older browsers that cannot understand style sheets. On the user's browser, JavaScript manages the dynamic behavior while PHP 5.1.6 scripting language is used to handle dynamic behavior on the server side and mediate communication with the database. Additionally, the jQuery JavaScript library facilitates certain user interface features and provides greater cross-browser compatibility.

On the site's second tier or "back end," there exists a straightforward MySQL database consisting of three tables: *lugo_chant*, *lugo_genres*, and *lugo_offices*. The first table, *lugo_chant*, contains most of the metadata for the various chants contained in the codex. Each record or row in the table corresponds to a separate chant contained in the codex. The table contains these fields (columns):

Column Name
id
incipit
part
folio
side
position
sequence
genre
office
feast_name
feast_code
mode
differentia
marginalia
concordances
extra
addendum
full_manuscript_text
standard_full_text
physical_issues
rep_dec
notes_a
notes_b
notes
internal_ref

Figure 16. Fields (columns) for the MySQL database table *lugo_chant*.

The numerical *id* field acts as a unique identifier or primary key on the table, and allows for chants to be unambiguously distinguished even if they share an incipit or other parameter. Because the field contents may be one of several languages (English, Latin, Spanish, or Galician), the data is stored in Unicode (UTF-8) format, which allows for the inclusion of macrons and other diacritics. This is true of all the tables and site pages, but is especially important for the *lugo_chant* table and the site page texts.

So that users are able to limit their searches using the genre of chant and its order in the office, two additional tables are used to organize the search results. The table *lugo_genres* associates the various letter codes used in the genre field of *lugo_chant* (e.g. “A,” “R,” “V,” abbreviations employed by the Cantus Database project³⁸) with the English descriptors of the various genres (“Antiphon,” “Reponsory,” “Versicle”). This allows users to search using a familiar word instead of the letter code used by Cantus Database.³⁹

abbreviation	genre_full_name
A	Antiphon
AV	Antiphon Verse
R	Responsory
V	Verse
W	Versicle
H	Hymn
I	Invitatory Antiphon
P	Invitatory Psalm
M	Miscellaneous
G	Mass Chants

Figure 17. Fields (columns) for the MySQL database table *lugo_genres*.

In a similar manner, the table *lugo_office* links the various office codes used in *lugo_chant* with their descriptors. The same table also defines the sort order of the office,

³⁸ See <http://cantusdatabase.org/description#genre> for more detailed information.

³⁹ Guerin, 2.

since it is more intuitive for users to see the list of offices in their temporal rather than alphabetical order.⁴⁰

abbreviation	office full name	sort order
V	First Vespers	1
C	Compline	2
M	Matins	3
L	Lauds	4
P	Prime	5
T	Terce	6
S	Sext	7
N	None	8
V2	Second Vespers	9

Figure 18. Fields (columns) for the MySQL database table *lugo_office*.

In many ways, such as the layout and functionality of the search interface, the Lugo Codex project combines the data layout of the Cantus Database project with the extended metadata content features of the Digital Scriptorium, not only making this project a helpful stand-alone tool for performers and researchers, but also making it broadly useful in the fields of chant performance studies and medieval manuscript research.

⁴⁰ Ibid.

User Interaction

The website's user interface provides two main modes of interacting with the digitized codex. The first mode, "Browse", is similar in function to an eBook, and allows the user to select any page in the codex from a drop-down menu. Additionally, the user can enter a folio number directly into a text field, or navigate through the codex backwards and forwards one image at a time using a set of buttons. In each case, interacting with a user interface element invokes JavaScript handlers to fetch the new codex image from the server and inject it into the page at the appropriate location.⁴¹

The second mode, "Search," is more complex due to the interaction of various tables and database elements. The user has the option to enter up to three separate search terms into text fields in the interface, connecting them with either Boolean operator "AND" or "OR." The terms are used to send a SQL query to the database and return a result list of matching chants. Additionally, various other menus allow limiters to be added to the query, restricting the results by feast name, office, genre, position, mode, differentia, as well one or more concordances. Finally a radio button allows the sorting criterion (folio, mode, differentia, feast name, incipit, office, genre) to be appended to the SQL query.

The list of results comprises one row for each chant matched in the database. Although all data are retrieved from the database, by default only a summary consisting of incipit, office, and folio number (as well as a thumbnail image of the first folio on which the chant appears) is displayed. However, clicking an "Expand" link involves a JavaScript handler whereby all available metadata about the chant are revealed. (The

⁴¹ Ibid.

“Expand” link becomes a “Hide” link when the record is expanded, and clicking “Hide” allows the user to return to the summary list.) The use of a summary and expanded view enables the user to more easily scan multiple chants within the confines of a typical browser window, only “drilling” into individual chants as more information is desired.

As mentioned above, each result contains a “thumbnail” view of the folio. Clicking on the thumbnail generates a modular, interstitial window where the user can select one of three size views of the appropriate page. Because a chant may span more than one page, a set of navigation icons allows the user to navigate forward and backward in the folio, similar to user operation in the “Browse” mode. Clicking outside the image causes the interstitial layer to disappear.

Mobile Platform Compatibility

At the time of this project's conception, production and first coding, mobile platforms were only beginning to gain a foothold in the user market. However, at the time of this writing, mobile platforms (in particular iOS and Android) are now ubiquitous and quite often used in research (and even performance). I tested both of these platforms in order to assess usability of the site and pinpoint any incompatibilities or platform-specific errors or "bugs." Fortunately, as a result of streamlined coding, the site has proven entirely compatible with these two major mobile platforms. The only initial bugs were related to formatting, namely, the placement of footer areas. Given the size of smaller mobile phone screens, features such as the interstitial windows are somewhat less optimally viewed on a mobile phone screen. However, with tablet-sized mobile devices (such as the standard iPad or Android tablets), the viewing experience is entirely satisfactory.

Virtual Restoration Protocols

DIAMM is an important resource in the field of digital manuscript restoration. In its restoration work, DIAMM has made particular use of the professional consumer version of Photoshop. Although not all functions of Photoshop are applicable to the digital restoration of manuscript images, several of its tools are particularly useful in the process. These include the Level-adjust control, Layers, and the Color-range selection tool. In summary, these tools are employed as follows: the Level-adjust control works within the histogram of the digital image and selectively adjusts the high, low, and midpoint values as desired. This is of value when isolating particular sections of a manuscript or bringing out less legible portions, such as when reversing the results of fading. The Layer function is also useful in enhancing sections that are difficult to read, inasmuch as multiple layers can be created, adjusted separately, and then directly superimposed, to create an image that brings out selected features of the document. The Color-range selection tool selects pixels of a specific color and allows them to be further manipulated. These tools can be used to assist in digitally “removing” glue, water stains, dirt, or over-writing. Adobe Photoshop is readily available at Indiana University, and I utilized versions CS2, CS 4 and CS5 (Adobe Creative Suite) in my own work. For further information on the DIAMM restoration methods, see also <http://www.diamm.ac.uk/about/technical-overview/digital-restoration/>.

In the examples shown on the Lugo Codex Project website, I focused on three instances of image manipulation of two folia from the manuscript. These examples

demonstrated some of the simpler techniques possible with Adobe Photoshop software, and made easier some of the codicological and data-entry work.

The first item manipulated was the verso of the overleaf or *hoja de honor*, which is discussed above in Chapter 1. Because the shade of the vellum made deciphering the text quite difficult when viewed in black on beige color, I performed an “Invert” command to change each color to its opposite complement. In the adjusted image, the vellum appeared mostly blue, and the writing white (figure 19). This “blueprint” effect made the text easier to read and deduce, particularly in the less clear sections, and is a technique sometimes used to make readable the erased writing of some manuscripts.⁴²



Figure 19. Folio A verso: original image file (left) and altered with Invert command (right).

⁴² See Planchart, Alejandro Enrique. “Image-enhancement Procedures for Medieval Manuscripts,” *Computing in Musicology* 12 (2001), 250. Planchart notes that while negative-inversion techniques have been available through standard photography for some time, the computer permits the selective cleaning and enhancement of specific sections of the color-inverted images.

Similarly, text was made to stand out using a combination of discreet contrast adjustments using the Curves control, which adjusts the various areas of luminosity to very specific levels. In basic terms, the function of the Curves tool is as follows: the range of tonal values in a given image is represented by a scale from 0 to 255 (a total of 256 points) from black (0) to white (255), given along the X-axis of the tool's display (the Input). Each luminosity point in the original image is set to a specific value, which is measured along the Y-axis (the Output). The number of pixels in the original image which belong to a tonal group is represented by the shaded area plotted as peaks and troughs. In the case of folio 109 recto, most of the original tonal areas fall between values 125 and 240 of the X-axis. When a control point (one of 16 available to the user) is added along the curve, the pixels that match that luminosity level in the original can then be adjusted to a new level on the Y-axis. In figure 20, original (input) pixels matching value 129 (just a few shades grayer than neutral gray) have been adjusted to a lower value of 4 in the output, which is almost black.

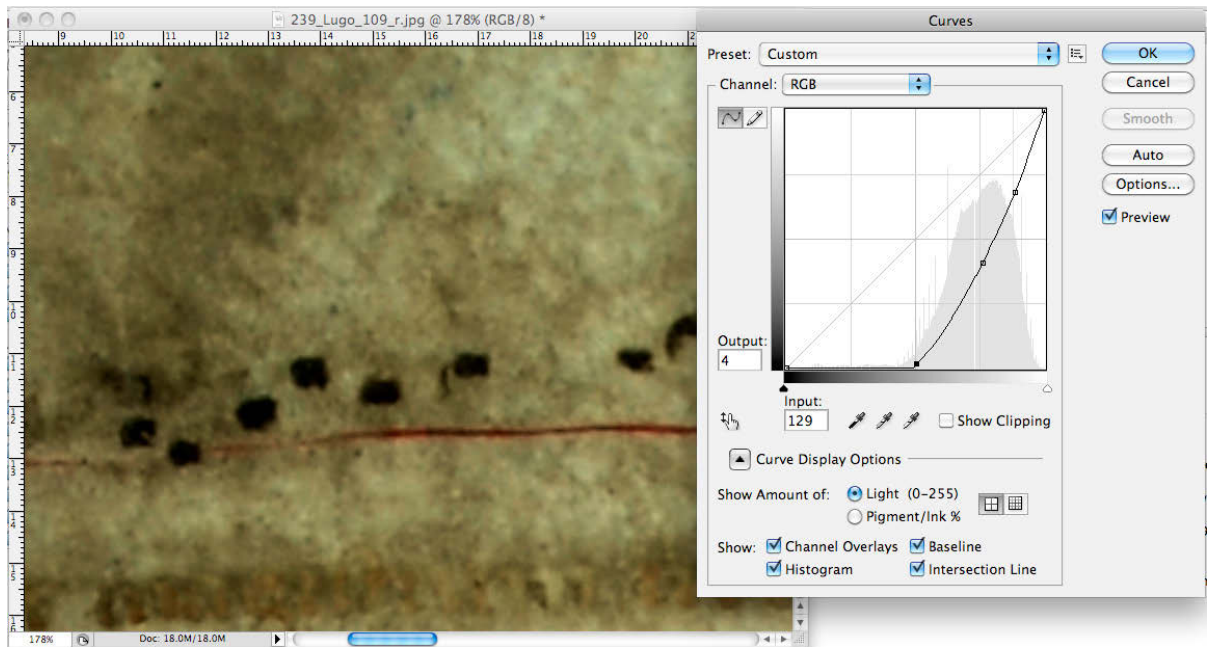


Figure 20. Folio 109r, Curves control showing neutral gray pixels darkened to almost black.

This effect—selecting the mid-tones of an image and darkening them—can be combined with the Layer command, where a new layer superimposed on a previous, identical one, can be selectively adjusted to add intensity or luminosity while retaining the distinct qualities of the original image.⁴³

⁴³ Wathey, Andrew, Margaret Bent, and Julia Craig-McFeely, “The Art of Virtual Restoration: Creating the Digital Image Archive of Medieval Music (DIAMM).” *Computing in Musicology* 12 (2001), 238. This article also describes use of the Level-Adjust and Color-Range Selection tools in manuscript image manipulation.

A second tool employed on folio 109 recto was a green-color filter, used to bring out indistinct writing on this page. Figure 21 shows how the use of the green filter brings out text just enough to allow a few key words to be deciphered.⁴⁴



Figure 21. Folio 109r, unretouched (left) and through a green filter to enhance readability of the text (right).

⁴⁴ Cf. Wathey et al., 239. I was inspired to experiment with color filters by the authors' suggestion in passing, that "[o]ther filters may also enhance legibility."

CONCLUSION

This project does not intend to demonstrate groundbreaking work in the fields of digital manuscript facsimile production, virtual reconstruction techniques or technology, or Hispanic medieval studies or musicology. Since its inception, the principal aim of this project has been to provide a digital resource which contains one of Spain's only complete chant codices, in particular one still housed in the church where it was originally used. Since the website and images for this doctoral project have been online in beta form since 2010, the project has, in essence, already fulfilled one of its main purposes and quietly continues to do so by virtue of its online presence.

This project does, however, hope to provide performance, research, and pedagogical material for musicians and academics anywhere. As the project goes fully online, it will be accessible to performers, teachers and researchers around the world who wish to add the Lugo Breviary to the list of available diastematic medieval chant sources. On several levels, this project hopes to be not only a useful stand-alone tool for performers and researchers, but also be of added value to the fields of chant studies, medieval manuscript research, and Hispanic Latin paleography. With its intended future integration into the Cantus, Digital Scriptorium, and GlobalChant databases, the project joins the multitude of digital manuscripts playing the important role of regional cultural ambassadors to the music and research worlds. By providing a basis for comparison amongst the varieties of plainchant that existed across Europe, the picture of Western medieval song becomes more complete. If, then, this project inspires users to explore the

world of plainchant and medieval song beyond its usual borders and its traditional sources, it will have fulfilled its central purpose.

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APPENDIX 1

Database Entry-fields of the Lugo Codex Project

Concordant with the Cantus Database and the Digital Scriptorium Project

(A full description of the Cantus Database search fields and their abbreviations is available online at <http://publish.uwo.ca/~cantus/descript.html>. The full description of Digital Scriptorium fields is available online at: https://www1.columbia.edu/sec/cu/libraries/bts/img/assets/7895/DS-Access_Data_Dictionary_v8.0.0.pdf.)

The table below lists the database entry-fields for the *Lugo Codex* project. The line numbers in the leftmost column designate the four levels of metadata contained within the database: Manuscript (1–39), Part (40–68), Text/Chant (69–83), and Image (84–89). The excerpt below, taken from the Digital Scriptorium's data dictionary, clarifies the nature of these four levels:

This data dictionary accompanies DS-Access, the particular configuration of Microsoft Access designed to meet the needs of the Digital Scriptorium. The database is intended to collect, in an efficient and organized manner, basic information about the manuscripts held by the Digital Scriptorium partners and to provide searching points for images from these holdings.

Each successive level is dependent upon the preceding level(s), in a potentially one-to-many relationship. For example: one manuscript may contain only one part which contains only one text and only one image will be photographed from it. Or, one manuscript may contain two parts (i.e. sections produced independently of one another), and each part may contain three or four texts, and each text may be illustrated in the image database by four or five images. In practice, the first level, "Manuscript" identifies the single codex; the second level, "Part" contains most of the physical information about the codex; the third level, "Text" holds bibliographic

information; the fourth level, "Image" refers to photographic image that the end-user sees on the Web.⁴⁵

Since my project deals exclusively with a single manuscript, all the fields for the “manuscript” level are identical, and all those for the “part” level are identical within a given part (in the case of the *Lugo Codex*, there are three parts). The bulk of unique database entries occur within the “text” and “image” sections, since these refer to each unique image and its linked text entry or entries. The total number of entries in the database will correspond to the total of unique “text” entries, since an image may contain several unique texts or chants. In addition, not all of the data fields contained in the database record will display for the user in the search results. Search results will contain only the information from those fields marked by an asterisk in the “Display” column of the following table. Every item which displays in the search results will, however, include a link titled “Full Information,” which will open a new page displaying the entire contents of that database record. (Note: in the paragraph above, the word “text” refers to first lines or *incipits* of texts and chants, not to full texts.)

Order	<i>Lugo Codex</i> Field Name	Display	Description of Contents
1	Folio	*	Actual folio number (with leading zeros)
2	Folio side	*	Folio side (r/v)
3	Sequence	*	Position of chant on the page (01 for first, 05 for fifth, etc.)
4	FeastName	*	Name of the occasion for which the chant is sung
5	Office	*	Office in which the chant is sung
6	Genre	*	Type of chant (antiphon, responsory, etc.)
7	Position	*	Identifies the liturgical role of the chant, ordered according to their position within the office
8	Incipit	*	The first few words of the chant

⁴⁵ Dutschke, C. W. “Digital Scriptorium Data Dictionary,” last modified July 13, 2006, accessed May 29, 2013, https://www1.columbia.edu/sec/cu/libraries/bts/img/assets/7895/DS-Access_Data_Dictionary_v8.0.0.pdf

9	Marginalia	*	Marginalia in left, right, top, bottom margins, or in main body of text
10	Concordances		Indicates concordances with manuscripts listed in volumes 1 and 2 of the <i>Corpus Antiphonarium Officii</i> (CAO)
11	ChantIDNumber		Indicates whether the text occurs in CAO or any other chant index
12	CantusIDNumber		To be assigned by Cantus in order to cross-reference any chants not included in the CAO
13	Mode	*	The apparent mode of the chant, stated in numerical values 1–8, or reflecting unidentifiable modes or lack of notation
14	Differentia	*	Refers to differentia, use of the <i>tonus peregrinus</i> , or the tone to be employed with an invitatory antiphon
15	Extra		Used for any non-standard information that will be useful for Cantus
16	FeastCode	*	Identifies chants by their liturgical occasions: Sundays, <i>temporale</i> , chants for certain days of the year, etc.
17	Siglum		Identification which identifies the manuscript, modeled on the system developed for RISM
18	Addendum		Any additional information not usually used in the Cantus format
19	City		Lugo
20	Institution		Lugo Cathedral
21	Library		Lugo Cathedral Archive
22	Shelfmark		No shelfmark
23	Nickname		Lugo Codex / Codice de Lugo / Lugo Breviary
24	Composite MS		Yes
25	Extent of Total folios		ff. I + 427
26	Total Folios	*	Total Folios
27	Physical Issue(s)		(To be determined)
28	Binding		Skin over chestnut wood, remains of two brass hasps on right side.
29	Provenance		Catedral de Santa Maria de Lugo
30	Bibliography		
31	Reproduction		12 ff. reproduced in sepia-toned black and white in Lopez–Calo, 56–61.
32	Acknowledgments		(To be determined)
33	Source		Wolodymyr Smishkewych
34	Inputter		Wolodymyr Smishkewych
35	Inputter/Date		(Unique to each entry)
36	Reviser		(Unique to each entry)
37	Reviser/Date		(Unique to each entry)
38	Revisit		(Unique to each entry)
39	Suppress		(Unique to each entry)
40	Part Number	*	Lugo 01 with Pt. I, Pt. II and Pt. III
41	Support		Parchment
42	Watermark		Default=none
43	Span of Folios		(Unique to each part)
44	Height		24 cm
45	Width		17.5 cm
46	Country		Spain
47	Cardinal Point		Northwest
48	Region		Galicia
49	CityA		Lugo
50	Document		(Unique to each part)
51	Dated		(Unique to each part)

52	Date		(Unique to each part)
53	Begin Date		(Unique to each part)
54	End Date		(Unique to each part)
55	Year-Month-Day		(Unique to each part)
56	Layout		(Unique to each part)
57	Alphabet		Latin
58	Script		(Unique to each part)
59	Number of Scribes		(Unique to each part)
60	Scribe		(Unique to each part)
61	Music	*	Default=yes
62	Representational Decoration		(Unique to each part)
63	Other Decoration		(Unique to each part)
64	Artist		(Unique to each part)
65	NotesA		(Unique to each entry)
66	AcknowledgmentsA		(To be determined)
67	SequenceA		(Unique to each part)
68	RevisitA		(Unique to each entry)
69	Span of Folios(A)	*	(Unique to each entry)
70	Author		(Unique to each entry)
71	Other Associated Name(s)		(Unique to each entry)
72	Title	*	(Unique to each entry)
73	Generic Title	*	(Unique to each entry)
74	Subject		(Unique to each entry)
75	Language(s)		Default=Latin
76	Document Summary		(Unique to each entry)
77	Rubric		(Unique to each entry)
78	Explicit		(Unique to each entry)
79	Status of Text		(Unique to each entry)
80	NotesB		(Unique to each entry)
81	URL Citation		(Unique to each entry)
82	AcknowledgmentsB		(To be determined)
83	RevisitB		(Unique to each entry)
84	Folio Number(s)	*	(Data matches row 2)
85	Caption		(Unique to each entry)
86	Iconclass		(Unique to each entry)
87	Notes to Photographer		(Unique to each entry)
88	SequenceB		(Unique to each entry)
89	RevisitC		(Unique to each entry)
90	Notes		Front board broken and front skin separated from board entirely and along spine. Evidence of 3 or 4 straps across spine given discoloration of skin binding. Skin still attached to rear board, and remains of two brass hasps on right side.
91	Internal Reference		

APPENDIX 2

CSS (Cascading Style Sheet) for the Lugo Codex Project Site

The style sheet code described below provides the style for entire Lugo Codex Project website. It is based on the style for a website I had previously designed and submitted for an independent study in the creation of online music database resources, BSpan: A Database for Baroque Spanish Music Sources (www.smishkewych.com/bspan). Originally coded by Jeremy Gottwig, the BSpan style sheet was then adapted and recoded by William Guerin for use in the Lugo Project website.

```
html{height:100%;}
input,select
{
    border-width: 1px;
    border-color: #593809;
    border-style: solid;
    font-family: arial, helvetica;
}
input.wide
{
    width: 300px;
}
input.gsearch
{
    width: 400px;
}
input.osearch
{
    width: 50px;
}
li:first-line
{
    margin-left: -15px;
}
div.reach,div.sreach
{
    margin-left: auto;
    margin-right: auto;
    margin-top: 10px;
    margin-bottom: 10px;
    width: 700px;
    min-width: 700px;
}
div.sreach
{
    text-align: center;
}
div.breach
{
    text-align: left;
    position: relative;
    display: block;
    margin-left: auto;
    margin-right: auto;
    width: 700px;
    min-width: 700px;
    border-width: 0px;
    border-color: black;
    border-style: solid;
    padding: 0px;
```

```

}
span.inner
{
    position: relative;
    display: table-cell;
    text-align: left;
    border-style: solid;
    border-color: black;
    border-width: 1px;
    width: 340px;
    padding: 0px;
    margin: 0px;
}
div.left
{
    float: left;
    width: 350px;
    border: 0px;
    border-bottom: 1px;
    border-right: 0px;
    border-left: 1px;
    border-top: 0px;
    border-style: dotted;
    border-color: black;
}
div.right
{
    margin-left: 210px;
    text-align: right;
    border: 0px;
    border-bottom: 0px;
    border-style: dotted;
    border-color: black;
}
div.data
{
    font-family: lucida sans, lucida sans unicode, helvetica;
    font-size: 10pt;
    border: 0px;
    border-bottom: 1px;
    border-style: dotted;
    border-color: black;
}
div#top
{
    background-color: #6677F4;
    border: 0px;
    border-right: 1px;
    border-bottom: 1px;
    border-left: 1px;
    border-style: solid;
    border-color: #593809;
    width: 80%;
    min-width: 700px;
    padding: 3px;
    font-style: italic;
    font-color: ffffff;
    font-family: garamond;
    margin-left: auto;
    margin-right: auto;
}
div.mask
{
    position: absolute;
    margin-left: 0px;
    margin-top: 0px;
    left: 0px;
    top: 0px;
    width: 100%;
    background-color: #000000;
    visibility: hidden;
    opacity: 0.7;
    filter: alpha(opacity=70);
}
div.allContent
{
    margin-left: 0px;
    margin-top: 0px;
    height: 100%;
    width: 100%;
}

```

```
div.imageBrowser
{
position:absolute;
margin-right: auto;
margin-left: auto;
z-index:20;
width:512px;
height:900px;
visibility:hidden;
background-color: #FFFFFF;
}
p.scrollSelect
{
    height: 30px;
    padding: 3px;
    overflow: auto;
    border: 1px solid #ccc }
```

APPENDIX 3

Technical Specifications

Nikon D-200 Digital Camera: Technical Specifications⁴⁶

Effective pixels: 10.2 million

Type of camera: Single-lens reflex digital camera

Image sensor: RGB CCD, 23.6 x 15.8 mm; total pixels: 10.92 million

Image size (pixels): 3,872 x 2,592 [L], 2,896 x 1,944 [M], 1,936 x 1,296 [S]

Storage media: CompactFlash (CF) card (Type I and II) and Microdrive

Sensitivity: 100 to 1600 (ISO equivalent) in steps of 1/3, 1/2, or 1 EV with additional settings up to 1 EV over 1600

File System: Exif 2.21, Compliant DCF 2.0, and DPOF

Storage system: Compressed or uncompressed NEF (RAW): 12-bit compression, JPEG: JPEG baseline-compliant

White balance: Auto (TTL white balance with 1,005-pixel RGB sensor), six manual modes with fine-tuning, color temperature setting, preset white balance, white balance bracketing possible (2 to 9 frames in increments of 1, 2, or 3)

LCD monitor: 2.5-inch, 230,000-dot, low-temperature polysilicon TFT LCD with brightness adjustment

Playback function: 1) Full frame 2) Thumbnail (4 or 9 segments) 3) Zoom 4) Slideshow 5) RGB histogram indication 6) Shooting data 7) Highlight point display 8) Auto image rotation

Interface: Can be selected from NTSC and PAL

Picture angle: 35 mm [135] format is approximately 1.5 times lens focal length

Text input: Up to 36 characters of alphanumeric text input available with LCD monitor and multi-selector; stored in Exif header

Compatible lenses: All AF-DX, AF-D, AF-G, AF-I, AF-S, and AF VR Nikkor lenses provide full AF and metering operation. AI-P lenses provide manual focus with electronic rangefinder and full metering operation. AI lenses provide manual focus with electronic rangefinder, Aperture Priority and Manual exposure mode, C/W and Spot metering operation.

Viewfinder: Fixed eye-level Pentaprism type; built-in diopter adjustment (-2.0 to +1.0m-1)

Eyepoint: 19.5mm (-1.0m-1)

⁴⁶ <http://www.nikonusa.com/en/Nikon-Products/Product-Archive/Digital-slr-Cameras/25235/D200.html#tab-ProductDetail-ProductTabs-TechSpecs>, accessed 6 June 2013, 23:20 GMT.

Focusing screen: Type-B BriteView clear matte screen Mark II with superimposed focus brackets and on-demand grid lines

Viewfinder Frame Coverage: Approximately 95% (vertical and horizontal)

Viewfinder Magnification: Approximately 0.94x with 50mm lens at infinity; -1.0m-1

Viewfinder Information: Focus indications, metering system, AE/FV lock indicator, flash sync indicator, shutter speed, aperture value, exposure/exposure compensation indicator, ISO sensitivity, exposure mode, flash output level compensation, exposure compensation, number of remaining exposures

Autofocus: TTL phase detection by Nikon Multi-CAM 1000 autofocus module with AF-assist illuminator (approximately 0.5 to 3.0 meters)

Lens servo: Instant single-servo AF (S); continuous-servo AF (C); manual (M); predictive focus tracking automatically activated according to subject status in continuous-servo AF

Focus area: Normal: 11 areas; single area or group can be selected; wide: focus area can be selected from 7 areas

AF Area Mode: 1) Single Area AF 2) Dynamic Area AF 3) Group Dynamic 4) Dynamic area AF with closest subject priority

Focus lock: Focus can be locked by pressing shutter-release button halfway (single-servo AF) or by pressing AE-L/AF-L button

Exposure metering system: Three-mode through-the-lens (TTL) exposure metering. 1) 3D Color Matrix Metering II (type G and D lenses); color matrix metering II (other CPU lenses); color matrix metering available with non-CPU lenses if user provides lens data; metering performed by 1,005-segment RGB sensor. 2) Center-weighted: Weight of 75% given to 6, 8, 10, or 13-millimeter diameter circle in center of frame. 3) Spot: Meters 3-millimeter diameter circle (about 2.0% of frame) centered on active focus area (on center focus area when non-CPU lens is used).

Exposure metering range: (ISO 100, f1.4 lens, 68 degrees F): 1) EV 0 to 20 (3D Color Matrix or center-weighted metering) 2) EV 2 to 20 (spot metering) (ISO 100 equivalent, f1.4 lens, 20 degrees C)

Exposure meter coupling: Combined CPU and AI

Exposure modes: Programmed Auto [P] with flexible program; Shutter-Priority Auto [S]; Aperture Priority Auto [A]; Manual [M]

Exposure compensation: Plus or minus 5 EV in increments of 1/3, 1/2, or 1 EV

Autoexposure lock: Luminosity locked at detected value with AE-L/AF-L button

Autoexposure bracketing: 2 to 9 exposures in increments of 1, 2, or 3

Shooting modes: 1) Single frame shooting mode 2) Continuous low speed (CL) shooting mode: 1 to 4 frames per second 3) Continuous high-speed shooting mode: 5 frames per second 4) Self-timer shooting mode 5) Mirror-up mode

Shutter: Electronically-controlled vertical-travel focal plane shutter, 30 to 1/8,000 second in steps of 1/3, 1/2, or 1 EV, bulb

Sync contact: X-contact only; flash synchronization at up to 1/250 sec.

Flash control: 1) TTL: TTL flash control by 1,005-pixel RGB sensor; Built-in Speedlight: i-TTL balanced fill-flash or standard i-TTL flash (spot metering or mode dial set to [M]) SB-800 or 600: i-TTL balanced fill-flash for digital SLR and standard i-TTL flash for digital SLR. 2) Auto aperture

Available with SB-800 with CPU lens. 3) Non-TTL Auto: Available with Speedlights such as SB-800, 80DX, 28DX, 28, 27, and 22. 4) Range-priority manual; available with SB-800 : Flash sync mode

1) Front-curtain sync (normal sync), 2) Red-eye reduction, 3) Red-eye reduction with slow sync, 4) Slow sync, 5) Rear-curtain sync: Built-in Speedlight

Manual pop-up with button release guide number (ISO 100, m): approximately 12 (manual 13) : Flash compensation

-3 to +1 EV in increments of 1/3 or 1/2 EV: Accessory shoe

Standard ISO hot-shoe contact with safety lock provided: Sync terminal

ISO 519 standard terminal: Self-timer

Electronically controlled timer with 2 to 20 seconds duration: Depth of field preview

When CPU lens is attached, lens aperture can be stopped down to value selected by user (A and M mode) or value selected by camera (P and S mode): Remote control

Via 10-pin remote cord MC-22/30/36 (optional) or wireless remote control WT-3 (optional) : GPS: NMEA 0183 (Ver. 2.01) interface standard supported with 9-pin D-sub and GPS Cable MC-35 (optional)

Power source: One rechargeable Li-ion battery EN-EL3e, MB-D200 battery pack (optional) with one or two rechargeable Nikon EN-EL3e Li-ion batteries or six AA alkaline (LR6), NiMH (HR6), lithium (FR6) batteries, or 2R6 nickel-manganese AA batteries, AC Adapter EH-6 (optional)

Tripod socket: 1/4 inch (ISO)

Dimensions (W x H x D): Approximately 147 x 113 x 74 millimeters

Weight: Approximately 830 grams without battery, memory card, body cap, or monitor cover

Nikon AF Nikkor 50mm f/1.8D Lens: Technical Specifications⁴⁷

Lens construction: 6 elements in 5 groups

Picture angle: 46° [31°30' with Nikon digital cameras (Nikon DX format)]

Number of diaphragm blades: 7

Minimum f/stop: 22

⁴⁷ <http://www.nikonusa.com/en/Nikon-Products/Product/Camera-Lenses/2137/AF-NIKKOR-50mm-f%252F1.8D.html#tab-ProductDetail-ProductTabs-TechSpecs>, accessed 6 June 2013, 23:22 GMT.

Closest focusing distance: 0.45m

Maximum reproduction ratio: 1/6.6

Macro focusing: N/A

Focus-limit switch: N/A

M/A mode: N/A

Focus lock button: N/A

Weight (approx.): 155

Dimensions (approx.) (from the camera's lens mounting flange): 63.5 _ 39 mm

Capture and Imaging Software: Technical Specifications

Nikon Camera Control Pro Version 2 (Macintosh)⁴⁸

CPU: 1 GHz or higher Power PC G4/G5, Intel Core series/Xeon series

OS: Mac OS X 10.3.9, 10.4.10

RAM: 256 MB or more (768 MB or more recommended)

Hard disk: Requires 1 GB or more for running

Monitor: 1,024 x 768 pixels or more

24-bit color (True Color) or more

Interface* USB: Only built-in USB ports supported

Firewire: Only Firewire ports supported

Miscellaneous: CD-ROM drive required for installation

Internet connection may be required

IEEE 1394 connection (D1 series) not supported with Macintosh with Intel processors

⁴⁸ http://imaging.nikon.com/lineup/software/control_pro2/spec.htm, accessed 6 June 2013, 23:27 GMT.

Aperture (Academic Version 2.1.4) - Technical Specifications⁴⁹

Aperture 2 - Part Number MB285Z/A

Minimum Hardware Requirements

One of the following Mac computers: Mac Pro, 15- or 17-inch MacBook Pro, MacBook, Mac mini with an Intel Core Solo or Duo processor, iMac with a 1.8 GHz or faster PowerPC G5 or Intel Core Duo processor, Power Mac G5 with a 1.6 GHz or faster PowerPC G5 processor, 15- or 17-inch PowerBook G4 with a 1.25 GHz or faster PowerPC G4 processor, 1 GB of random-access memory (RAM), 2 GB of RAM required for Mac Pro

One of the following graphics cards:

ATI Radeon X600 Pro, X600 XT, X800 XT Mac Edition, X850 XT, X1600, X1900 XT, 9800 XT, 9800 Pro, 9700 Pro, 9600, 9600 XT, 9600 Pro, 9650, HD 2400 XT, or HD 2600 Pro, ATI Mobility Radeon 9700 or 9600, ATI Mobility X1600, NVIDIA GeForce FX 5200 Ultra, 6600, 6600 LE, 6800 Ultra DDL, 6800 GT DDL, 7300 GT, 7800 GT, or 8600M GT, NVIDIA Quadro FX 4500, Intel GMA950

DVD drive for installation

Minimum Software Requirements: Mac OS X v10.4.11 Tiger, Mac OS X v10.5.2 Leopard (or later)

Recommended Configuration: Mac computer with a 2 GHz or faster Intel Core Duo processor or dual 2 GHz or faster PowerPC G5 processors, 2 GB of RAM

One of the following graphics cards:

ATI Radeon X800 XT Mac Edition, 9800 XT, 9800 Pro, X1900 XT, or X1600 NVIDIA GeForce 6800 series or 7800 GT, NVIDIA Quadro FX 4500

5 GB of disk space for the application and sample projects

Available Hard Disk Space

Aperture and its associated features require a certain amount of available disk space:

5 GB of disk space for the application and sample projects

Input: Import images directly from cameras and storage devices (CompactFlash I, CompactFlash II, and Microdrive, Memory Stick and Memory Stick Duo, Secure Digital, MultiMedia, and SmartMedia cards, xD-Picture cards)

Import from multiple cards simultaneously

Drag in files from any volume (preserves Finder folder hierarchy)

Browse and import directly from iPhoto library

⁴⁹ http://support.apple.com/kb/SP524?viewlocale=en_US&locale=en_US, accessed 6 June 2013, 23:28 GMT.

Capture images directly from tethered Nikon and Canon cameras¹

File Formats

Native RAW import and editing of images from leading digital cameras and camera backs (See RAW support page for model listing.) (.ARW, .CR2, .CRW, .MOS, .NEF, .RAF, .RAW, .SRW, .TIF, .OLY, .FFF, .3FR, .DNG2)

Compatible with all major still image formats: (JPEG, GIF, TIFF, PNG, PDF, PSD3)

Photo Management: Store photographs anywhere: external hard drives, RAID arrays, optical media

Import photos into an Aperture-managed library or reference them in place without copying or moving them from their physical locations

Tools: Exposure, Highlight Recovery, Black Point, Vibrancy, Definition, Histogram, Levels, Color, Highlights and Shadows, Edge Sharpen, White Balance, Monochrome filter with RGB Channel Mixer, Crop, Straighten, Flip Image, Red-eye Correction, Noise Reduction, Vignette and Devignette, Retouch (soft-edged Repair and Clone), Color Monochrome filter, Sepia Tone filter, Spot and Patch tools, Lift and Stamp tool to copy and paste adjustments, Stacks to manage alternate versions, Seamless Photoshop integration⁴, One-click export directly to Photoshop as PSD or TIFF (8-bit or 16-bit), Native support for flattened or single-layer PSD files³, Management of Photoshop-generated image versions, Plug-in architecture enables third-party imaging software to work with either TIFF or RAW images directly within Aperture as plug-ins. Dodge & Burn plug-in adds brush-based tools for Dodge (Lighten), Burn (Darken), Contrast, Saturation, Sharpen, and Blur, Compare and Select Tools, Stacks: Group sequences of shots, Automatically group bursts and bracketed shots, Manually stack alternate shots, Collapse entire shoots down to selects, Full-screen workspace for comparing images

Viewing of multiple images side by side, Simultaneous zooming of multiple images, Quick Preview mode for rapid-fire image browsing, Compare mode for selecting shots, Digital Loupe tool for magnifying images

Digital Light Table for organizing images and creating comp layouts, Output, ColorSync color-managed output

Onscreen soft proofing, Specify size and resolution of exported images, Embed ColorSync and ICC profile data during file export, Embed IPTC metadata during file export, Drag-and-drop JPEG export into Mac OS X applications, Export IPTC metadata as XMP sidecar files or embed into master images on export

Expert local printing: Images, Customizable contact sheets, Light Table comps, Gamma adjustment, Black point compensation, Print sharpening with radius control

Metadata

Comprehensive IPTC and EXIF metadata support

View, extract, or add any metadata

Define custom metadata sets

Speed metadata entry by creating Metadata Presets — prefilled IPTC presets from copyright, captions, and other metadata fields

Customize display of metadata throughout workflow

Add metadata automatically to batches on import

Embed IPTC metadata on export of versions or master images

Use powerful Query tool for searching, sorting, and sifting

Search images based on adjustments applied

Adjust time and date to correct timestamps on images

Lift and Stamp tool for copying and pasting metadata

APPENDIX 4

Internet Sources and Digital Archive Models

CANTUS: A Database for Latin Ecclesiastical Chant

Indices of chants in selected manuscripts and early printed sources of the liturgical Office.

<http://cantusdatabase.org/> (formerly <http://publish.uwo.ca/~cantus/index.html>)

Digital Image Archive of Medieval Music (DIAMM)

<http://www.diamm.ac.uk/>

- Description of digital imaging standards developed by DIAMM:

<http://www.diamm.ac.uk/content/description/index.html>

- Description of the process of virtual restoration developed by DIAMM:

<http://www.diamm.ac.uk/content/restoration/index.html>

Digital Scriptorium

An image database of medieval and Renaissance manuscripts. Also contains technical information and specifications for digital imaging processes for historical manuscripts.

<http://www.digital-scriptorium.org/>

Technical information:

https://www1.columbia.edu/sec/cu/libraries/bts/digital_scriptorium/technical/

Gallica

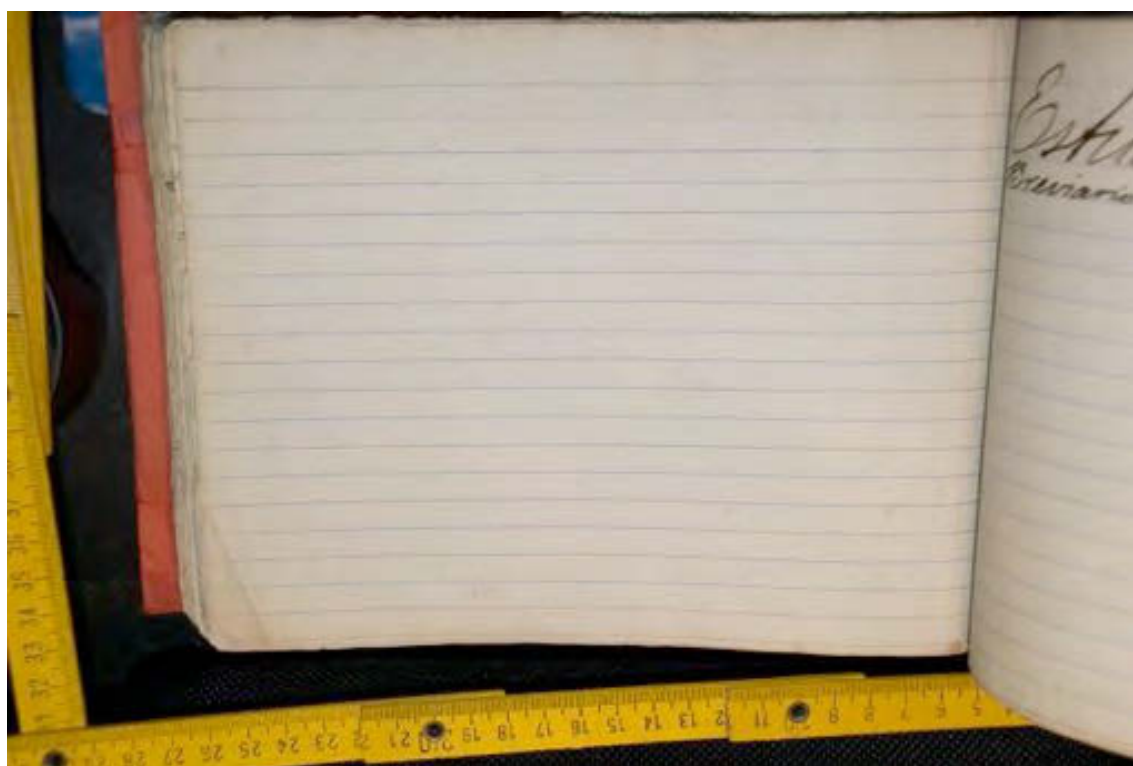
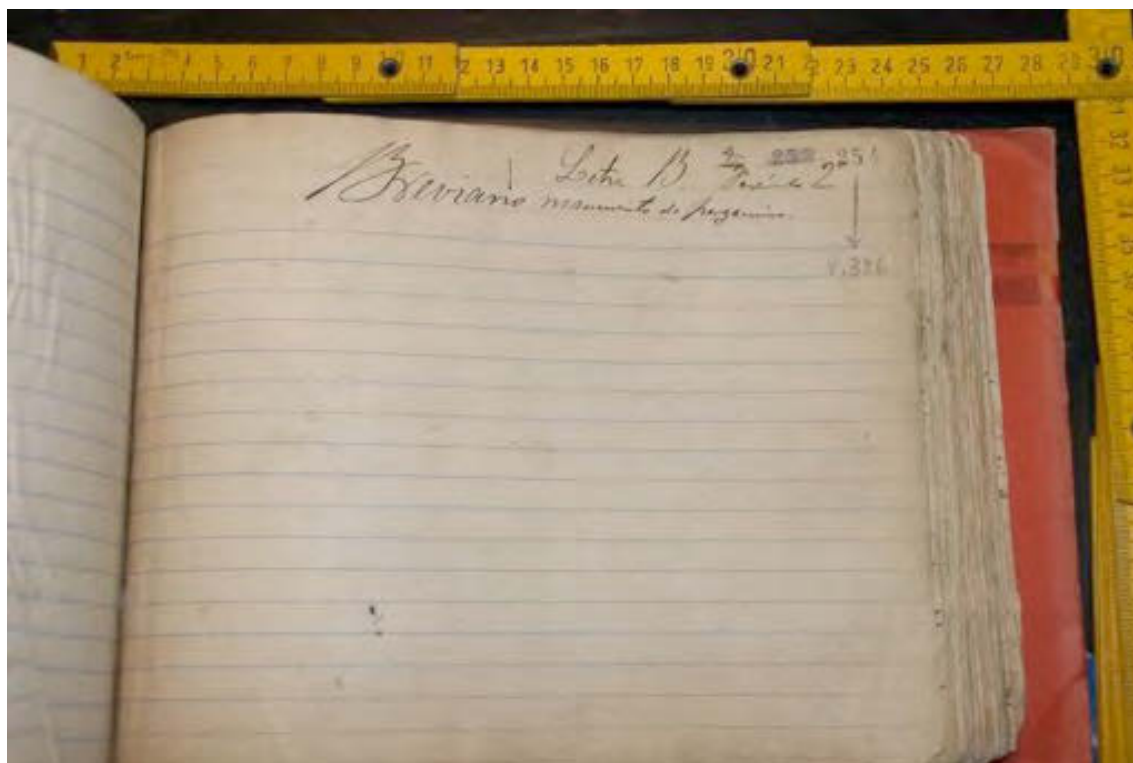
This is the digital portal for the Bibliothèque Nationale Française, and houses a large number of important medieval manuscripts, in particular those containing chant and medieval song.

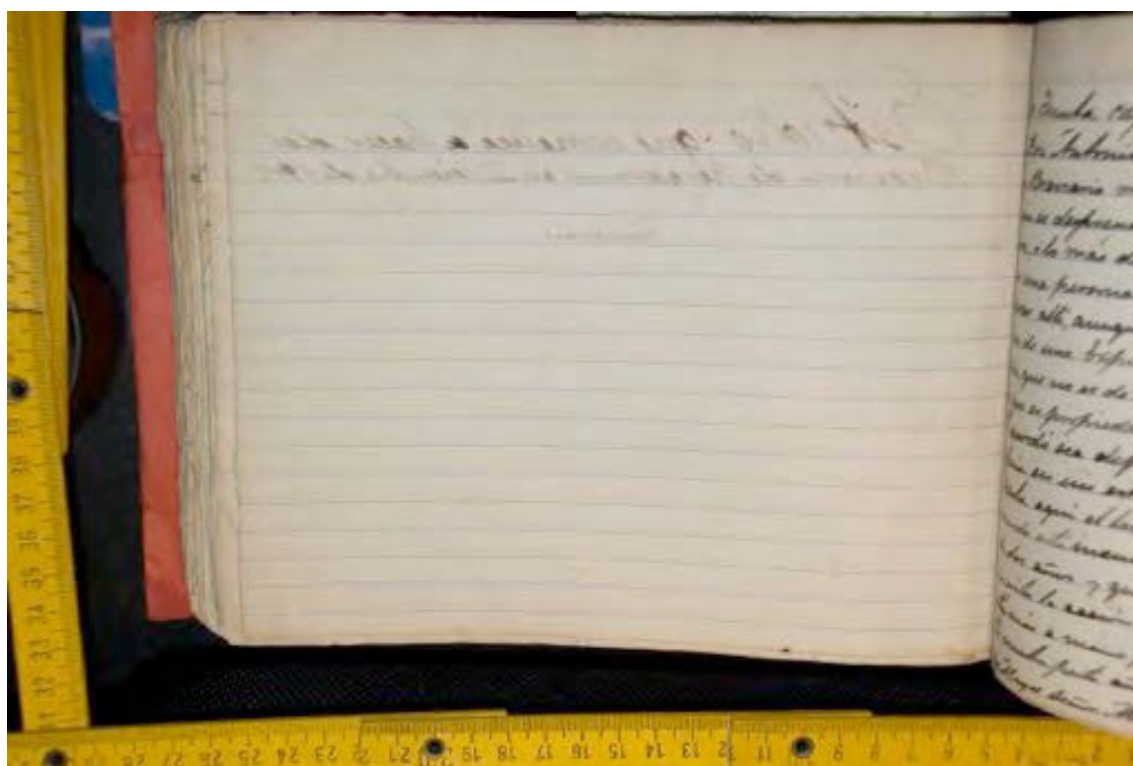
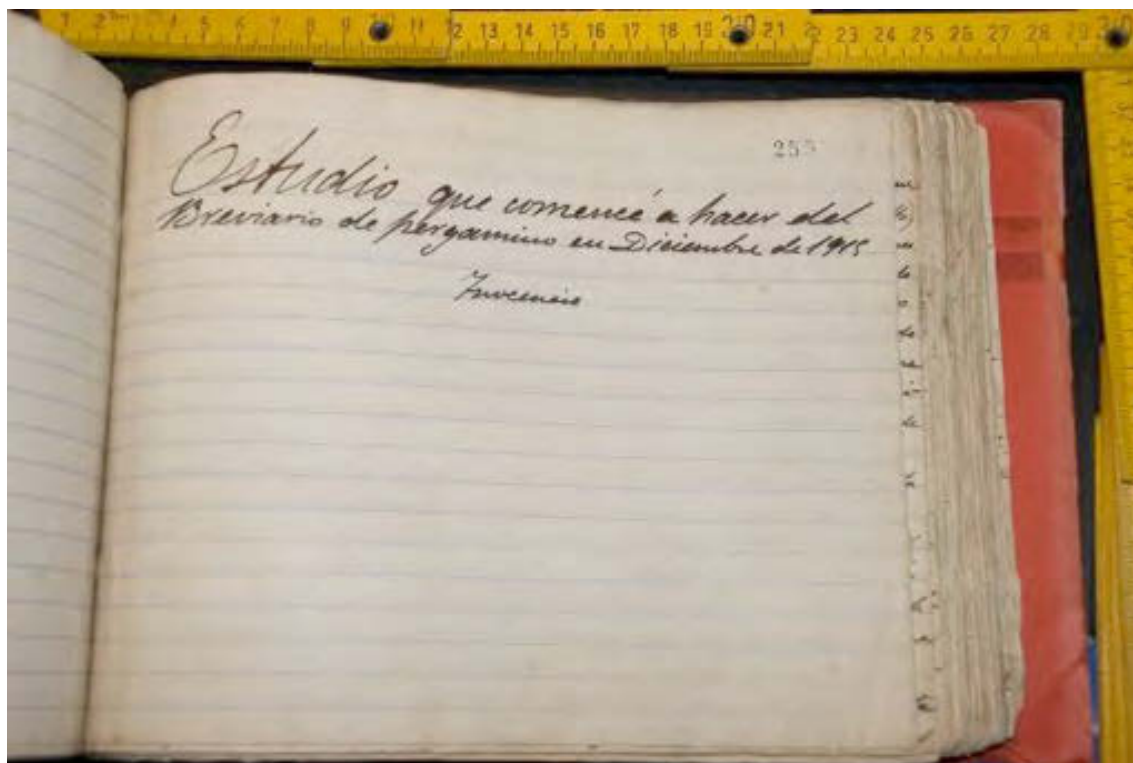
<http://gallica.bnf.fr/>

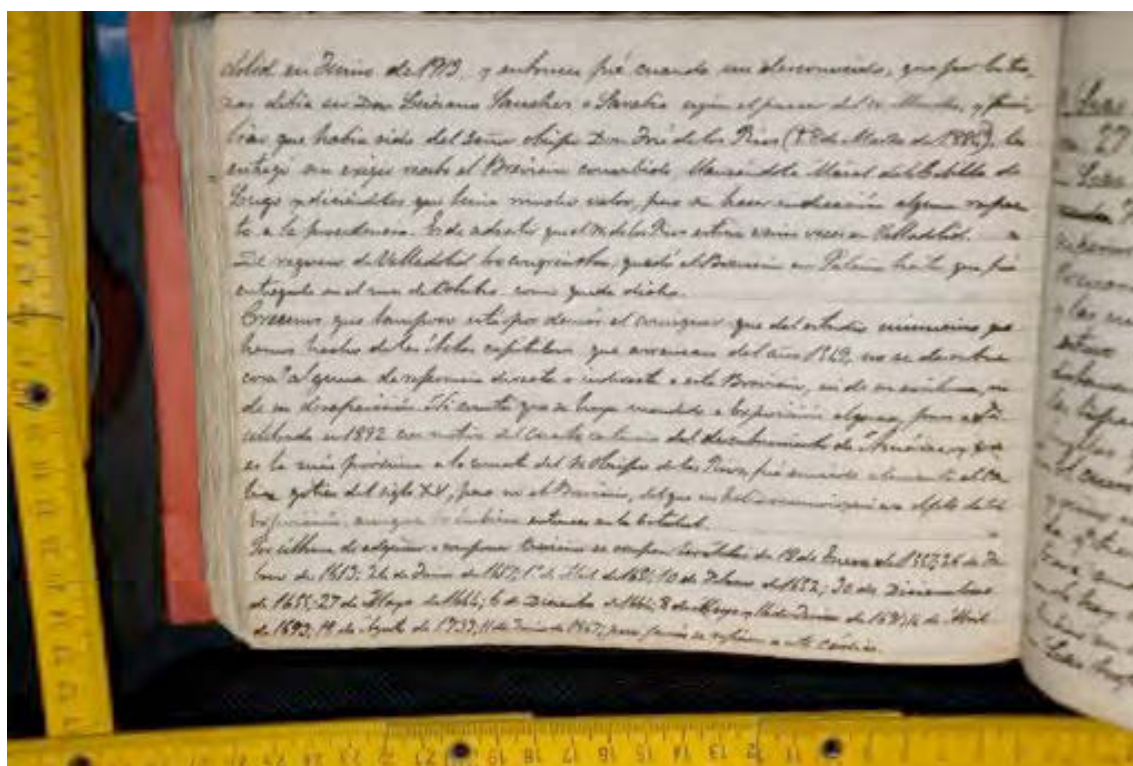
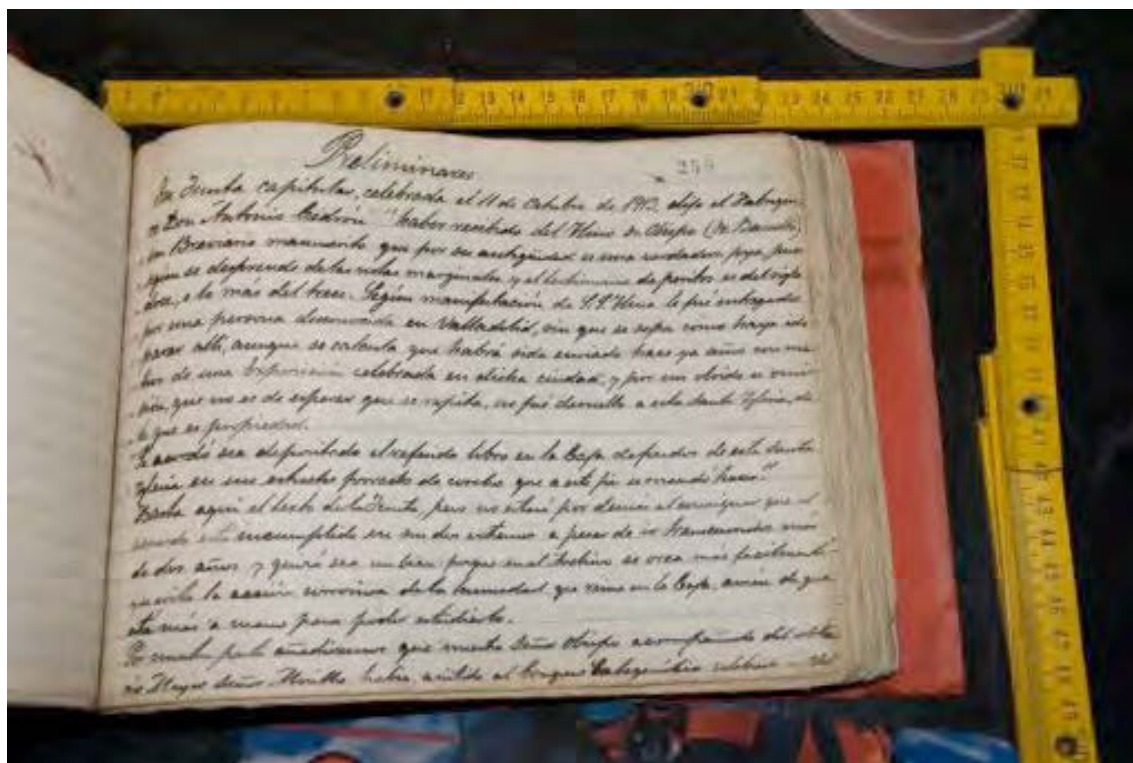
APPENDIX 5

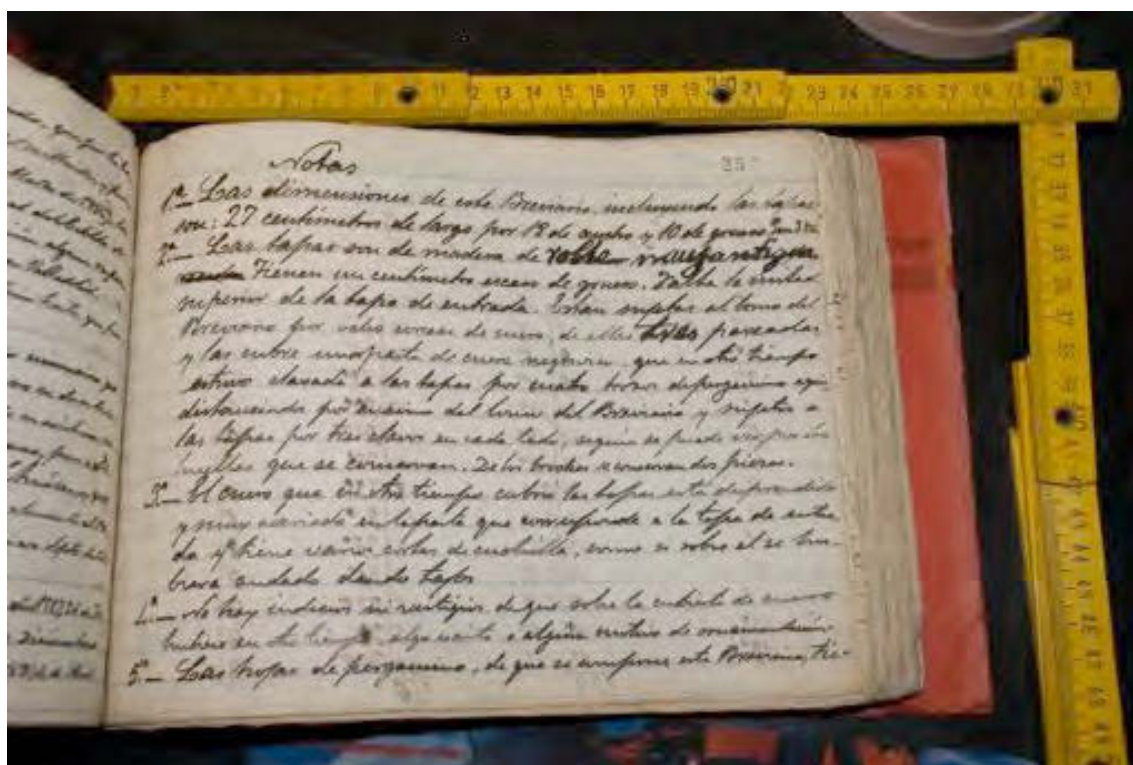
The *Abecedario* of Inocencio Portabales, vol 1. ff. 254r–379r











non 25 centímetros de largo por 17,5 cm anchura de ancho y
 entre cordas a cuadernillos con hilo blanco de hilo retorcido,
 lo que le da aspecto de bramante delgado.

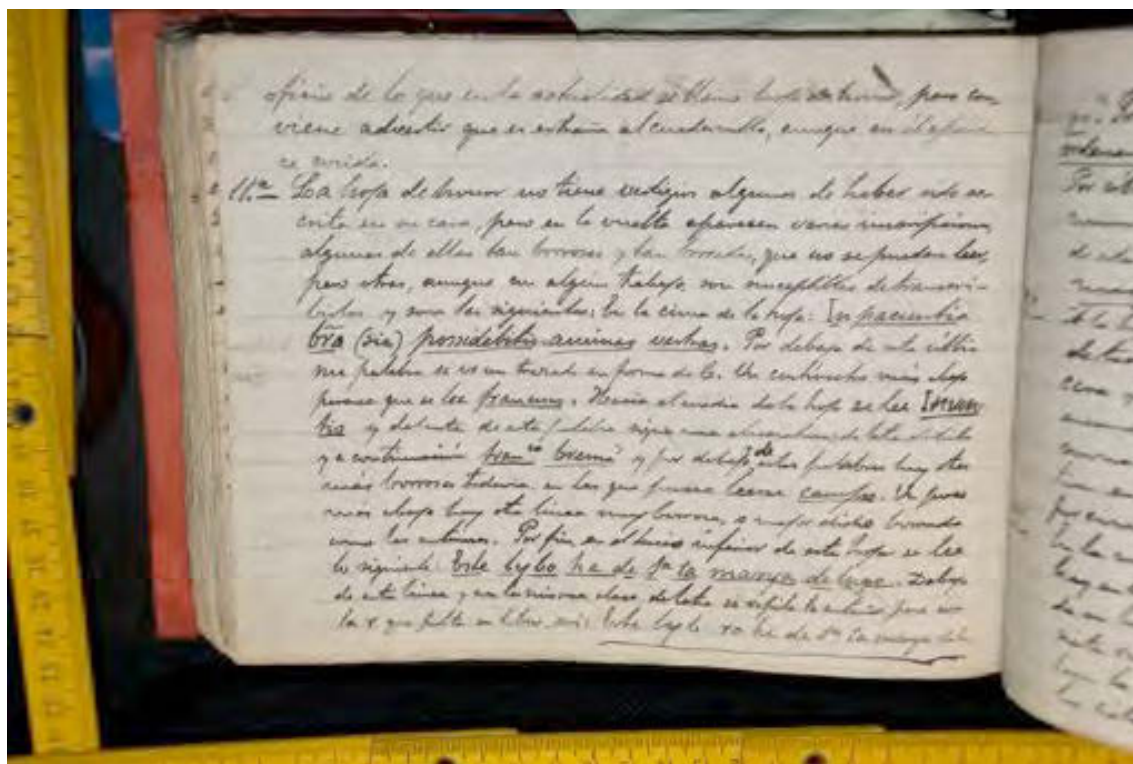
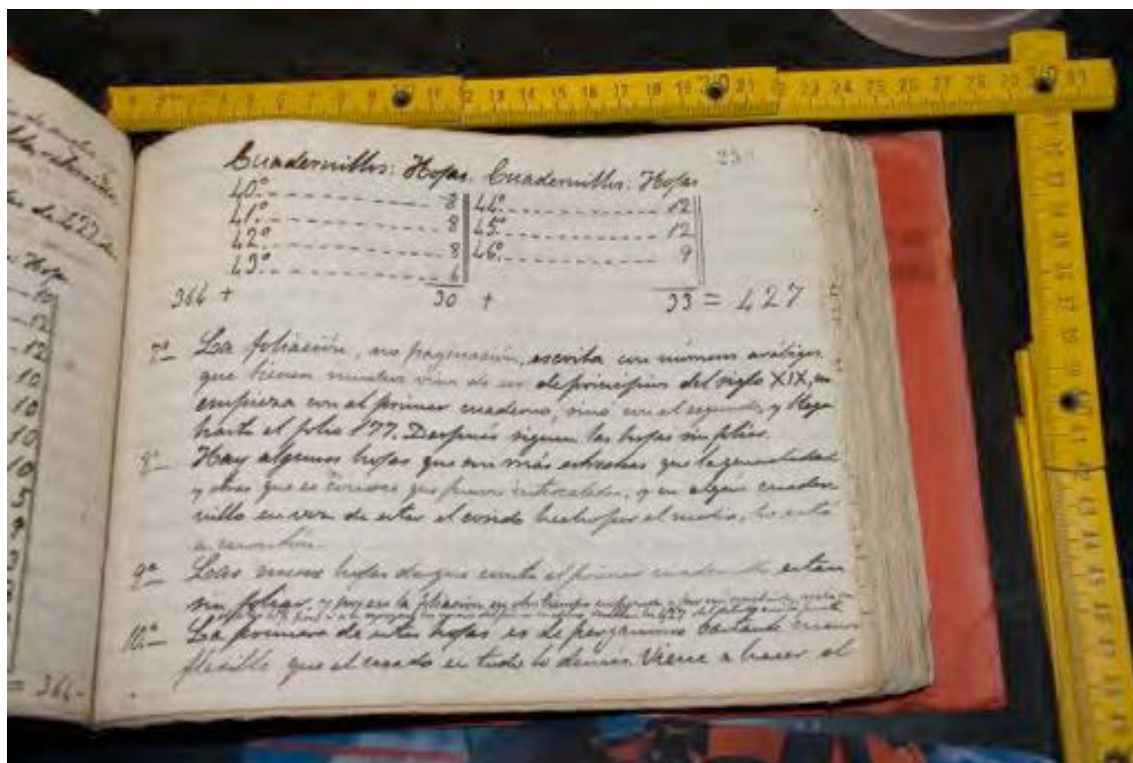
El número de cuadernillos es el de 18 y el de hojas de 27, de
 tribando en la siguiente proporción:

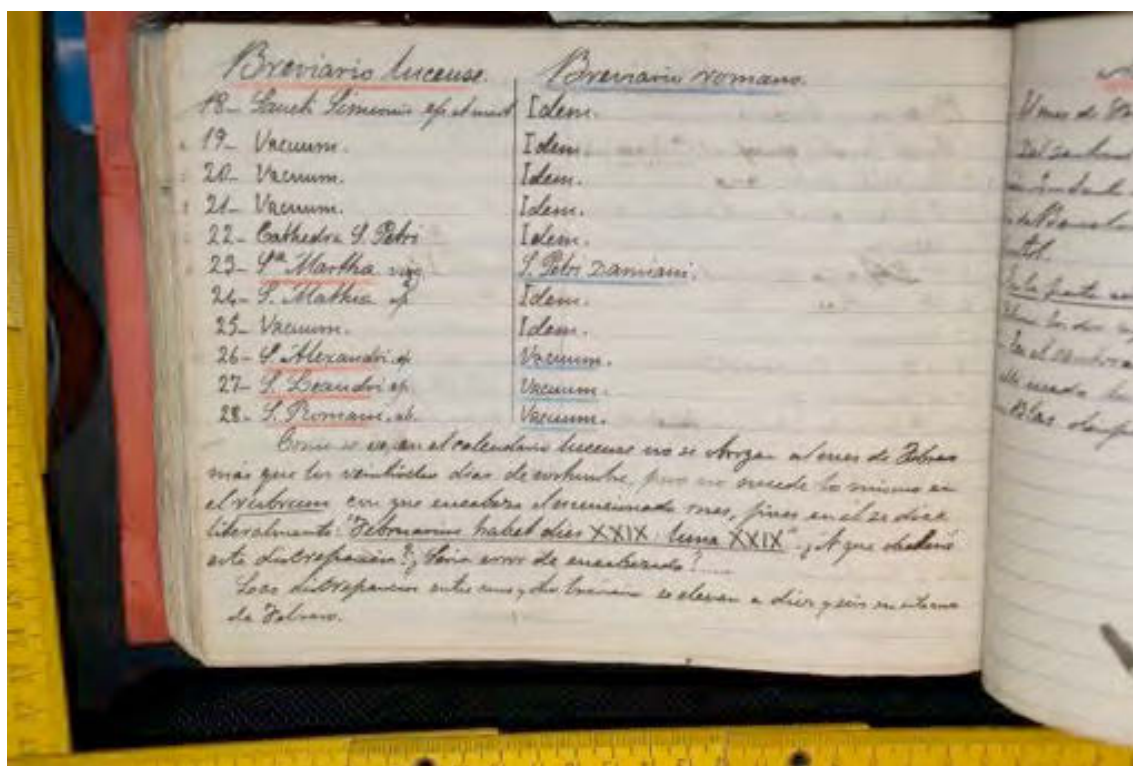
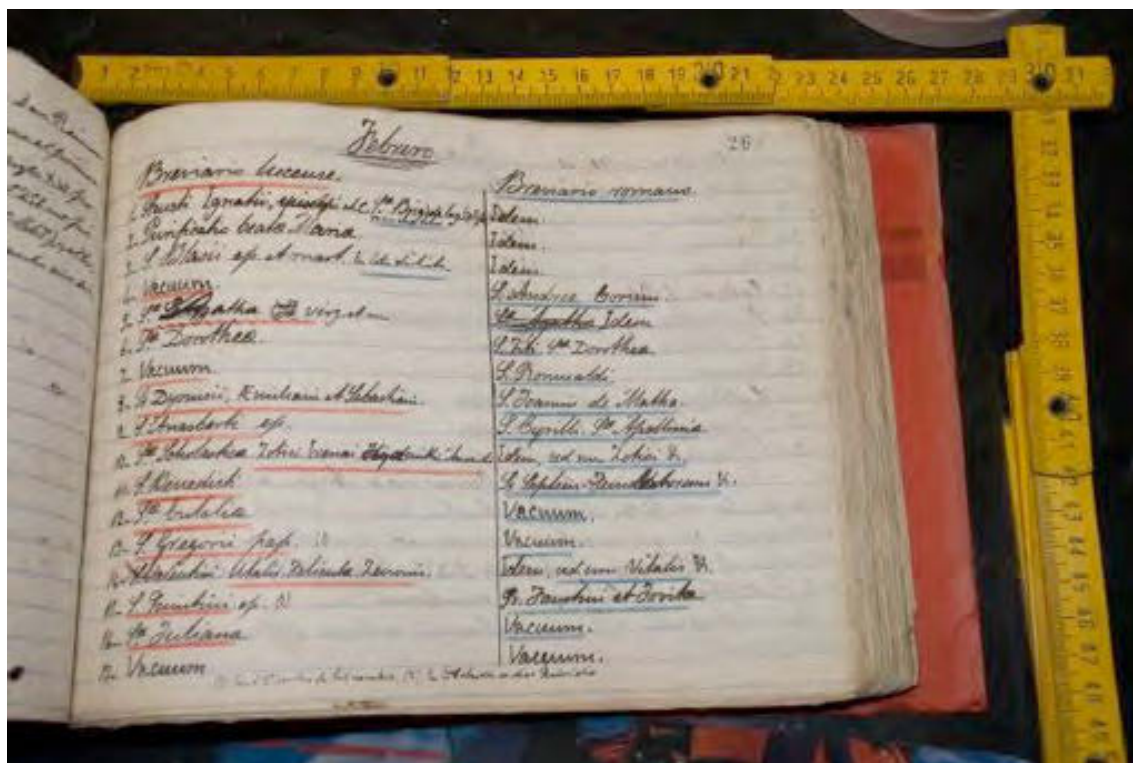
Cuadernillos: Hojas. Cuadernillos: Hojas. Cuadernillos: Hojas			
1.ª	9	11.ª	12
2.ª	8	15.ª	10
3.ª	8	16.ª	10
4.ª	10	17.ª	10
5.ª	10	18.ª	10
6.ª	12	19.ª	10
7.ª	12	20.ª	8
8.ª	12	21.ª	12
9.ª	12	22.ª	4
10.ª	12	23.ª	3
11.ª	12	24.ª	8
12.ª	10	25.ª	3
13.ª	12	26.ª	10

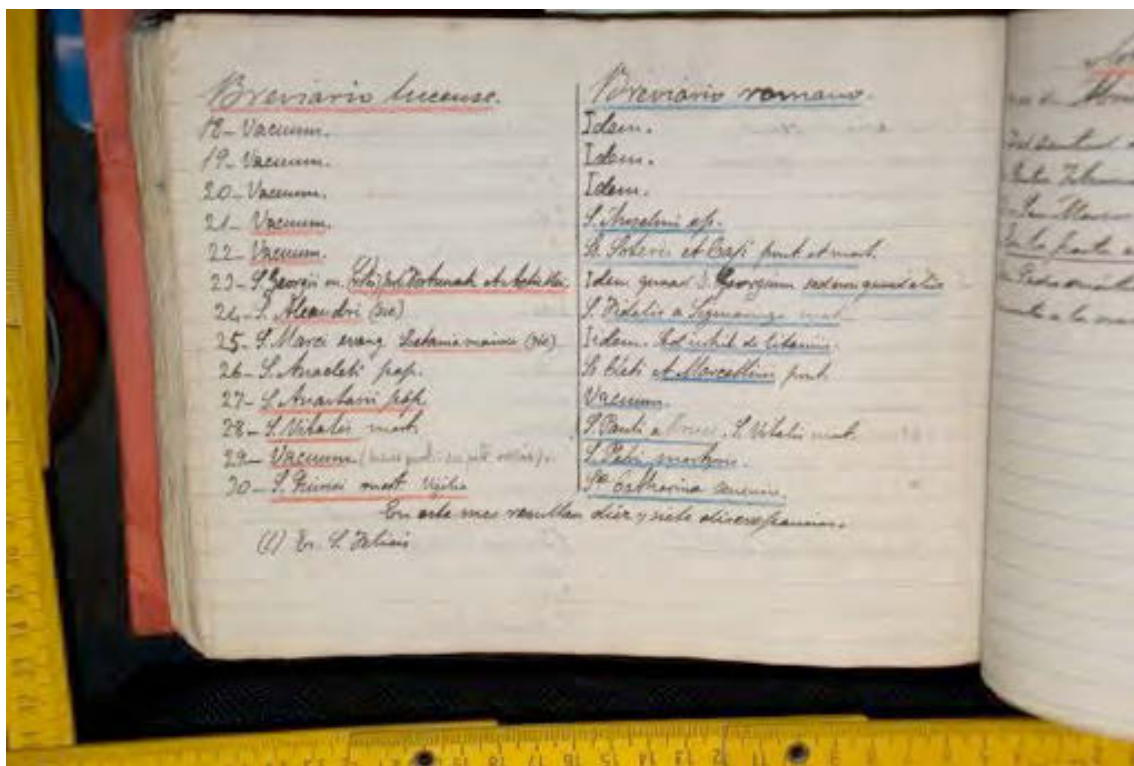
159

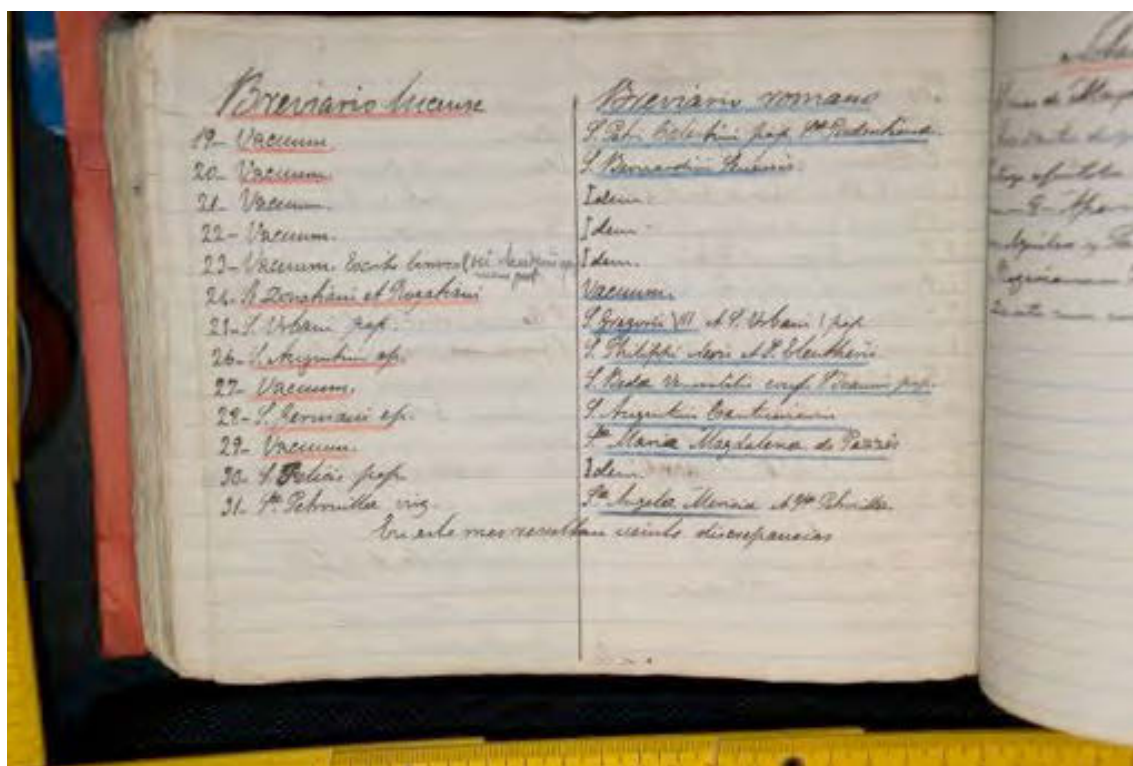
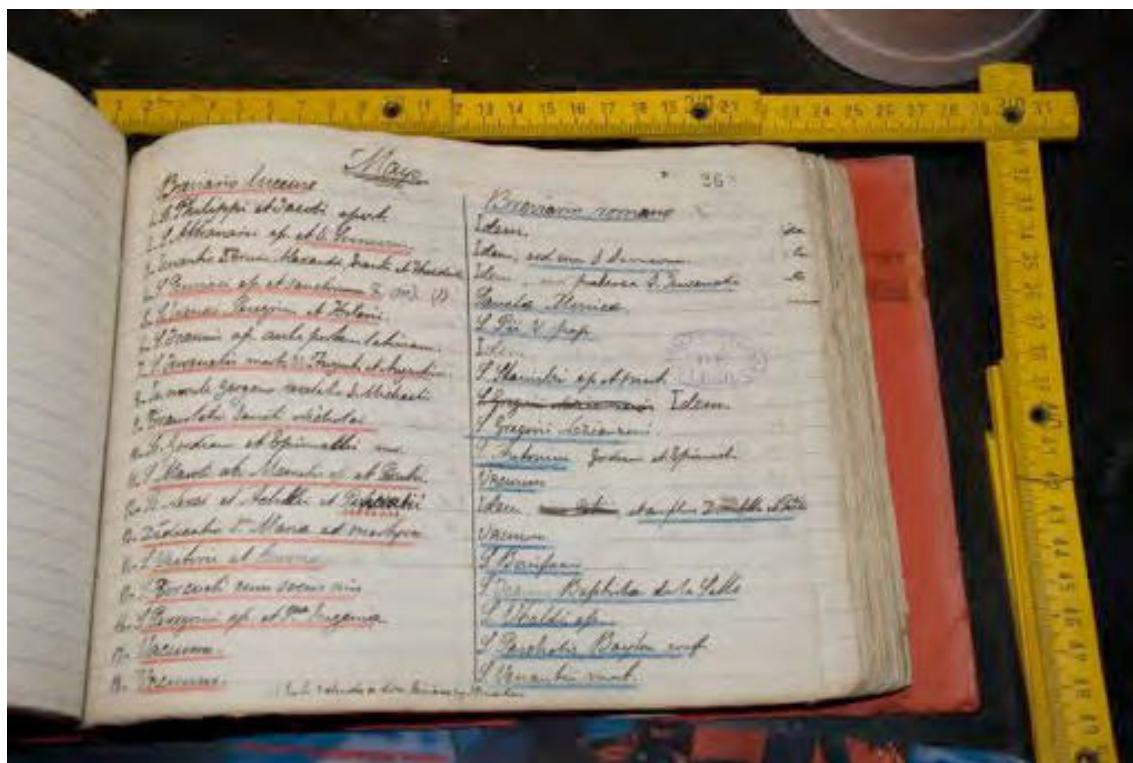
110

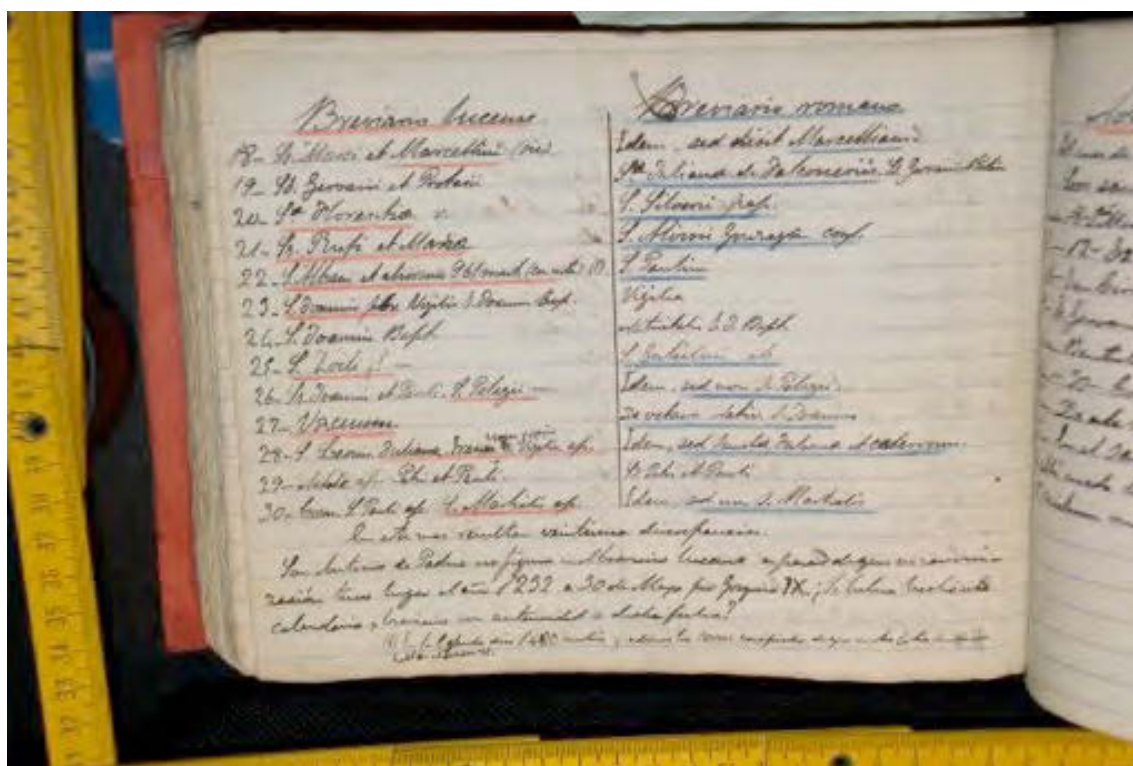
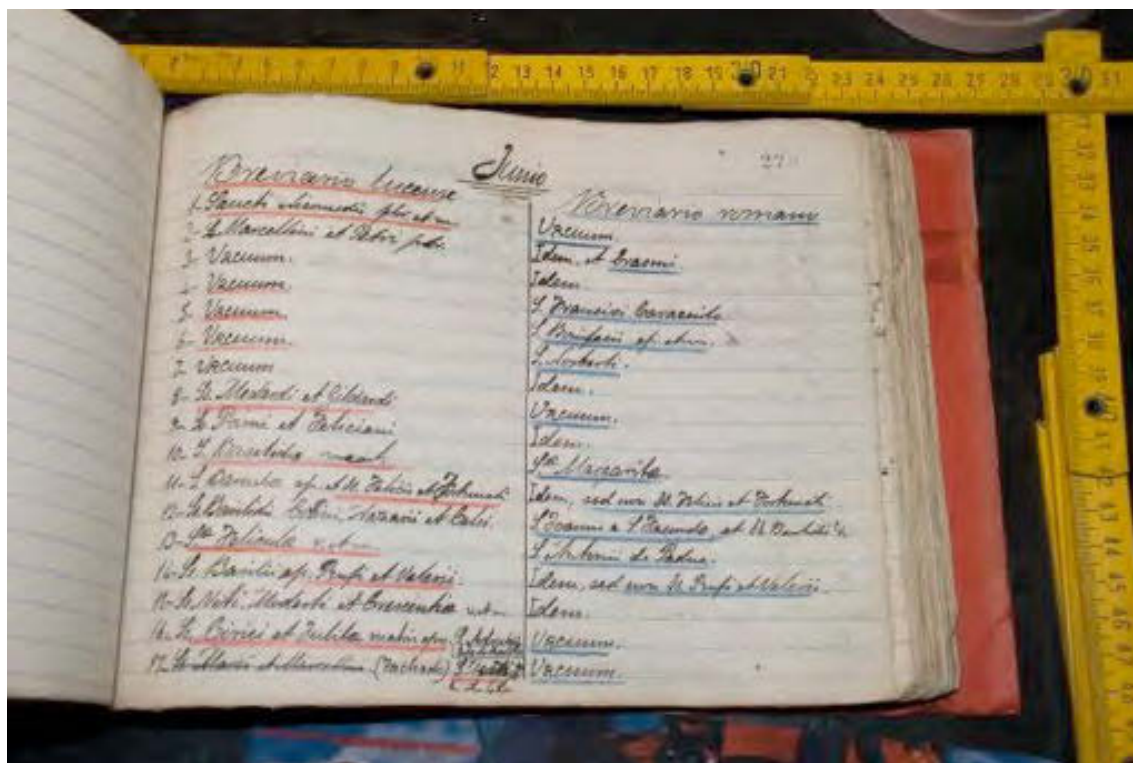
159 + 110 = 269

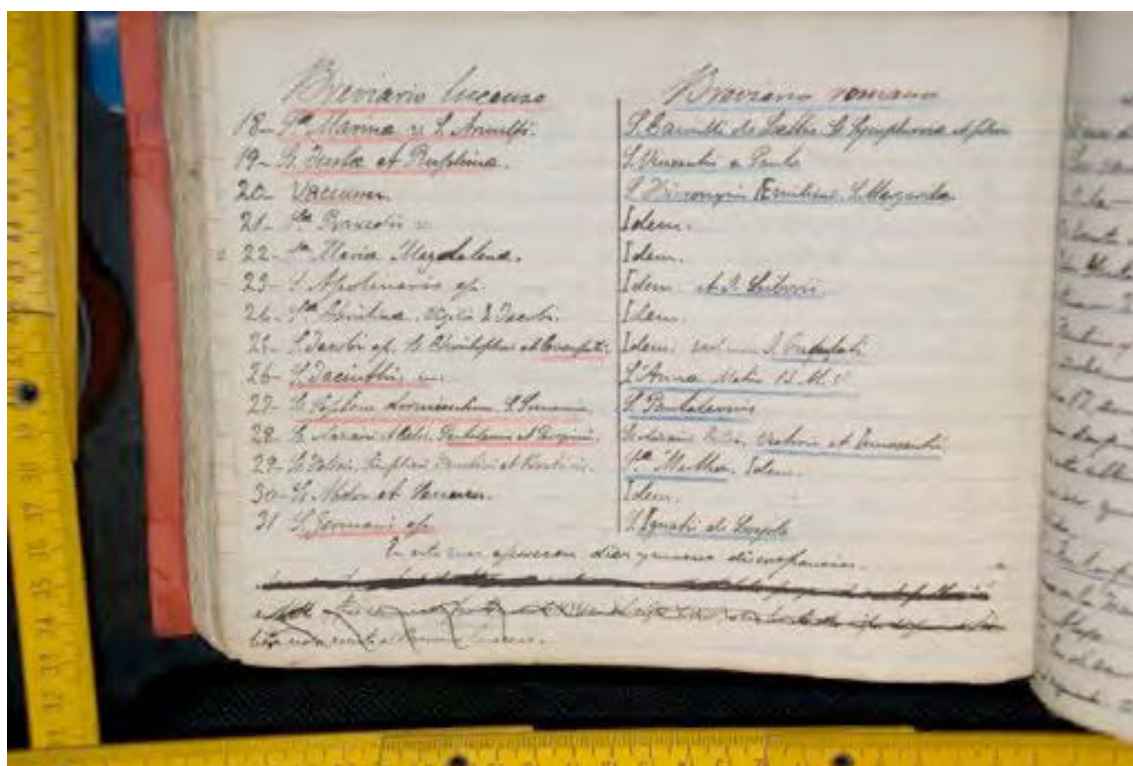
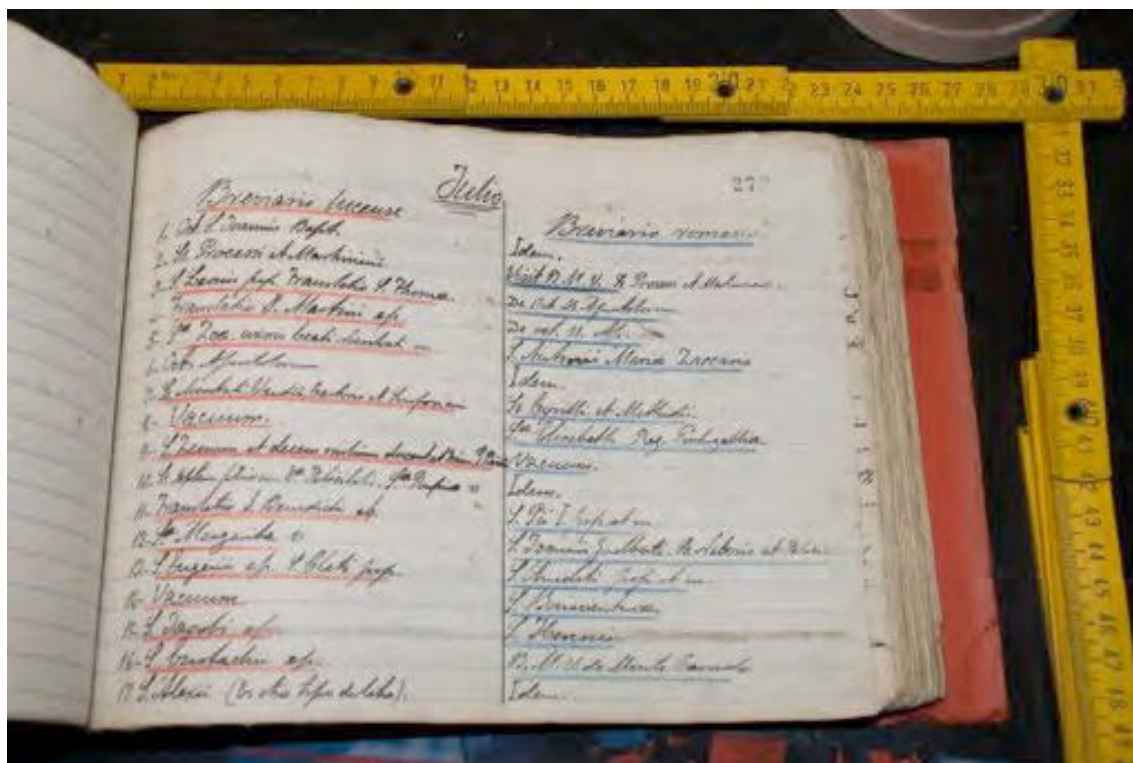


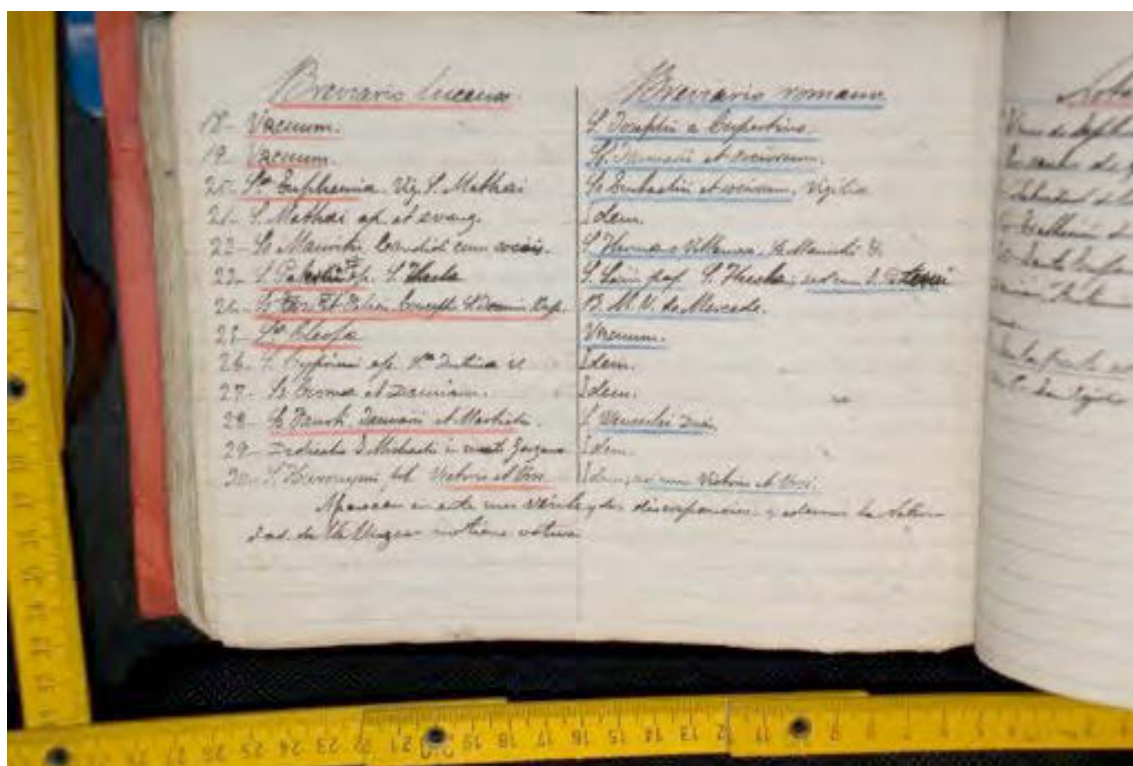
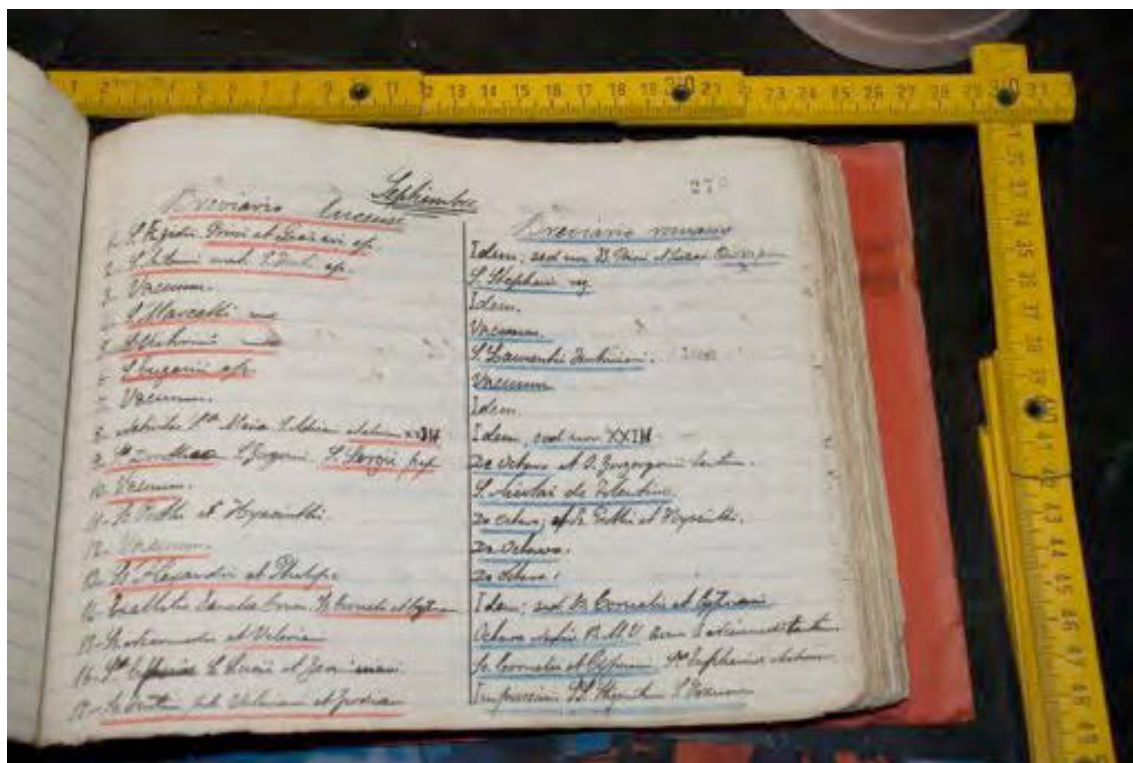


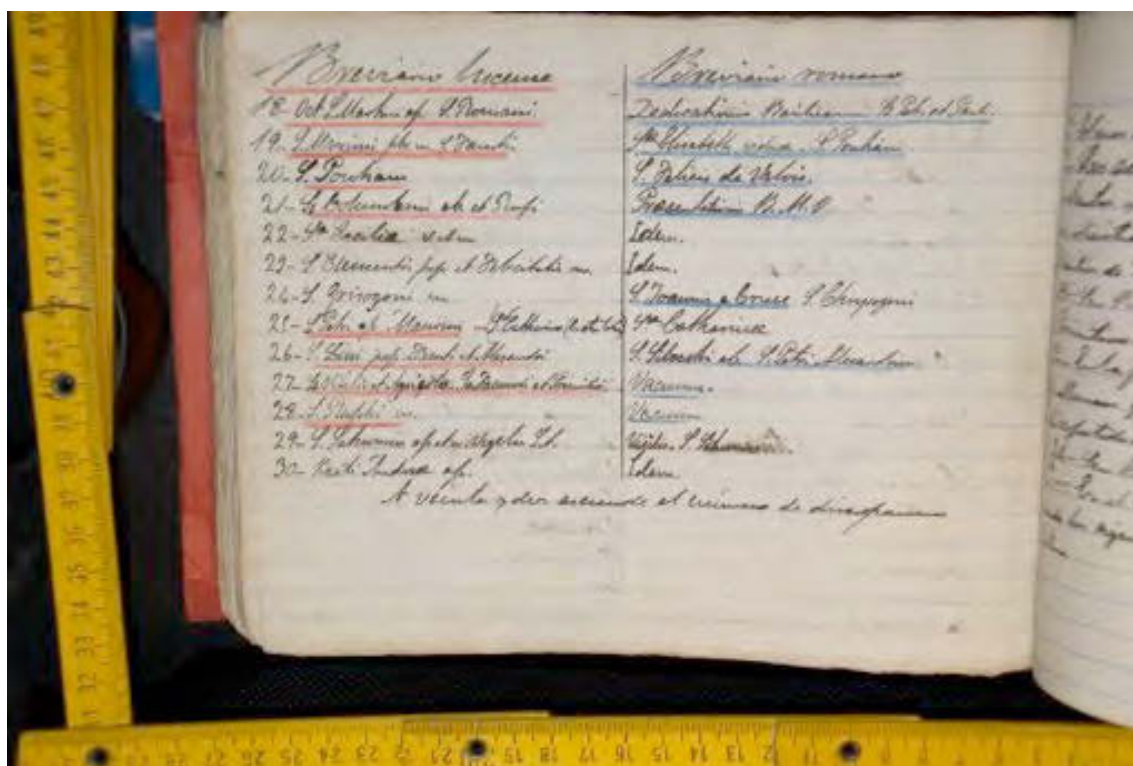
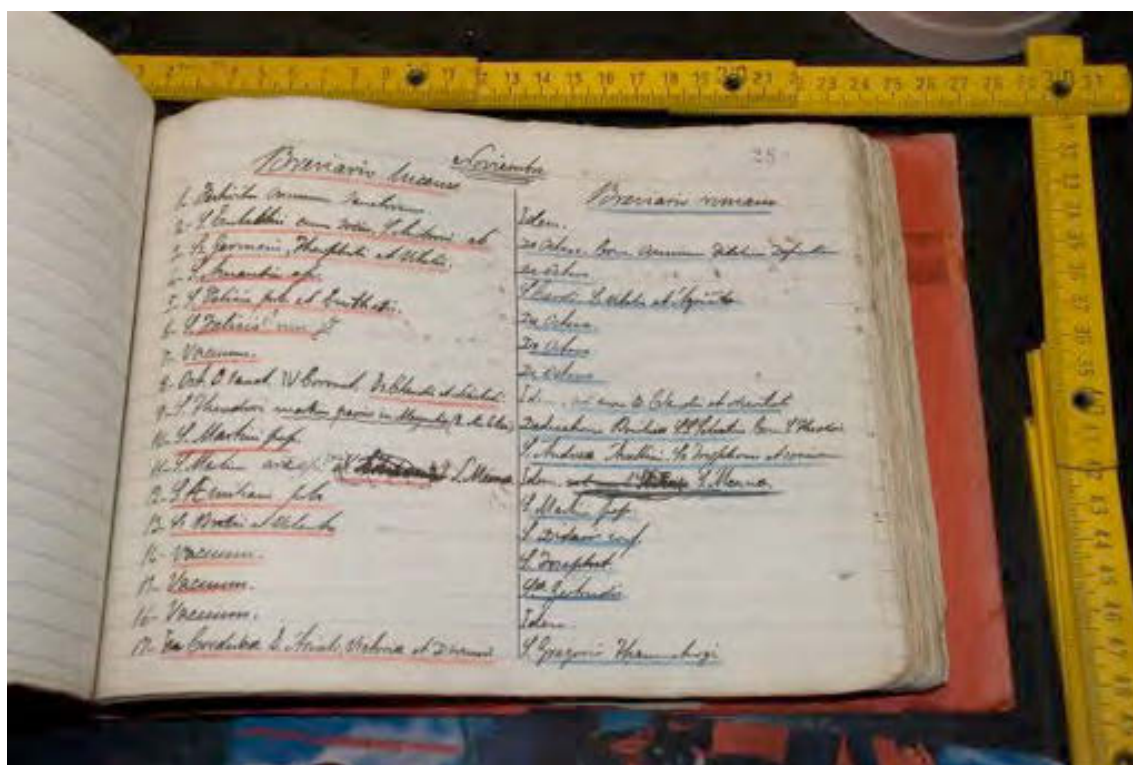








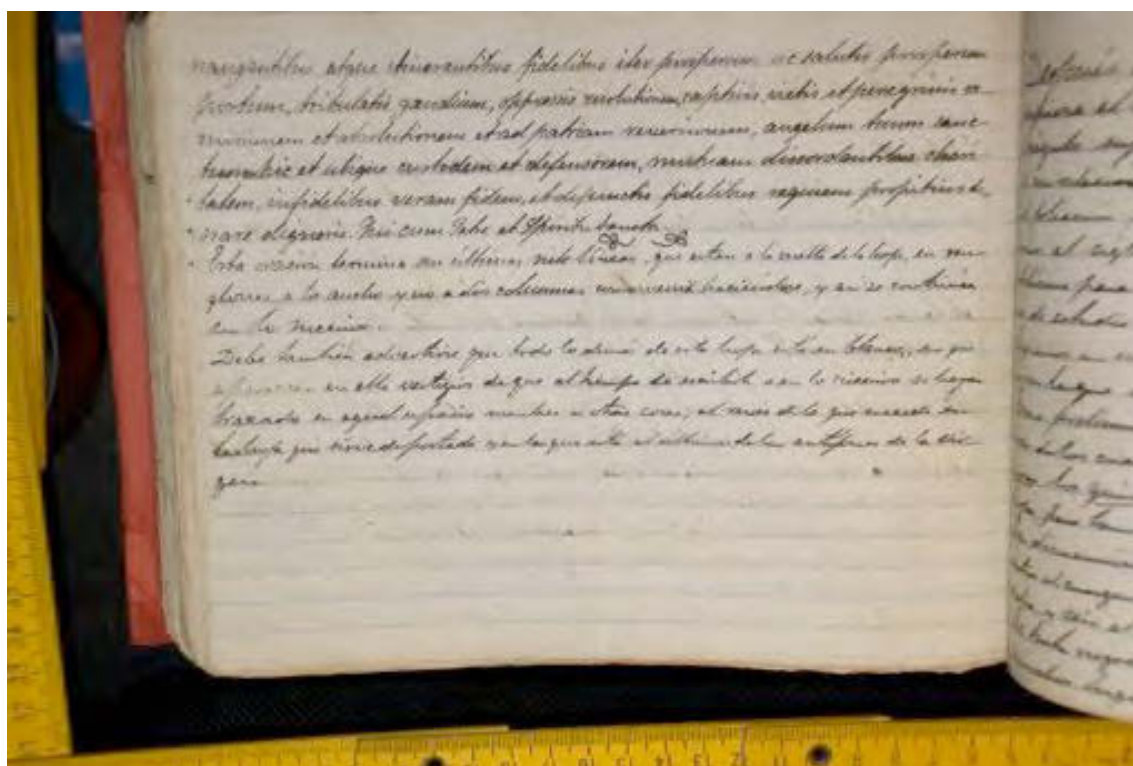
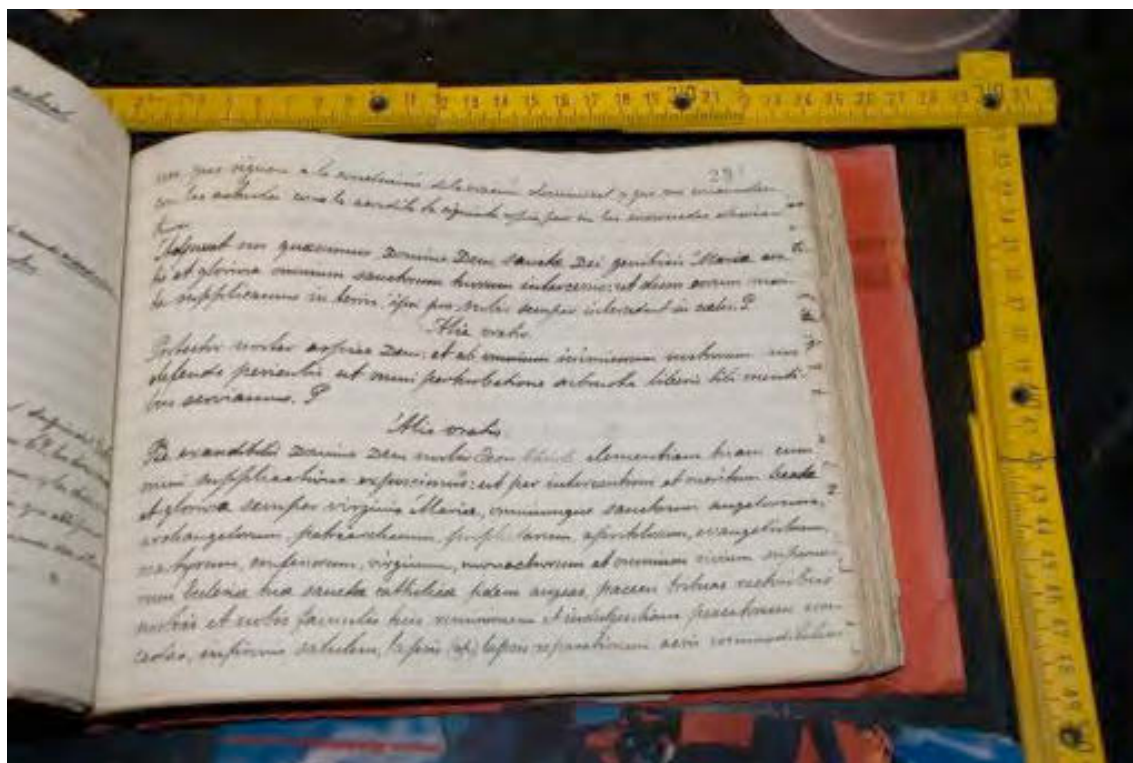


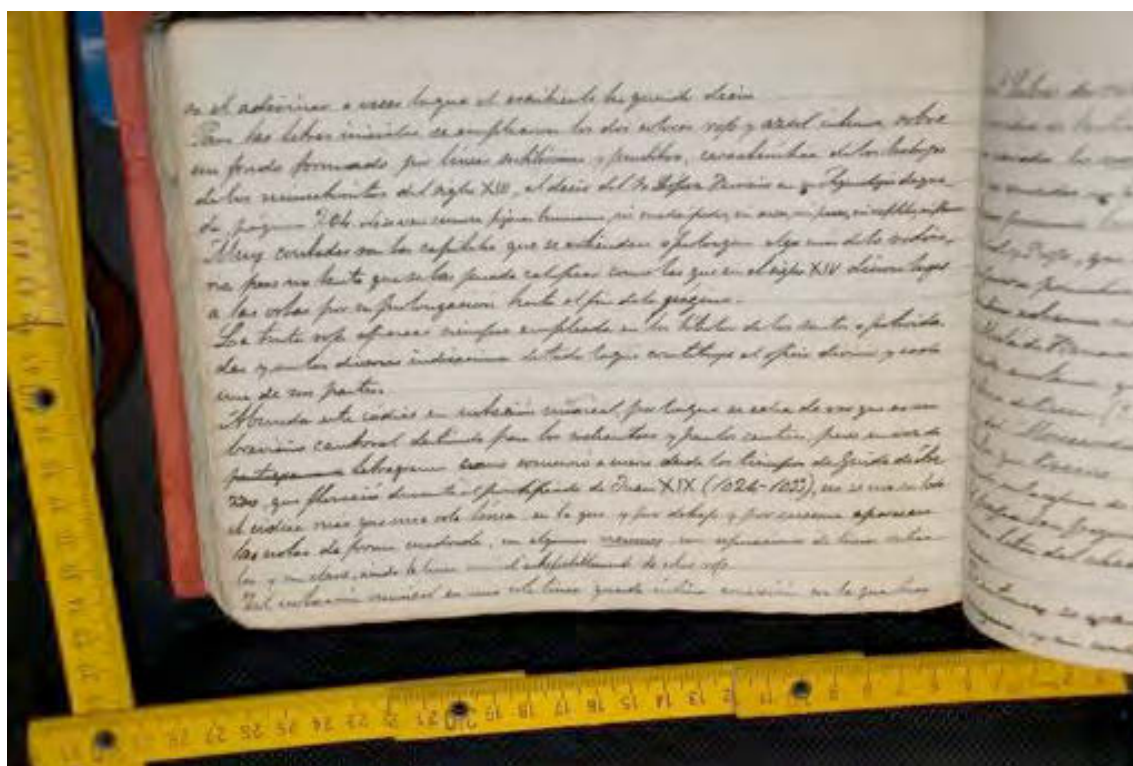
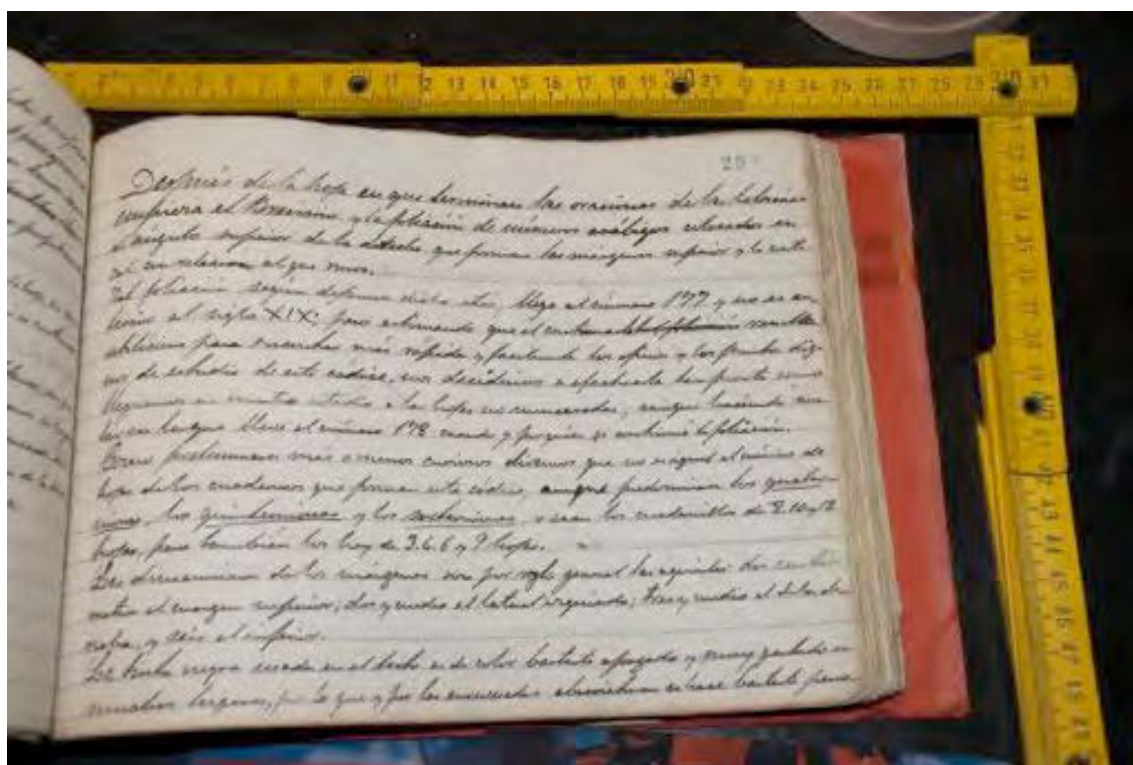


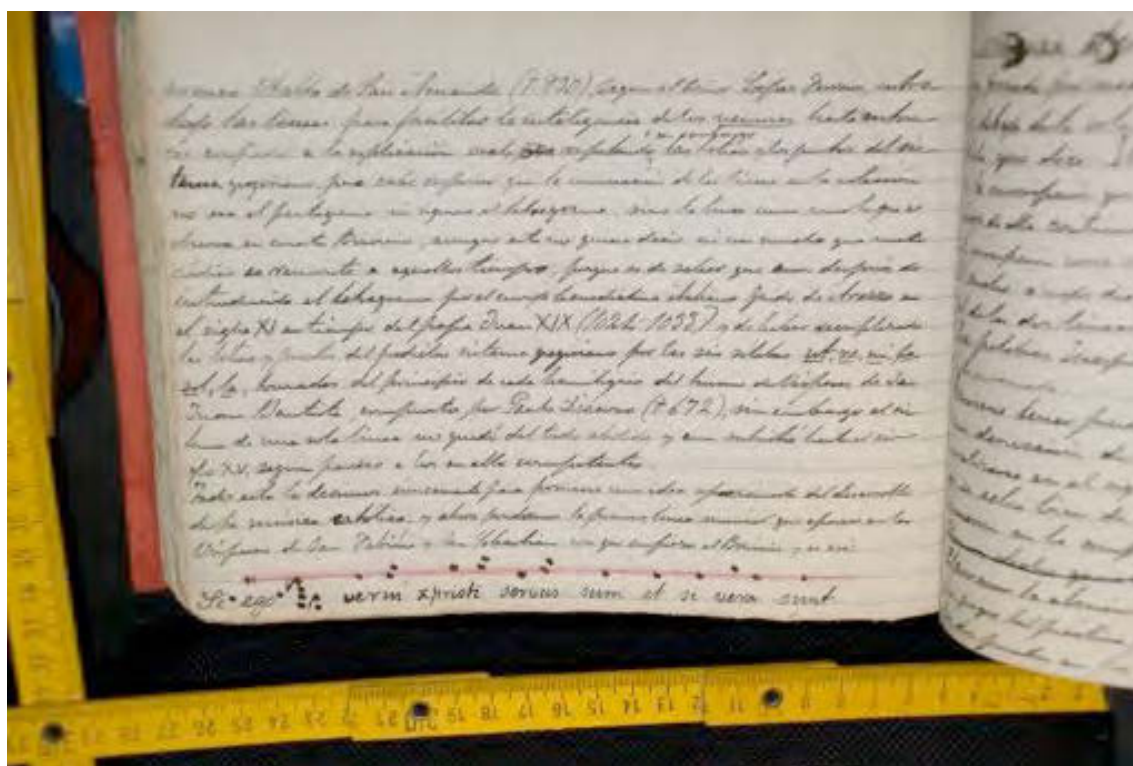
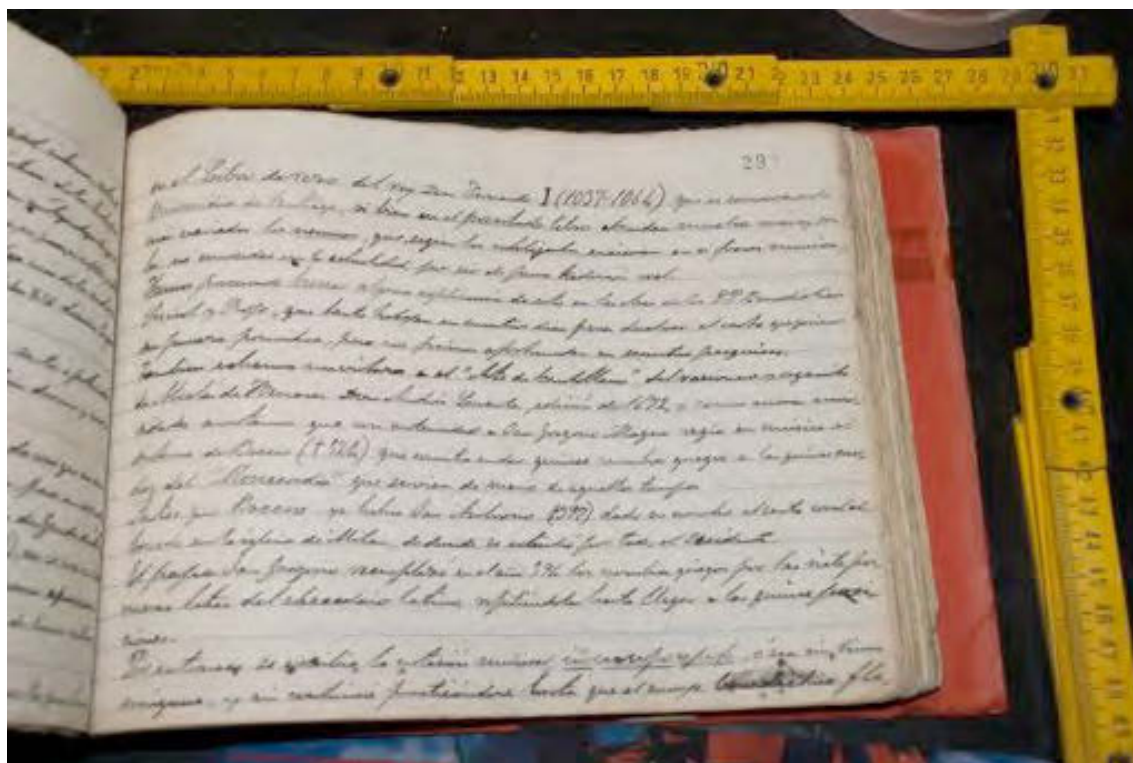
[illegible]

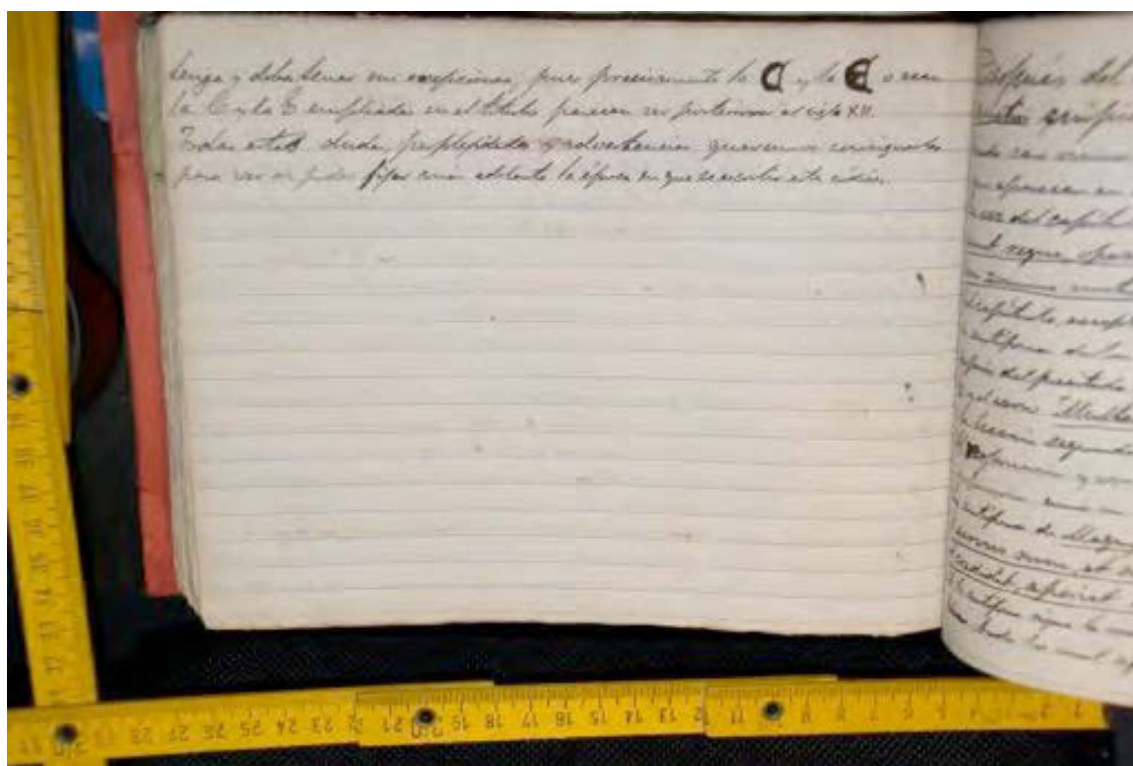
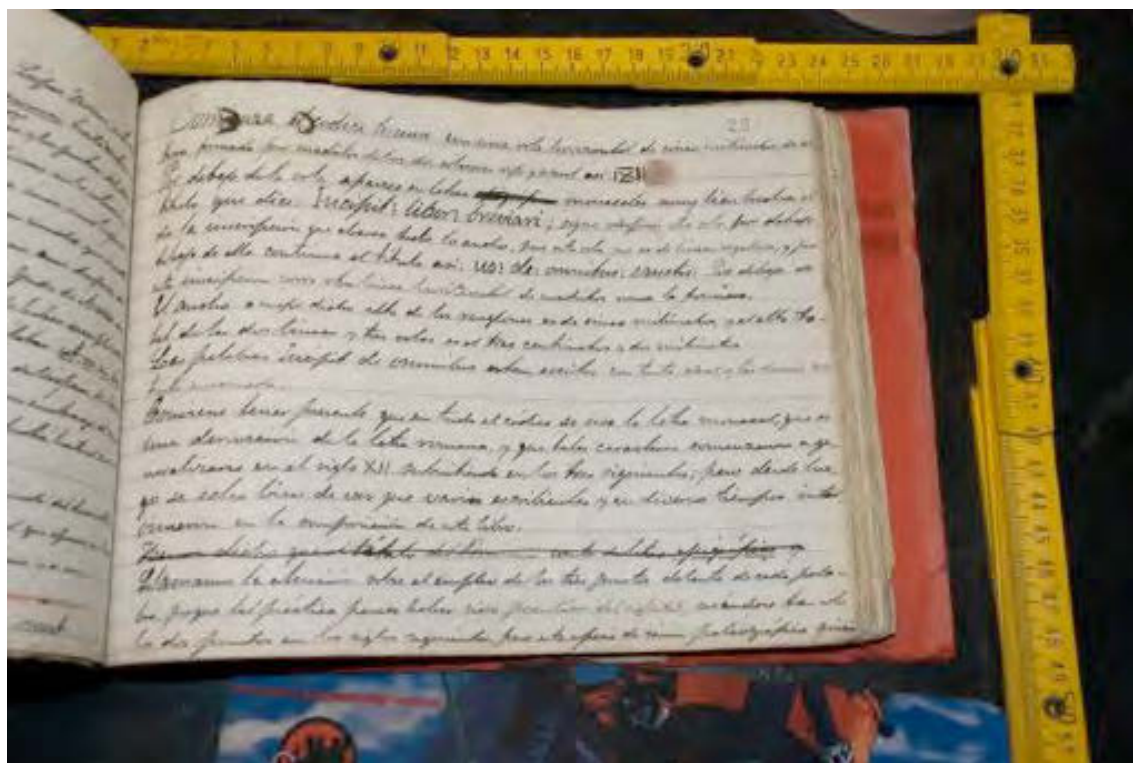
Se puede apreciar la diferencia por los dos sistemas de libranos a dos columnas y ~~libranos~~ ^{los} las invocaciones en que en cada una se libran en los complementos *Epistola*, *Epistola*, *Epistola*.

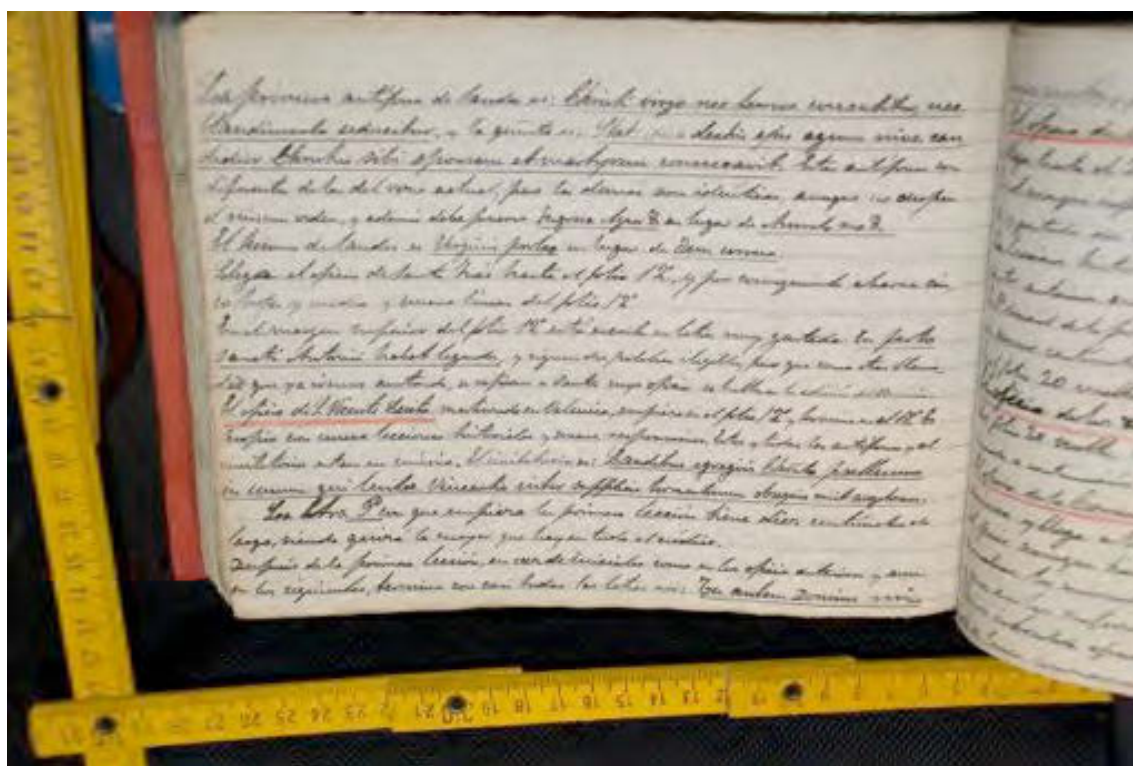
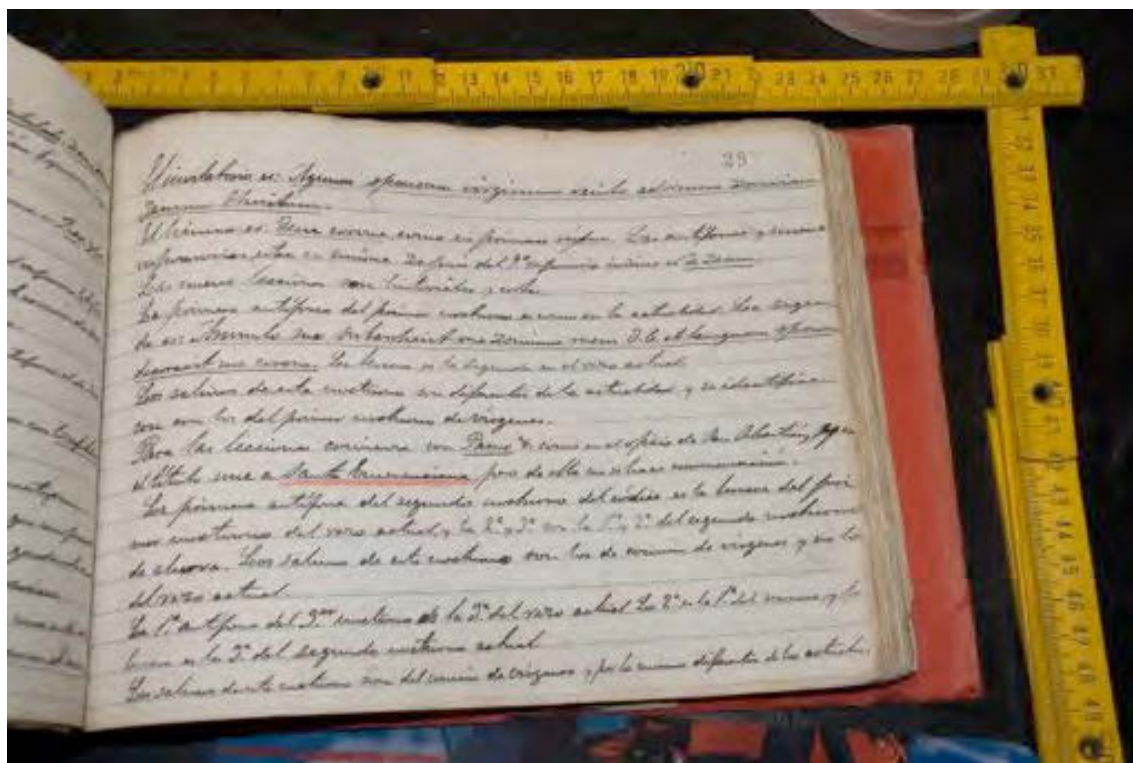
<u>Mariano laevis.</u>	<u>Mariano actual.</u>
Kyrie, olim.	Idem.
Gloria, olim.	Idem.
Kyrie, olim.	Idem.
Gloria, quid. nov.	Idem.
Gloria, exaudi. nov.	Idem.
Gloria, <u>parce peccatis nostris</u>	Infant
Psalm de celis Deus, miserere nobis	Idem.
Psalm Psalterium nunti. Deus, &	Idem.
Psalm. Deus, &	Idem.
Deus Trinitas, nov. Deus, &	Idem.
Deus Trinitas, nov. Deus, &	Infant
Deus Maria, ora pro nobis	Idem.
Deus Dei Genitrix, &	Idem.
Deus Virgo virginum, &	Idem.

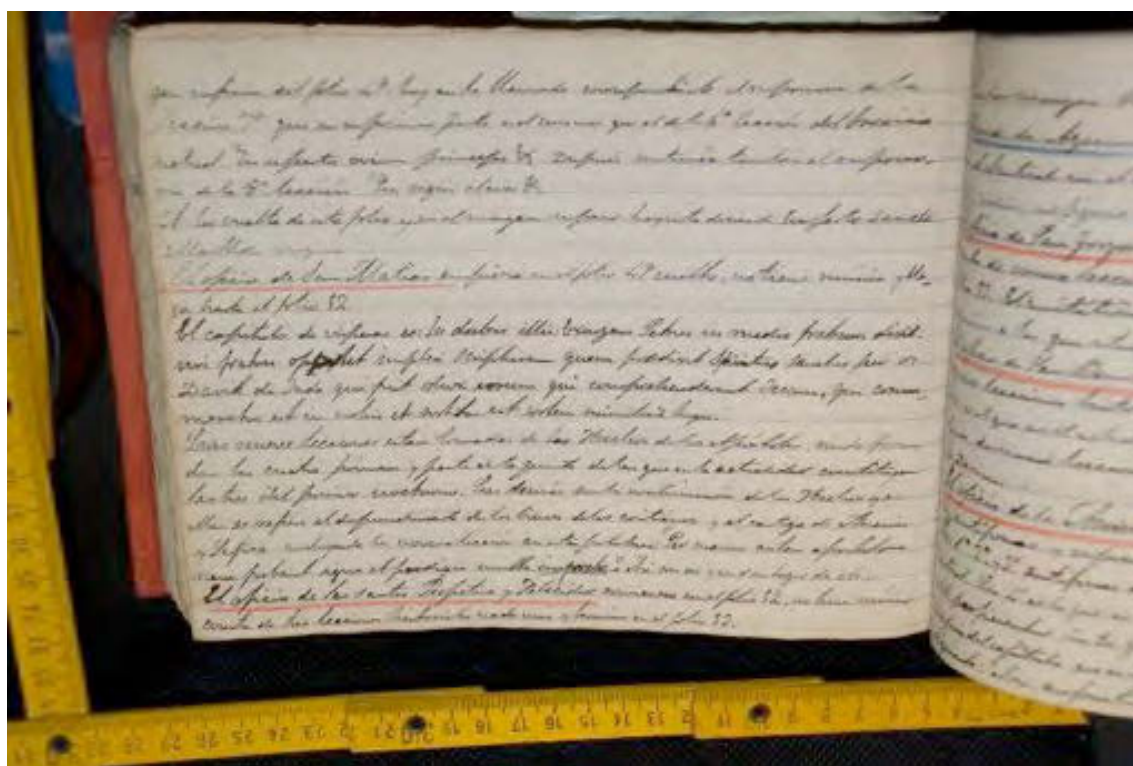
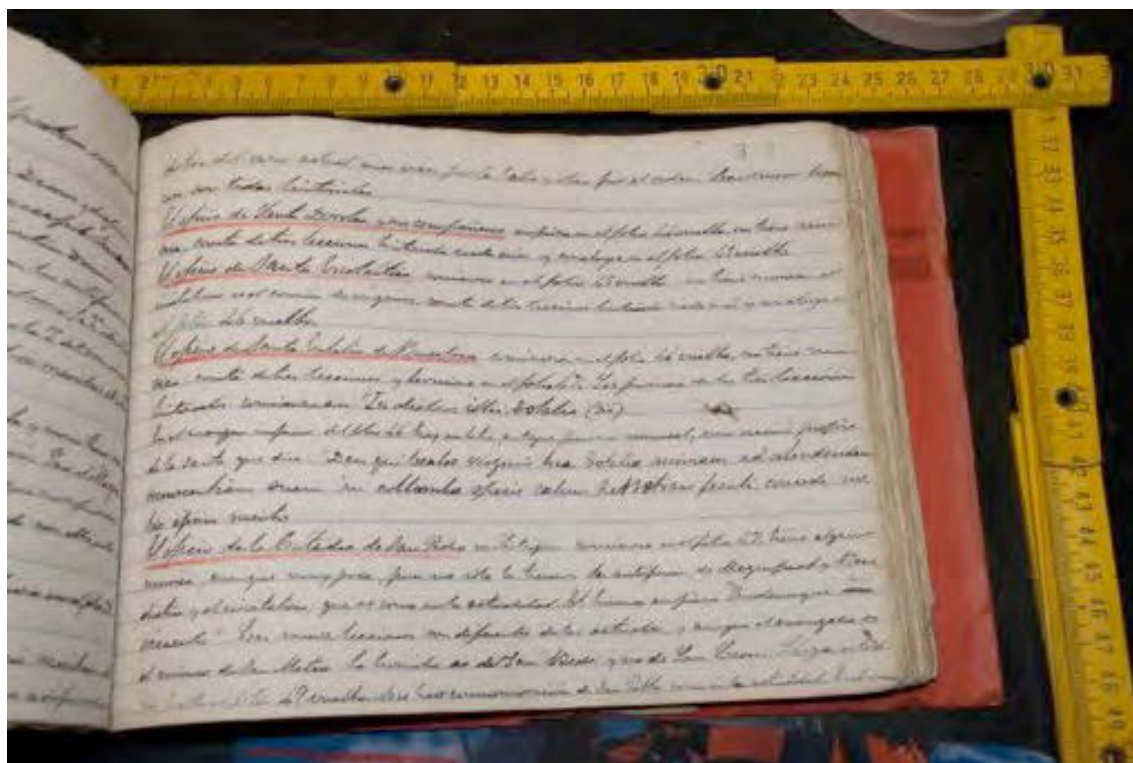


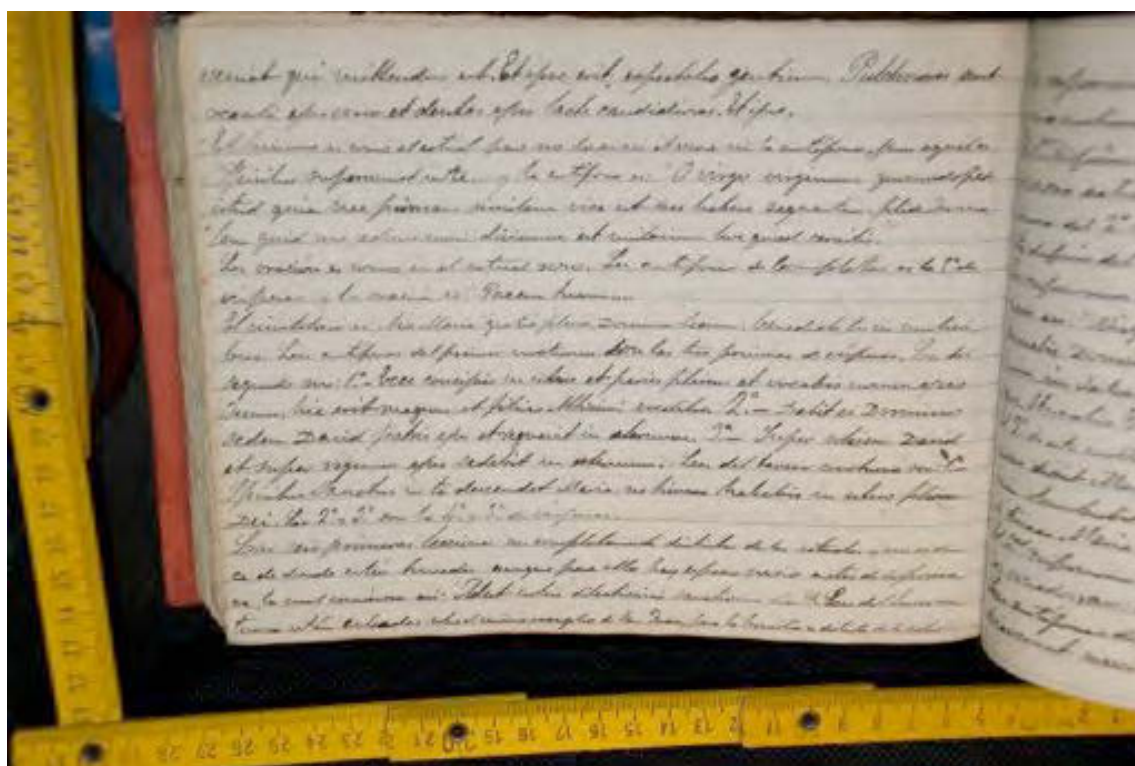
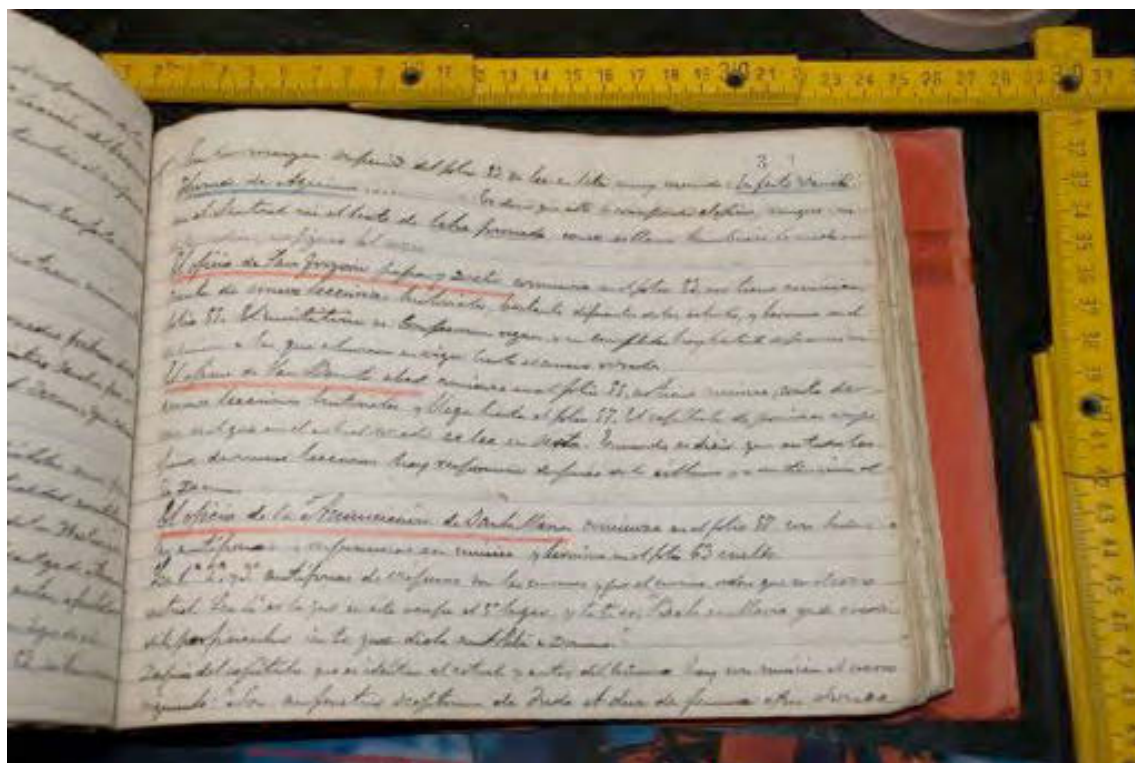


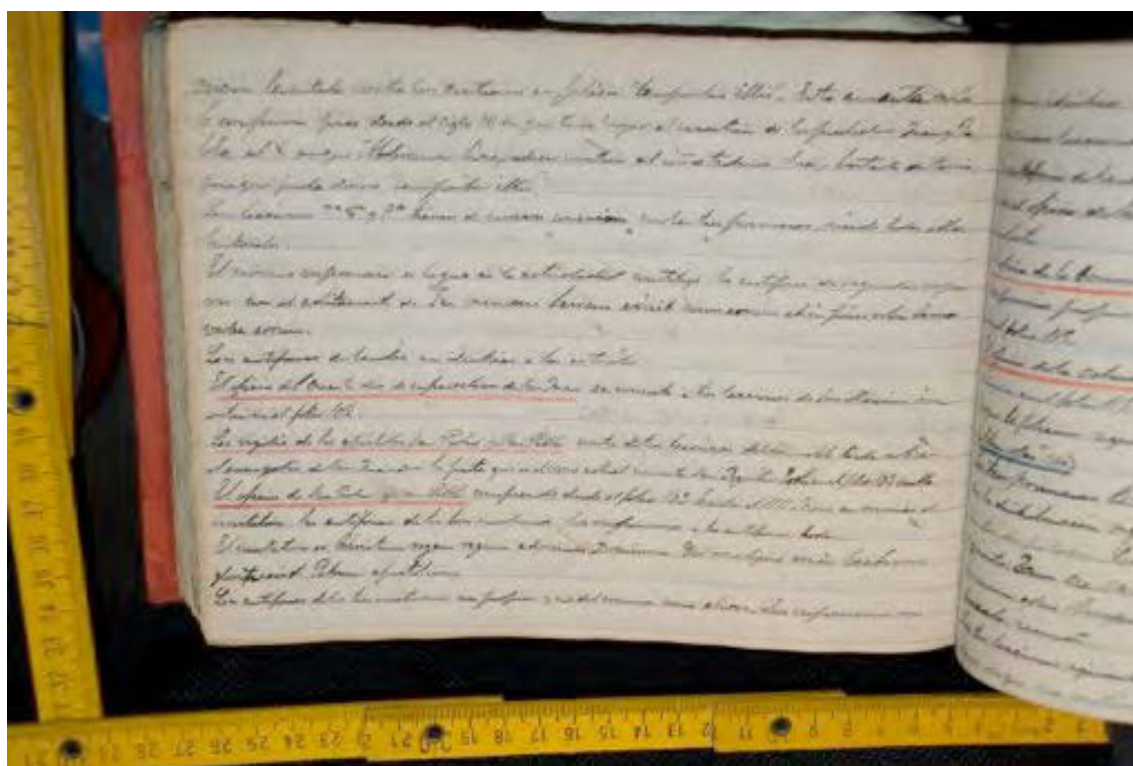
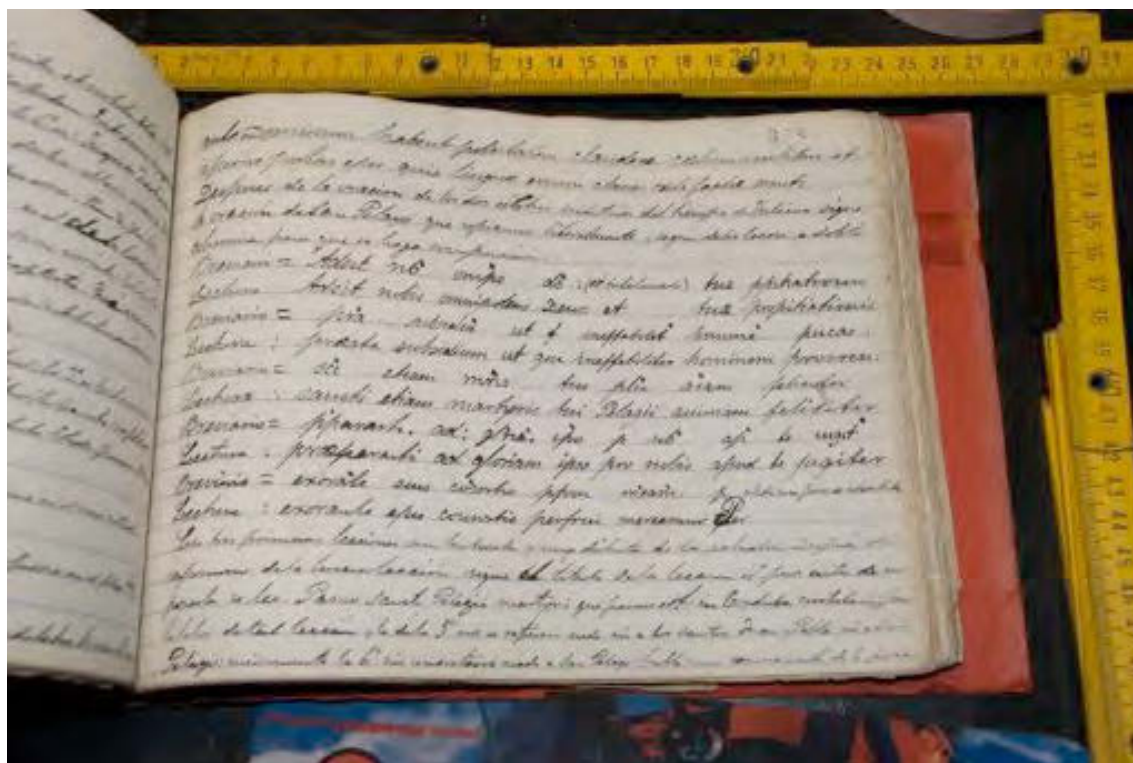


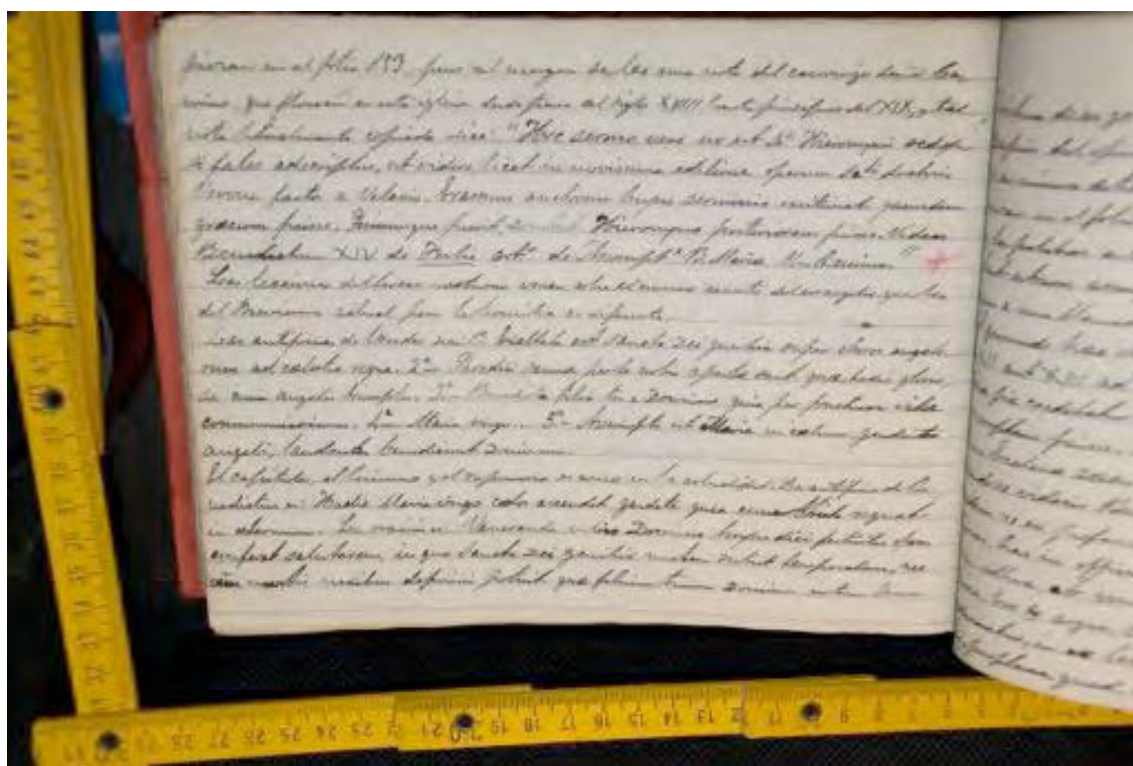
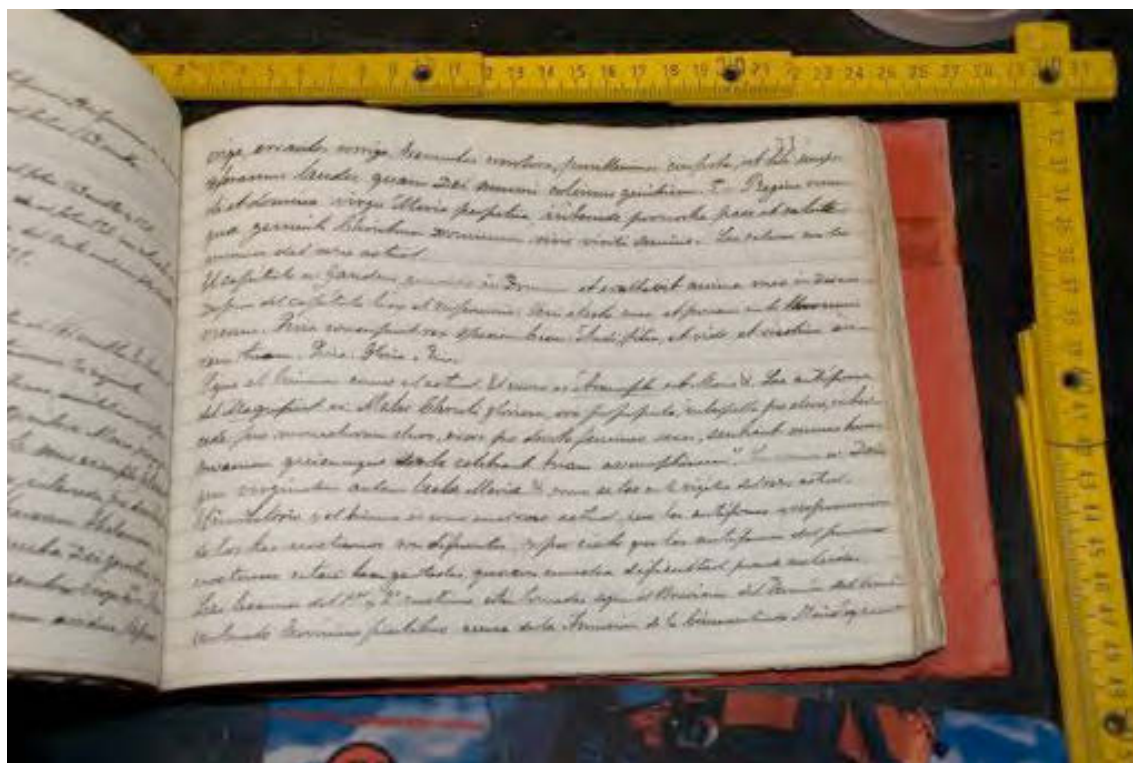


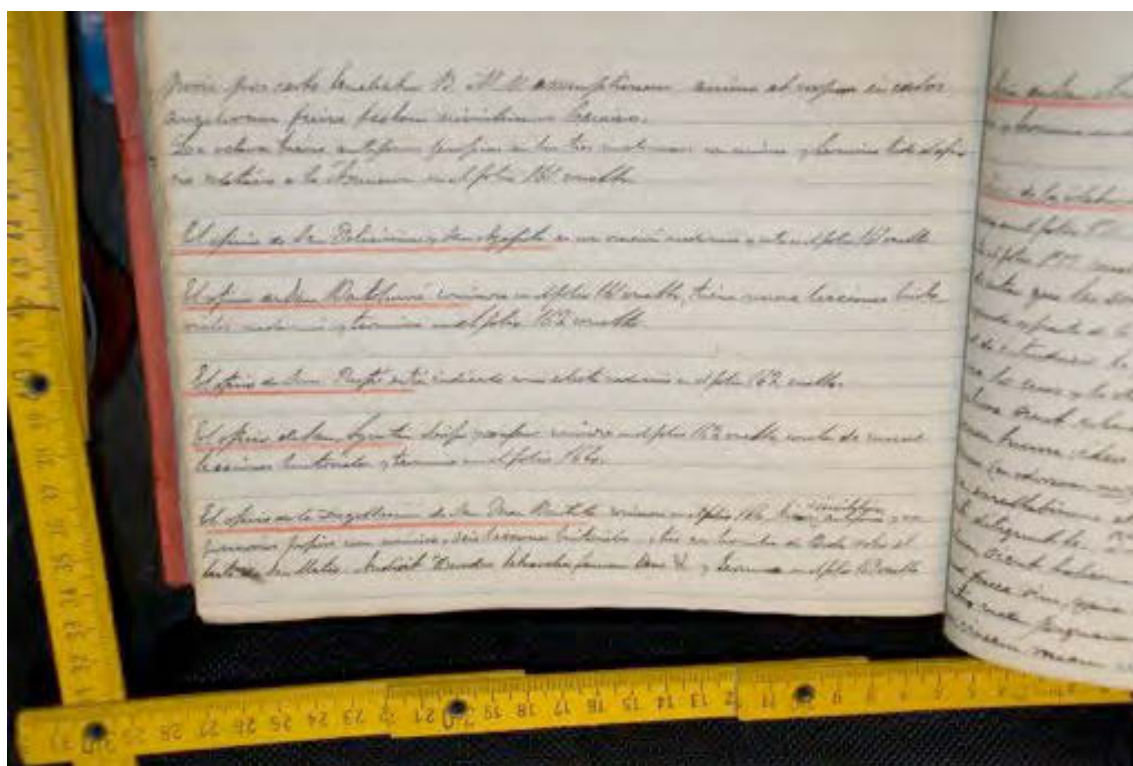
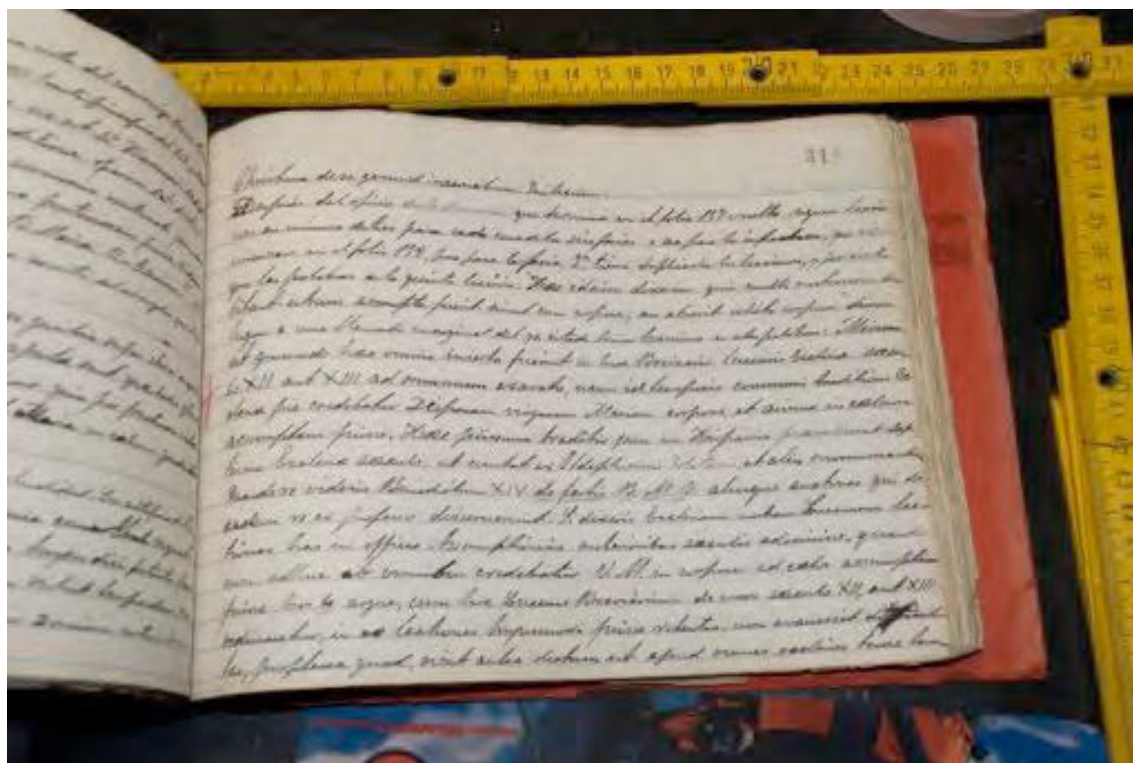


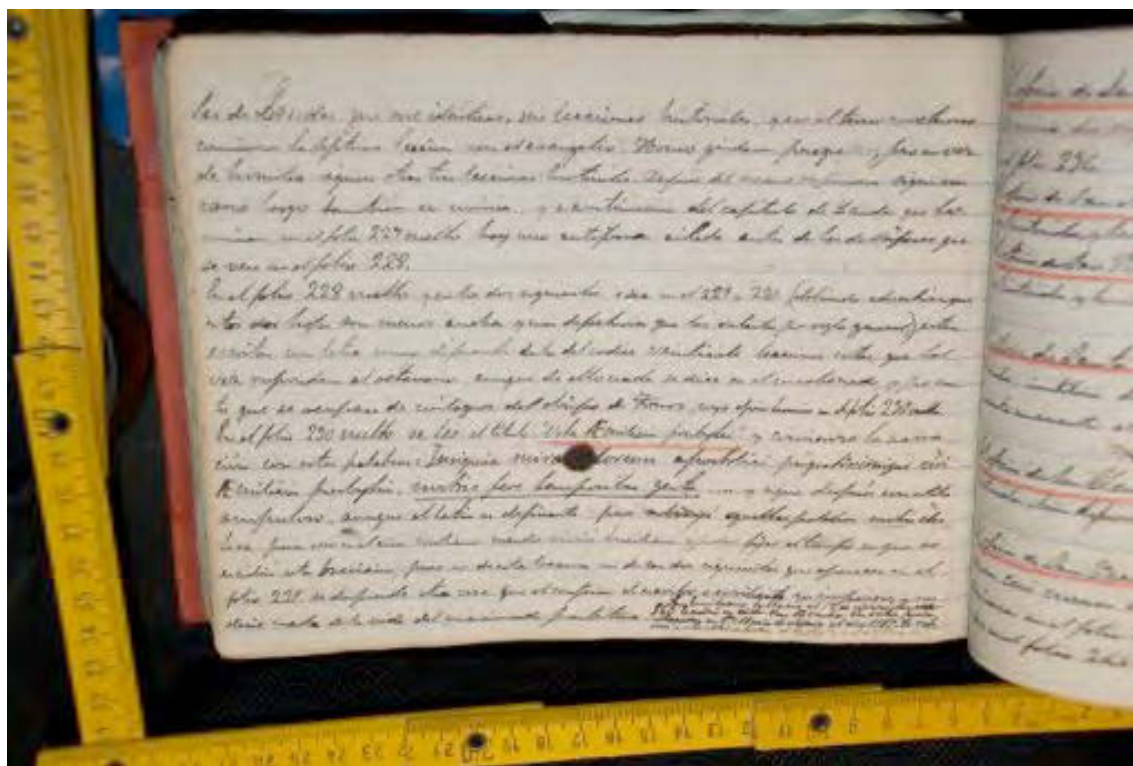
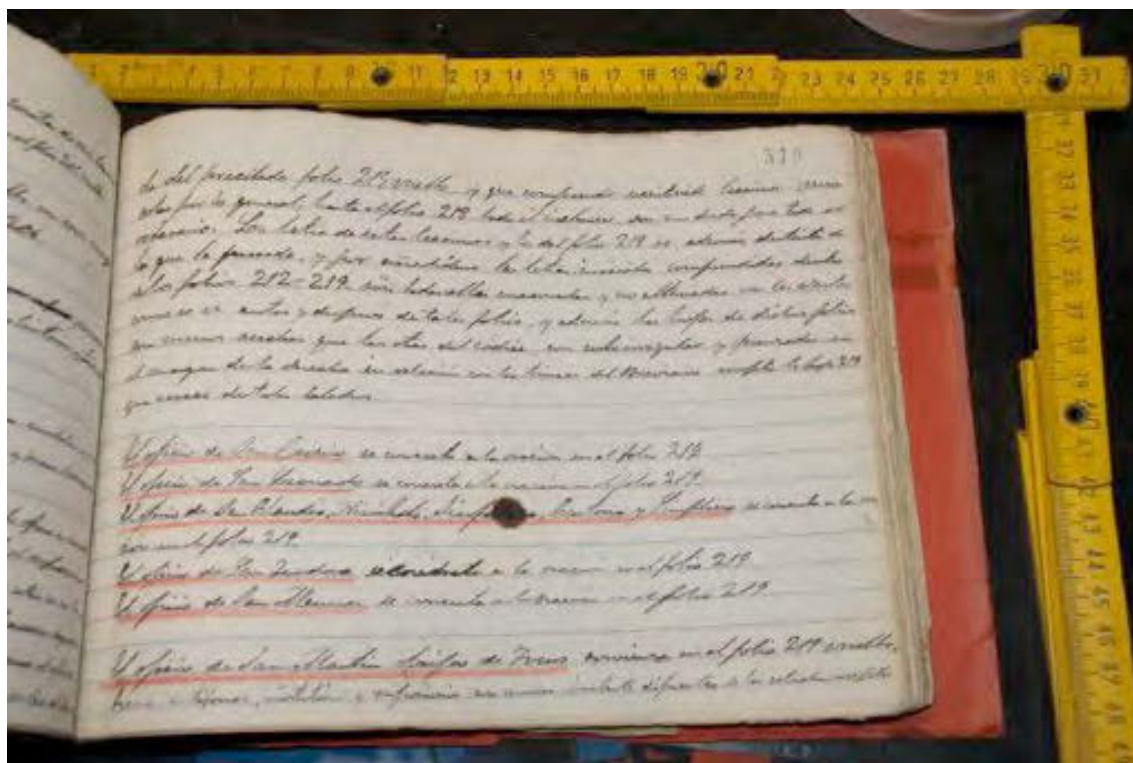


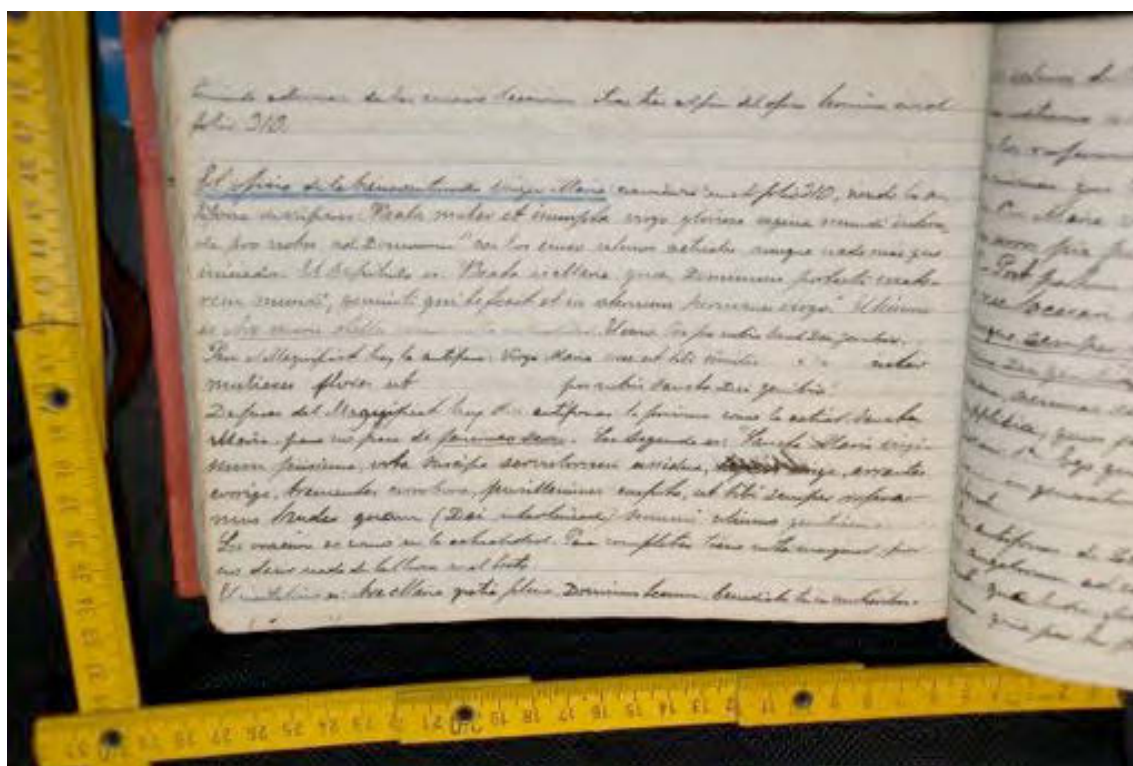
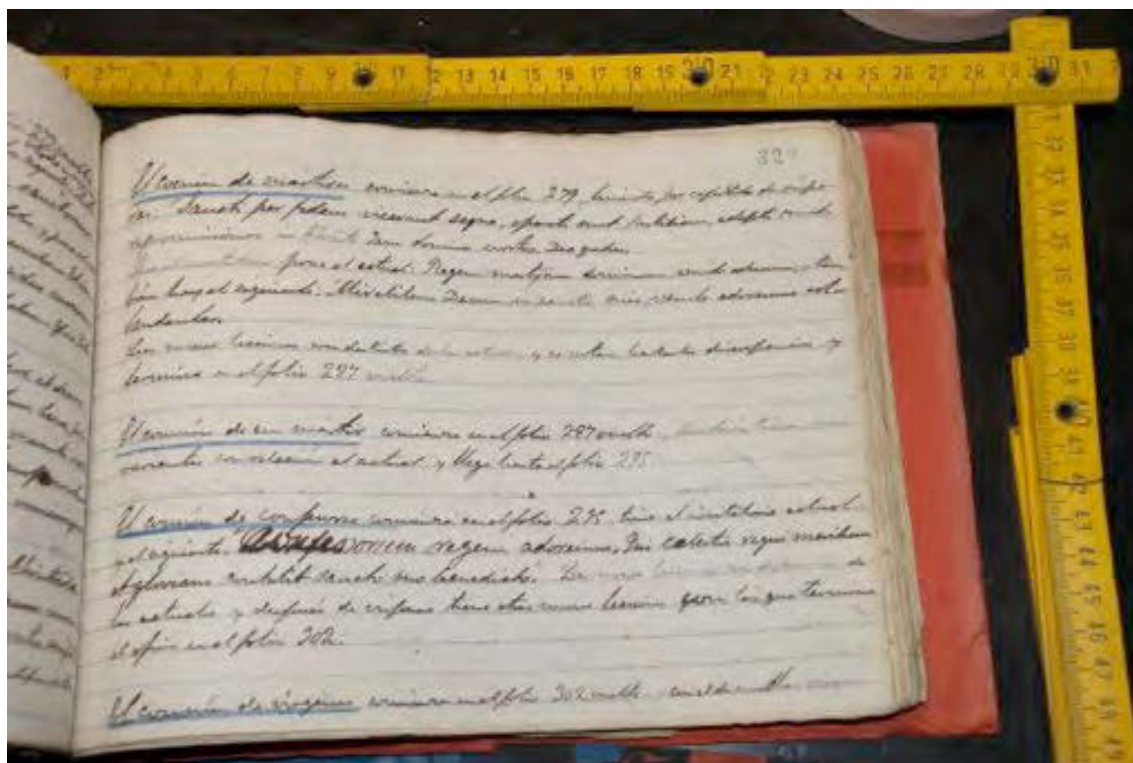


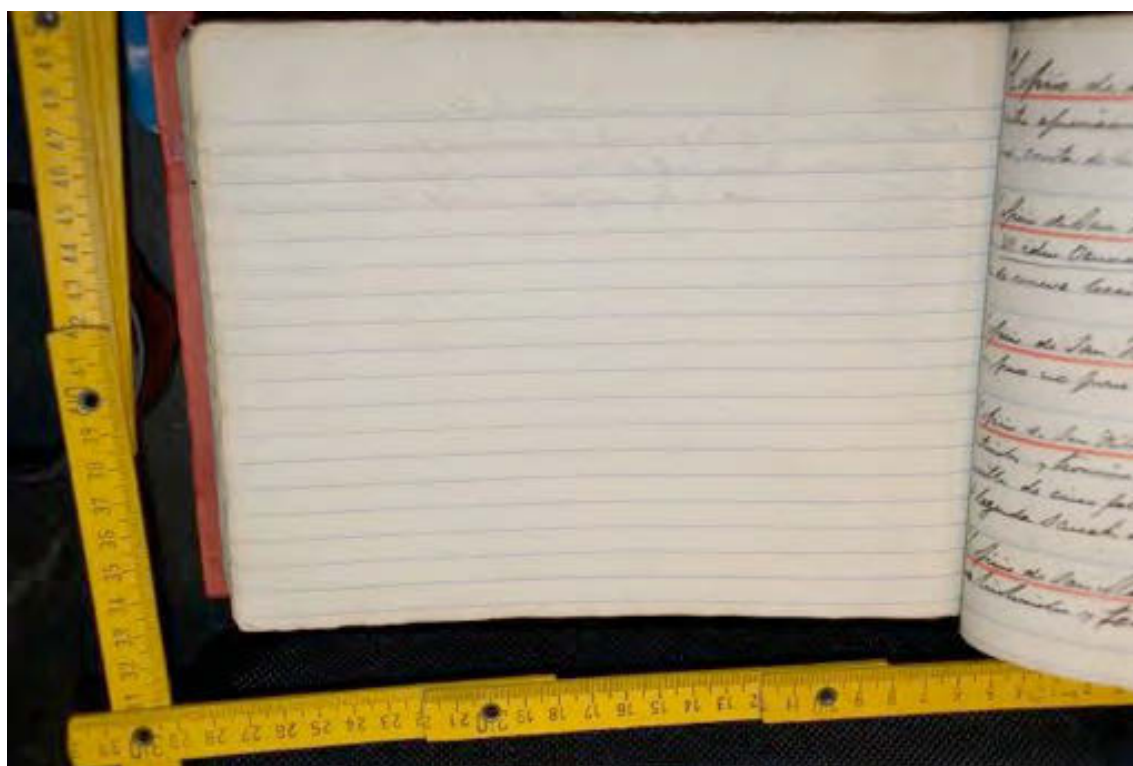
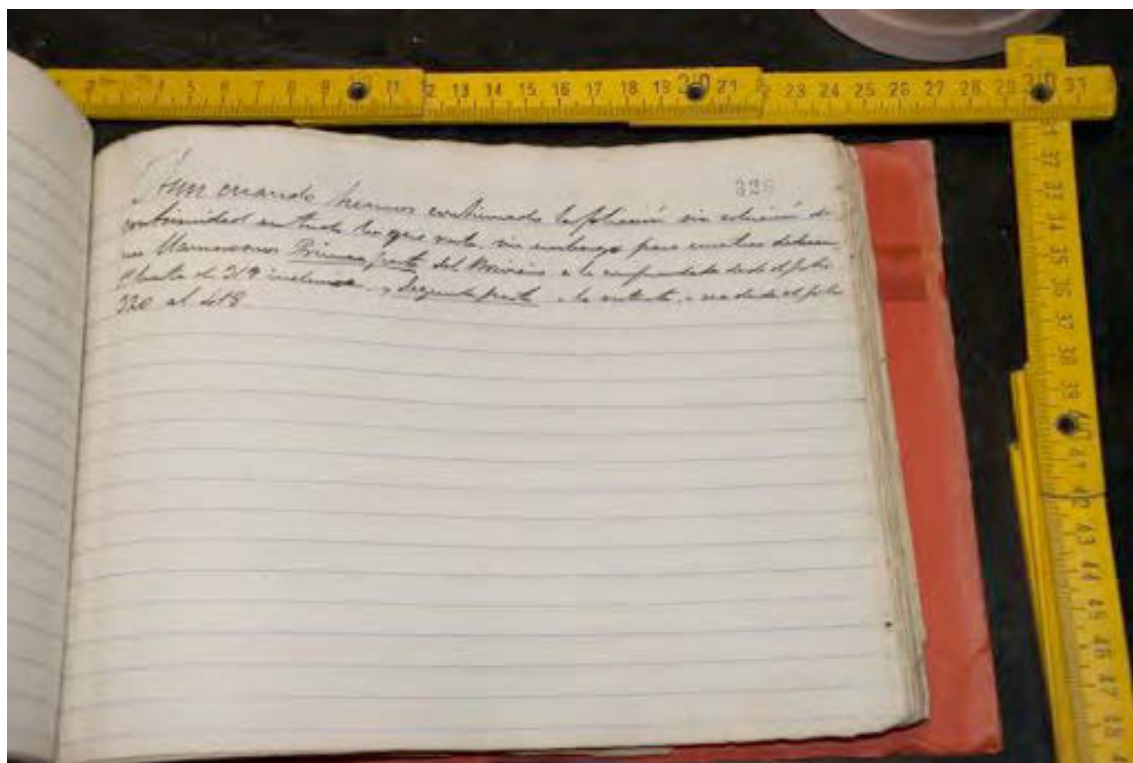


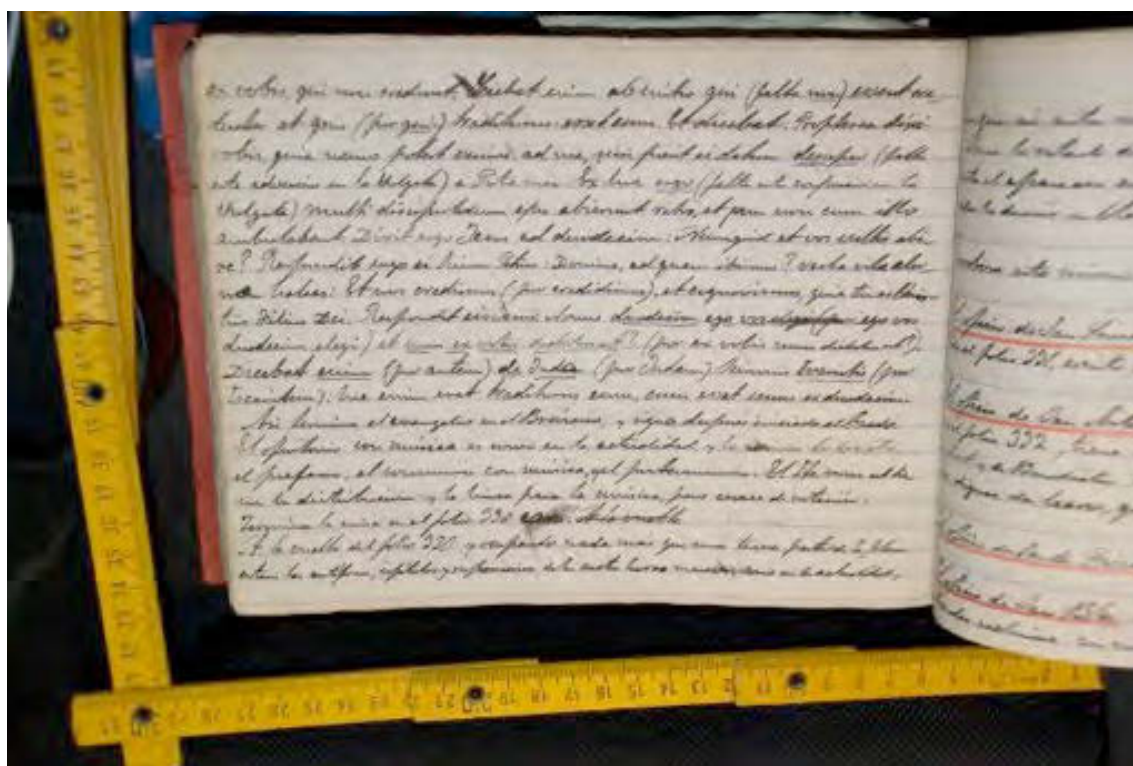
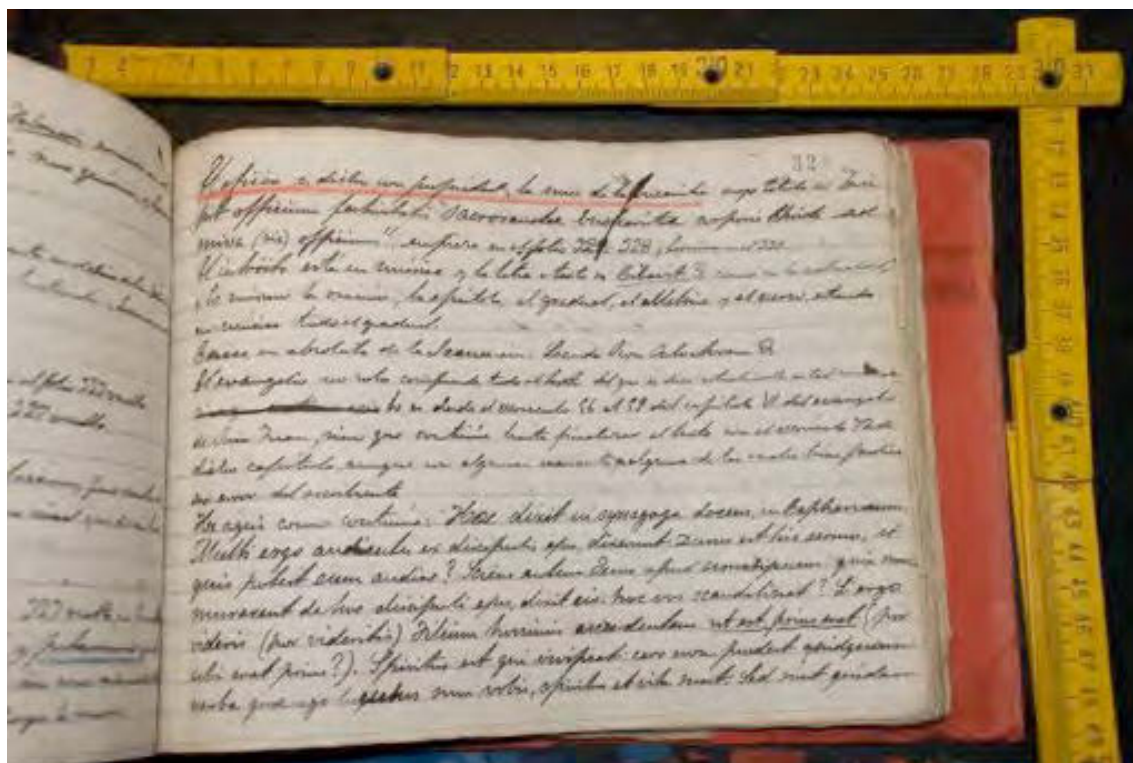


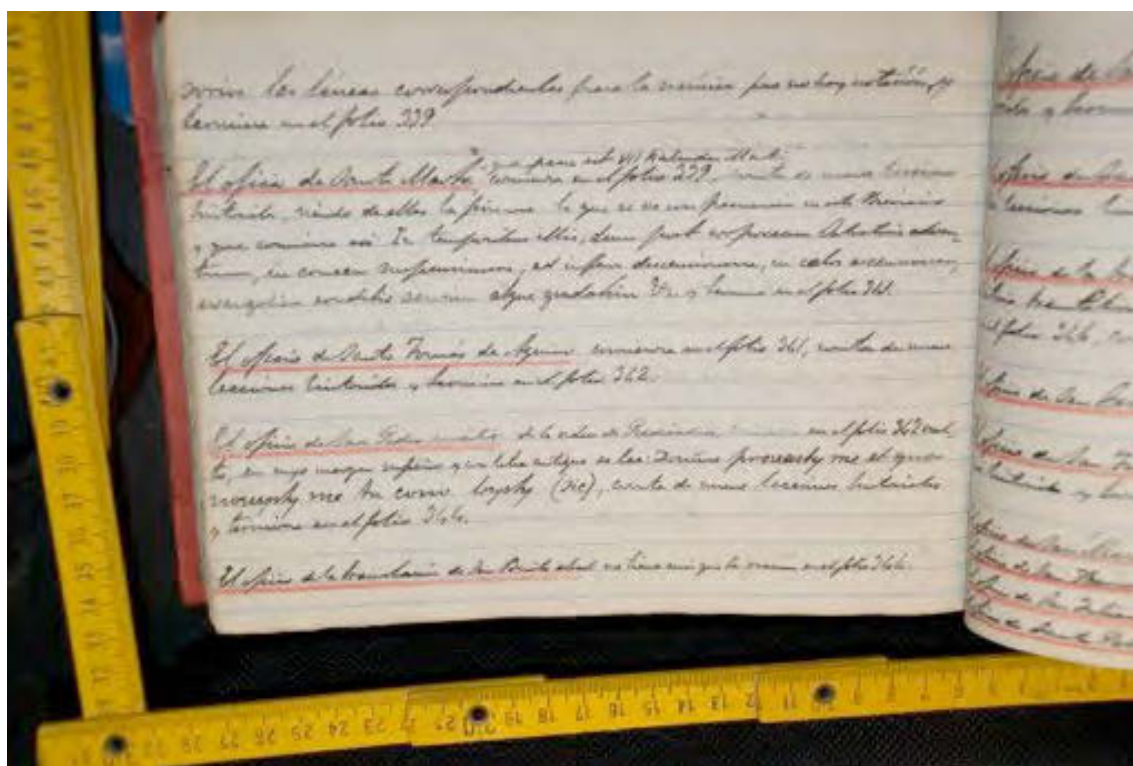
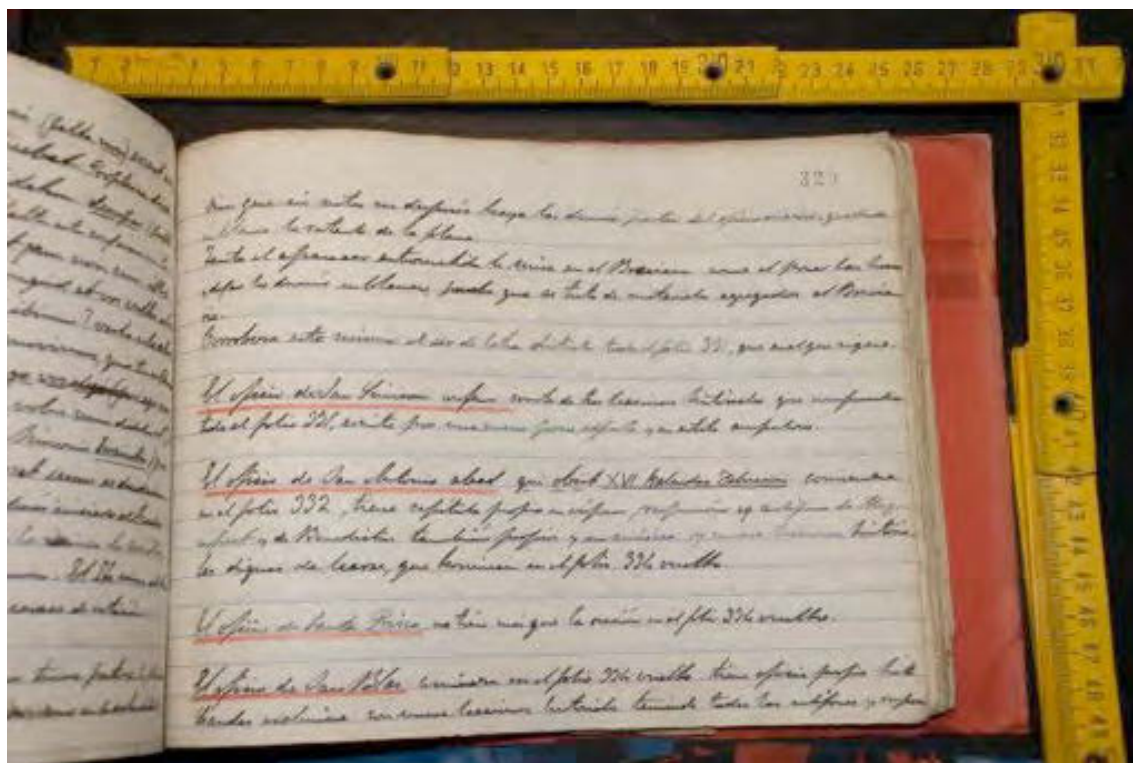


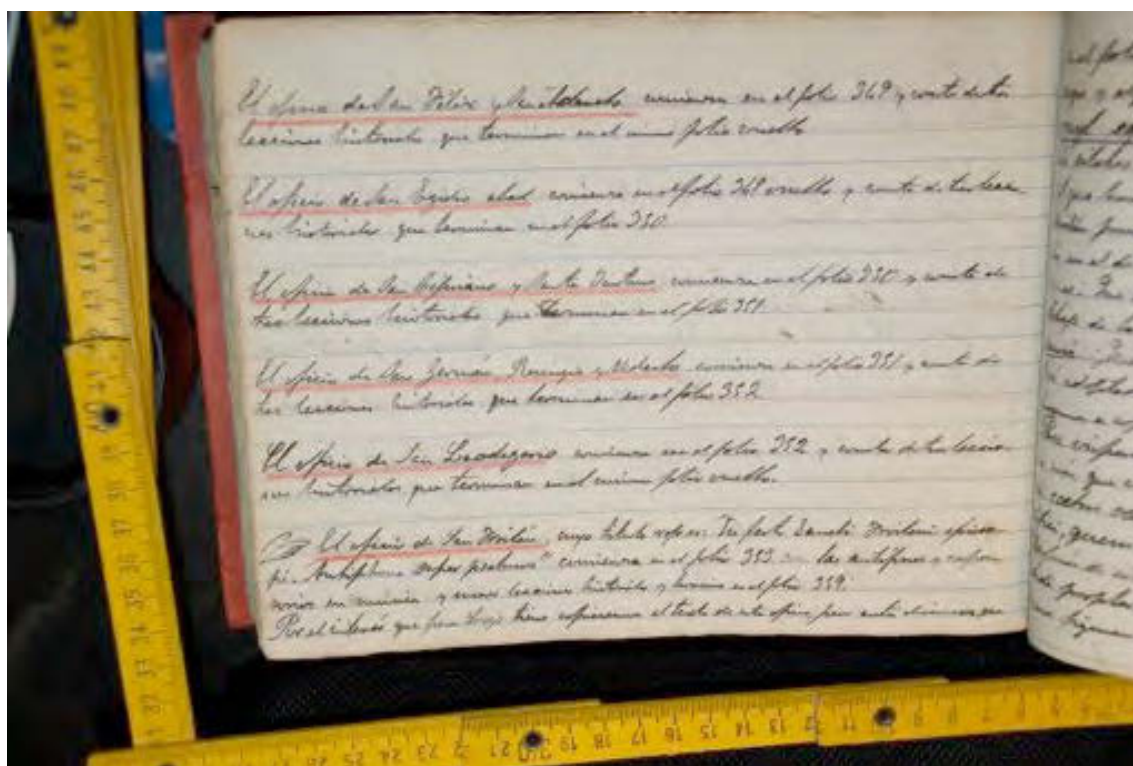
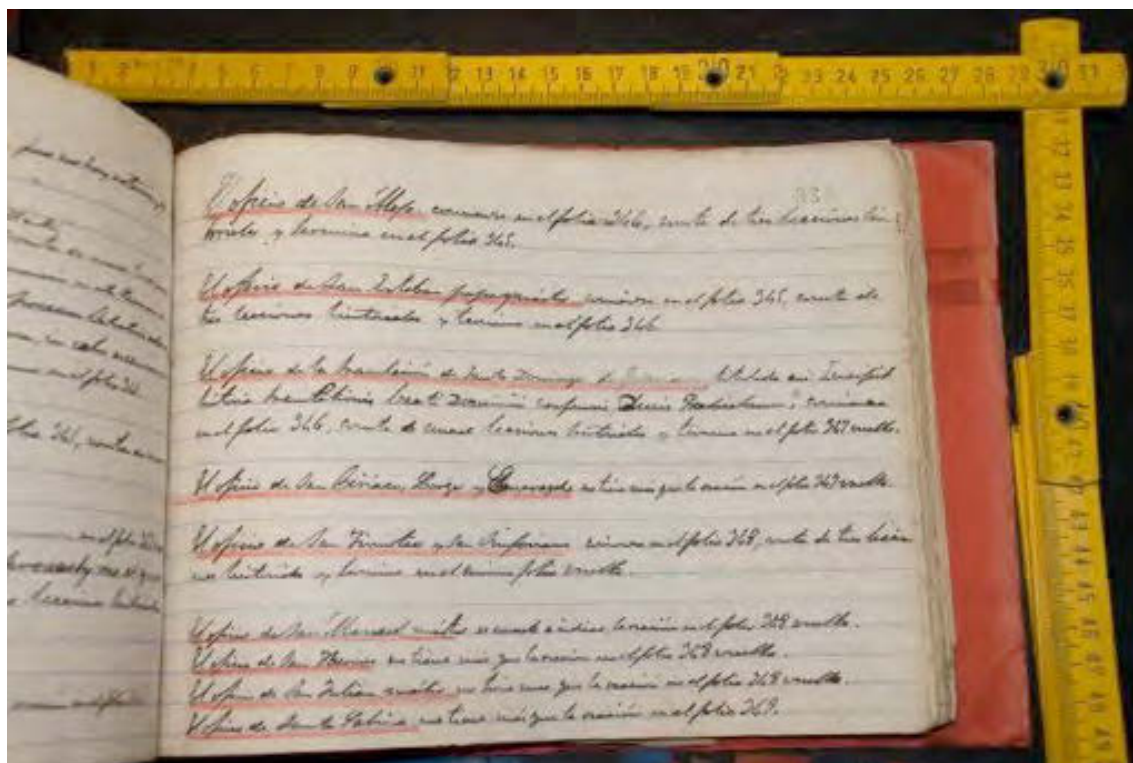


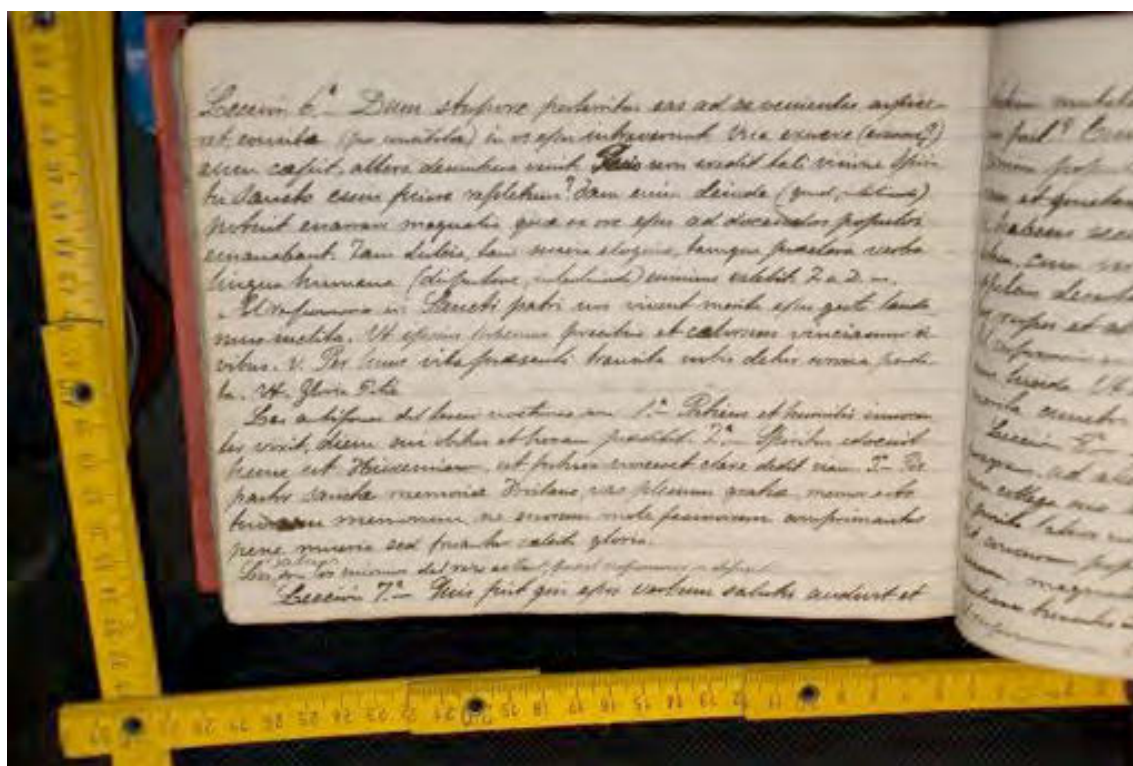
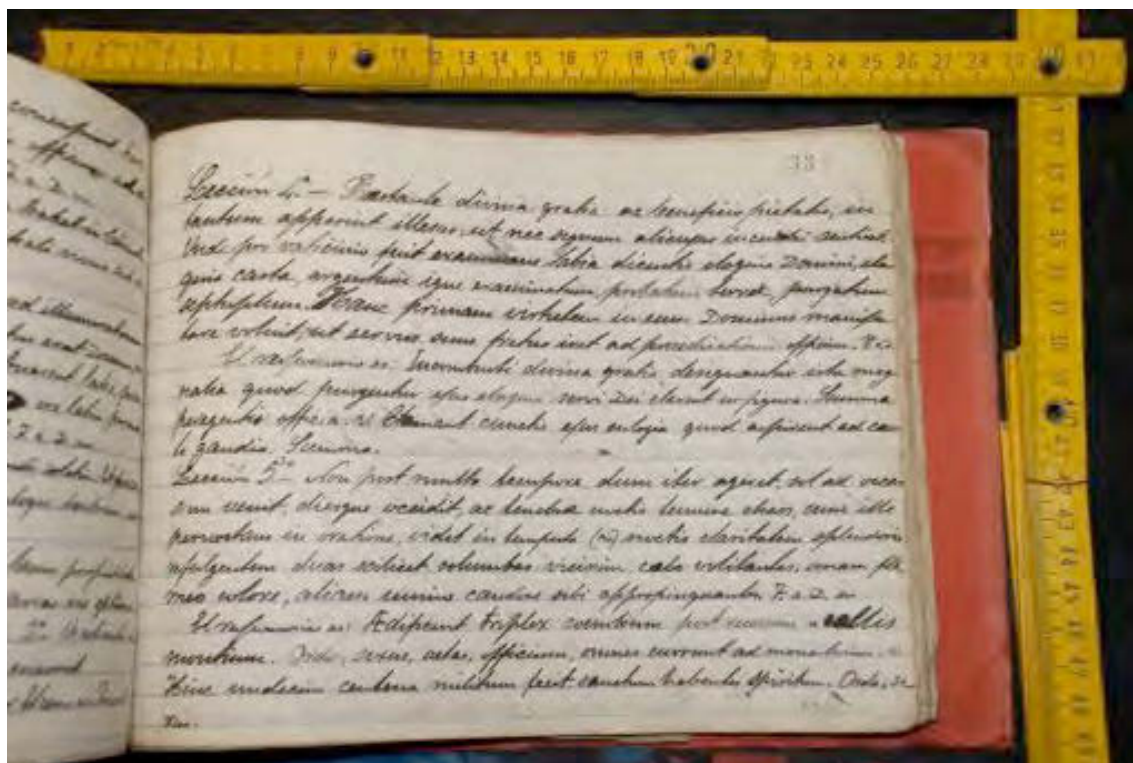


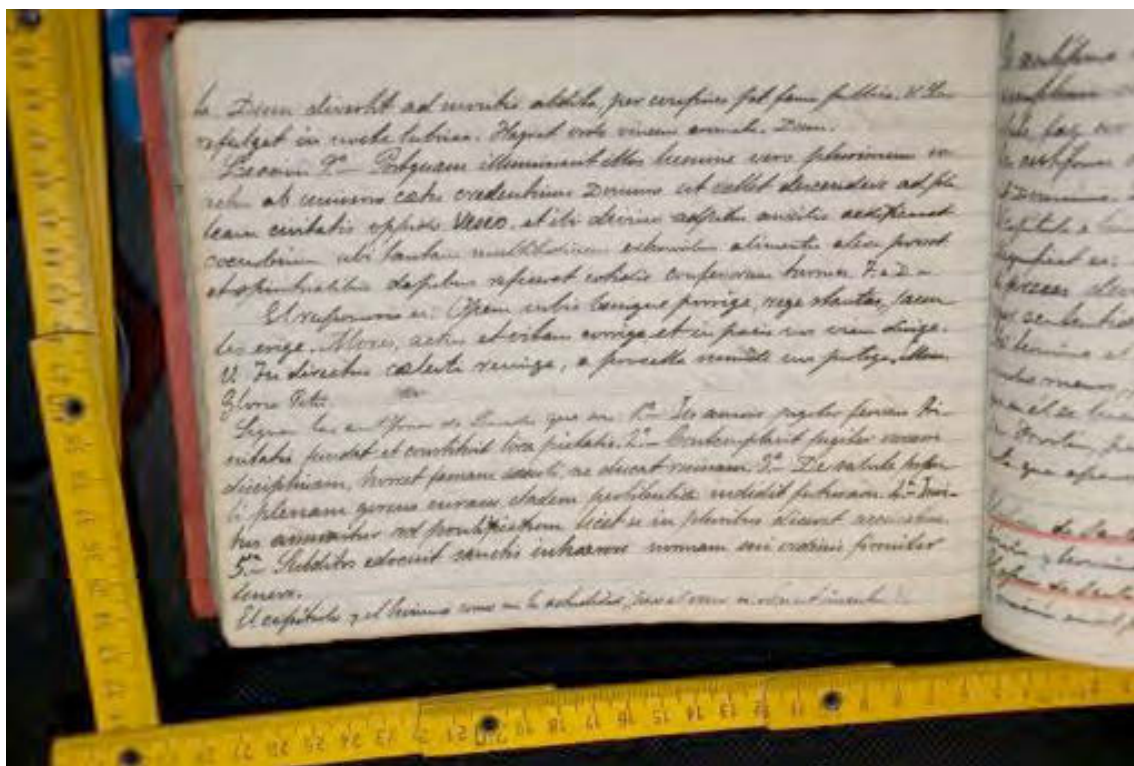


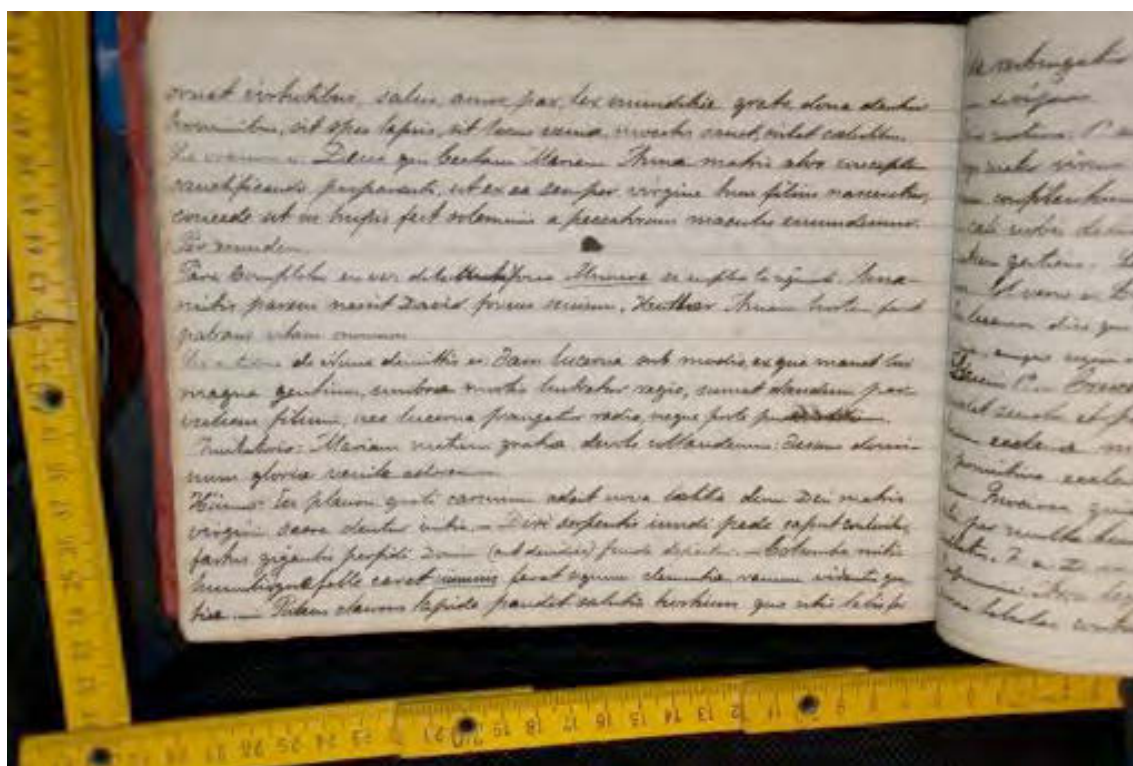
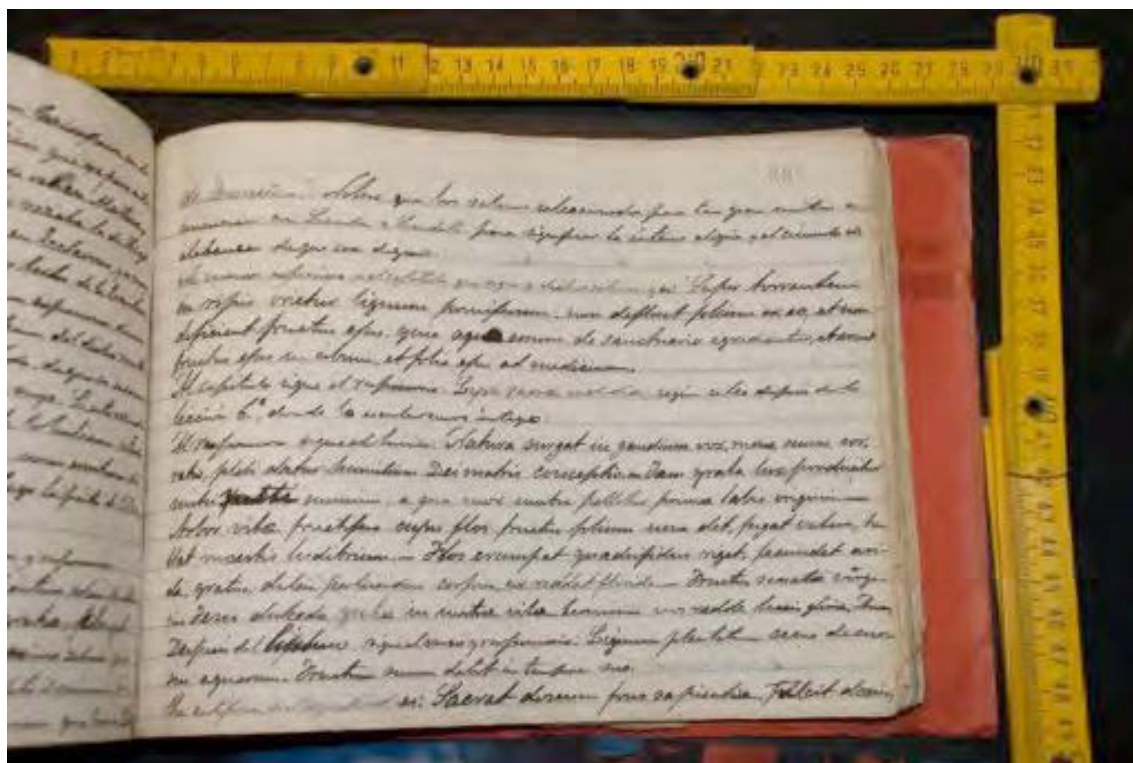


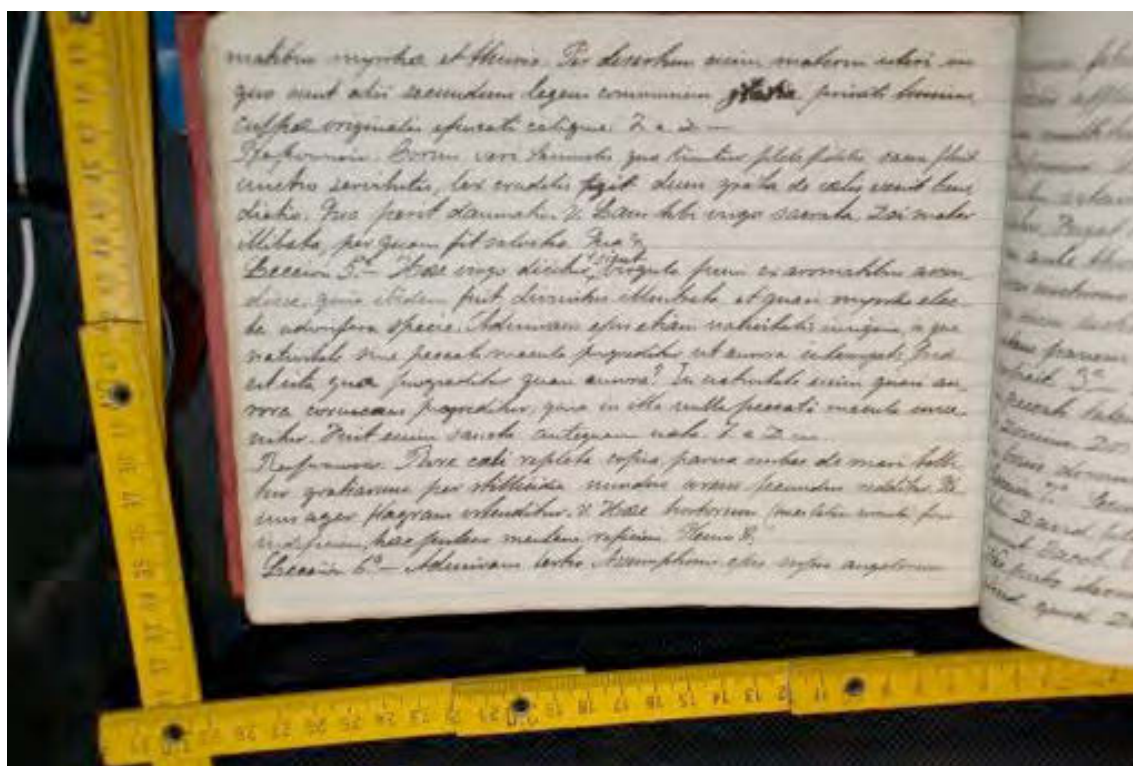
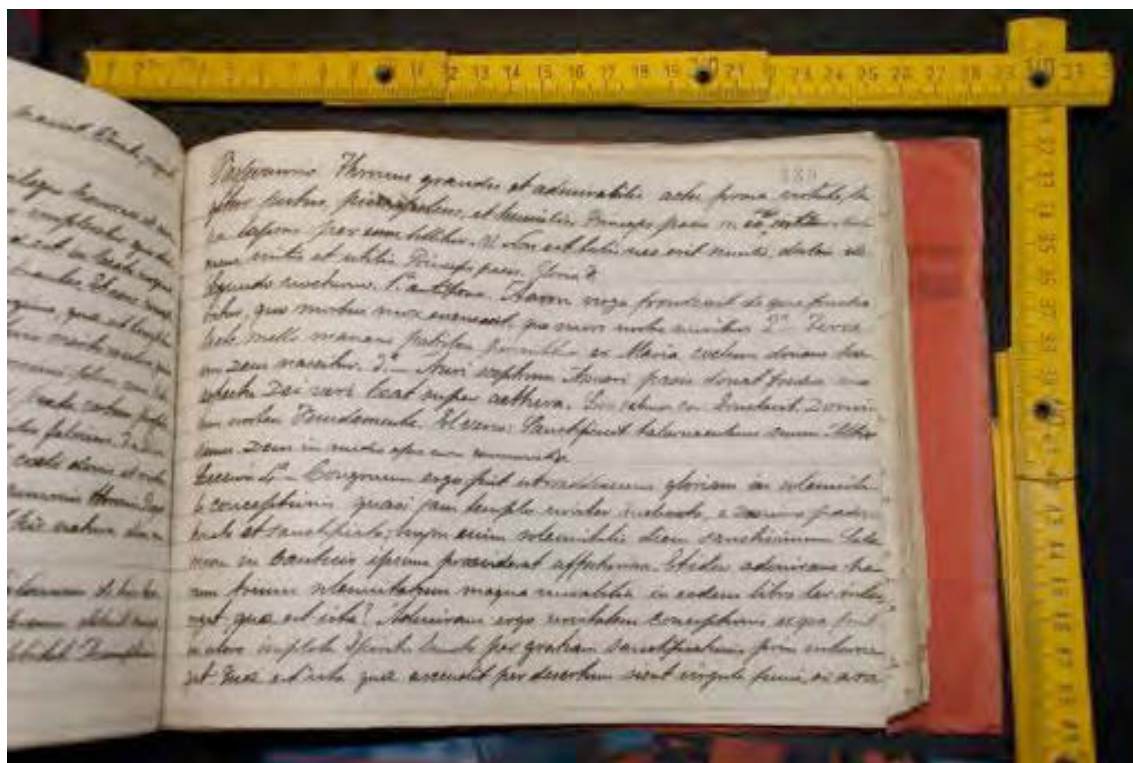


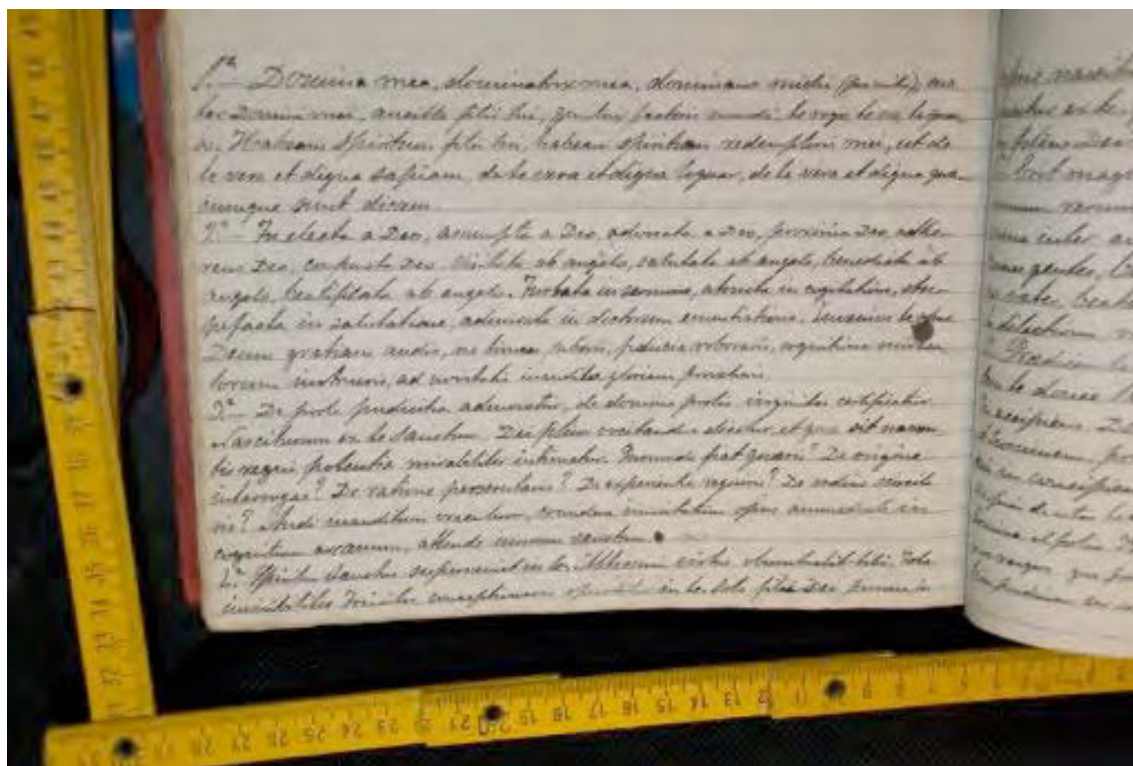
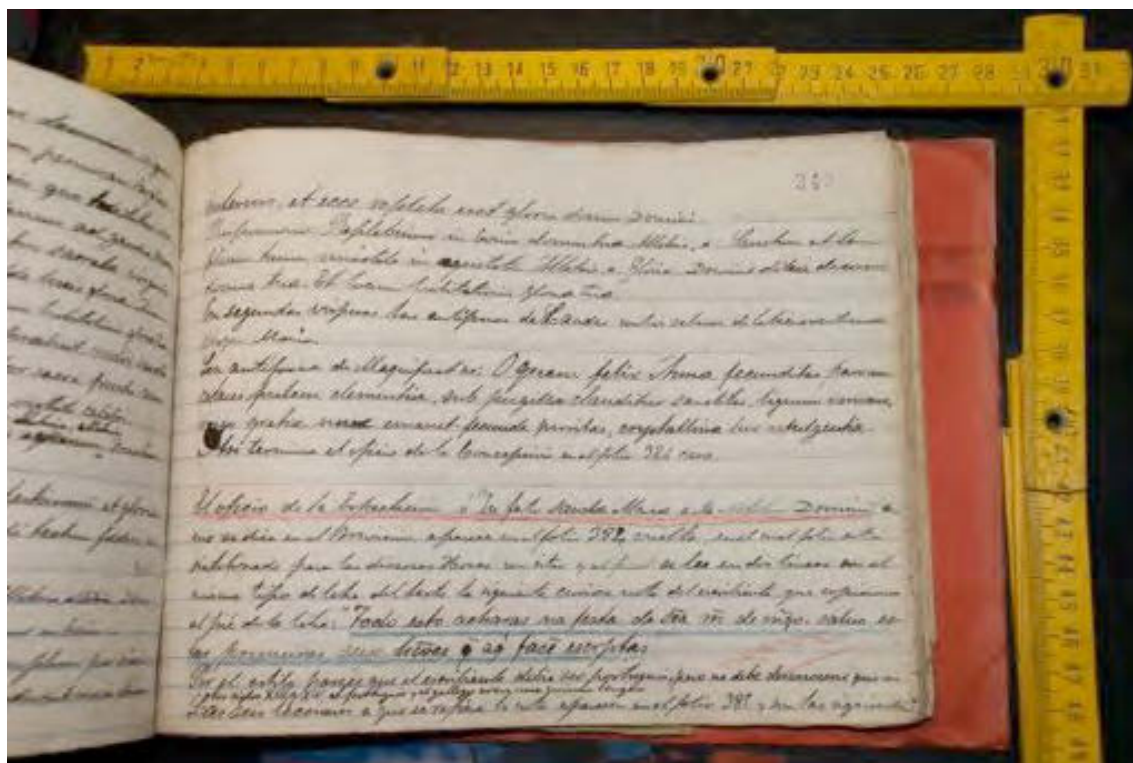


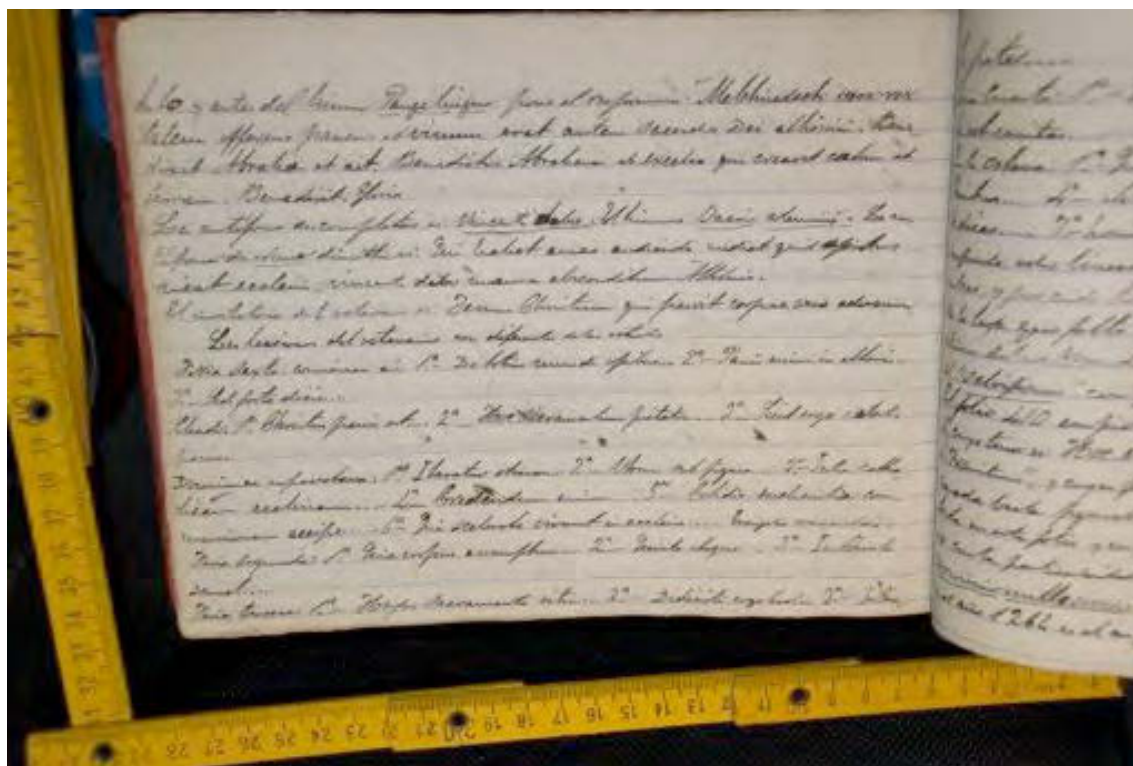
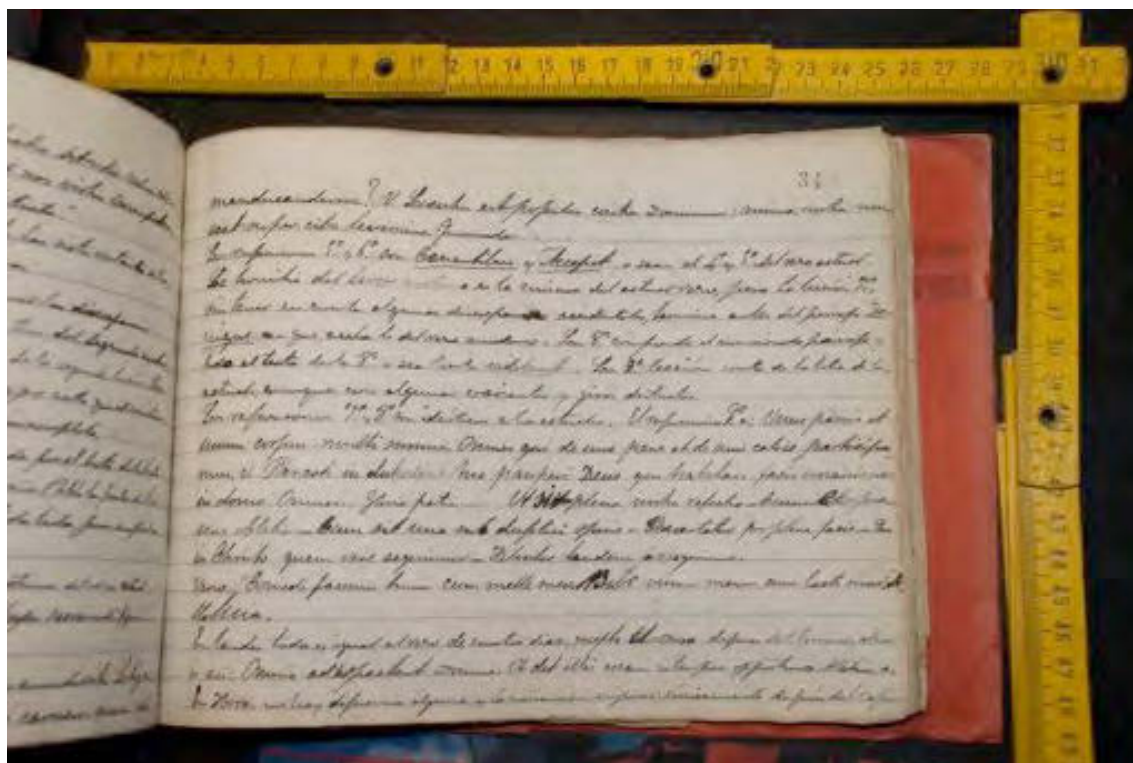


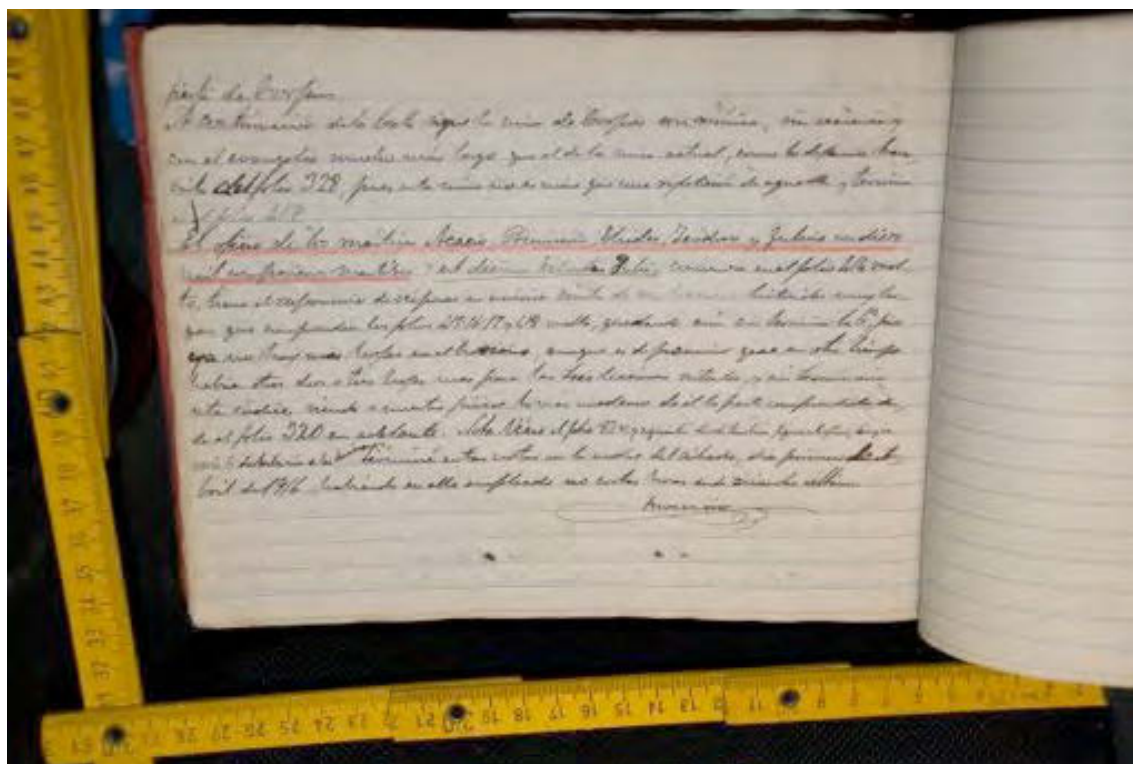
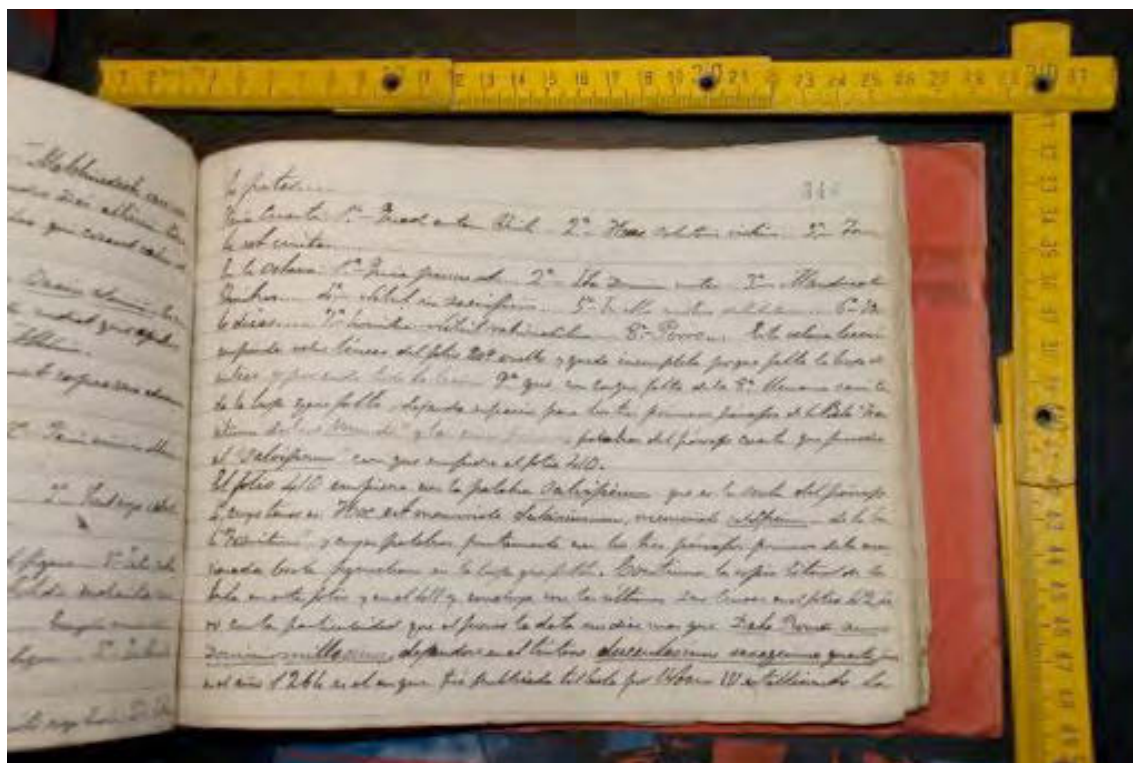


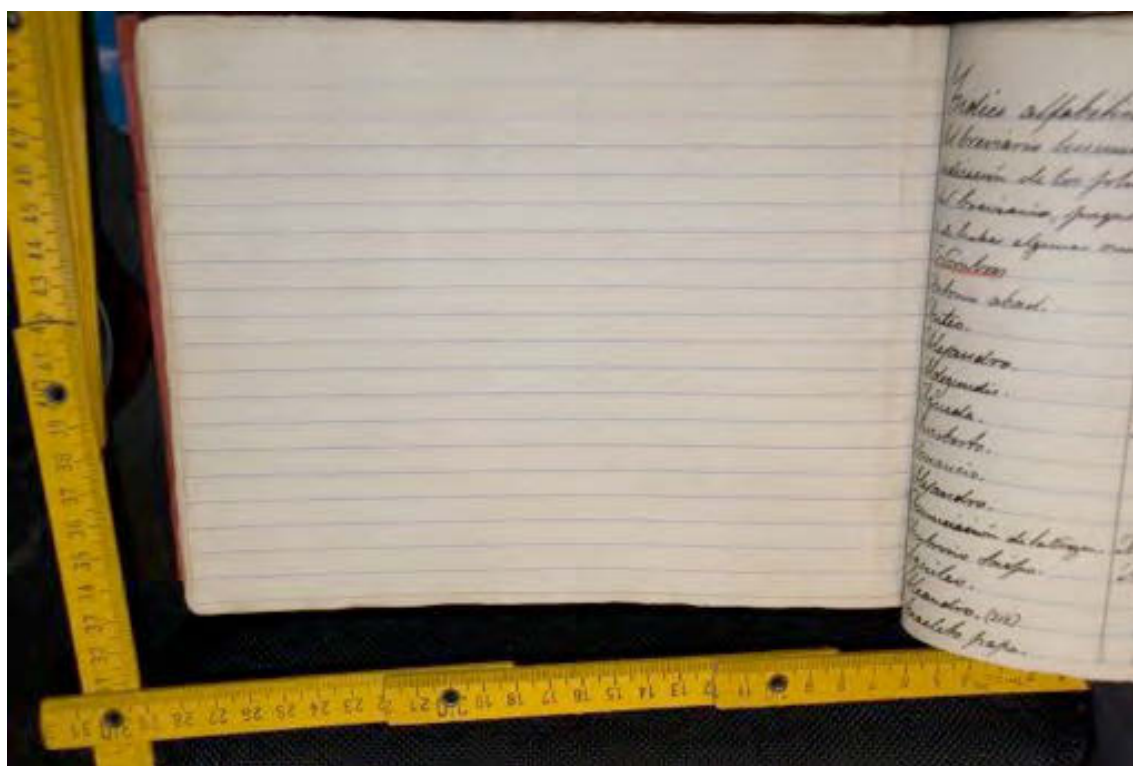












Indice alfabético por orden de meses, calculado sobre el calendario
del breviano lucense y sobre el cuerpo del versario en un breviano o según el fin de
medicinas de los folios y de la parte superior, siempre que se pague en el cuerpo
del breviano, pague en el apéndice todos los del calendario, en un día de
p. de haber algunos números con defecto o exceso.

	Me	2a	3a	4a
<u>Alcorno</u>				
Antonia abad.	Bravo	2 ^a	222-224	
Antio.	"	27		
Alapucaro.	"	30		
Alapucaro.	"	31		
Agueda.	Debar	5	1 ^a	28-44
Agueda.	"	9		
Agueda.	"	10		
Agueda.	"	24		
Agueda de la Virgen.	Maro	25	1 ^a	57-63
Agueda de la Virgen.	Maro	4	"	63-65
Agueda.	"	23	"	66
Agueda.	"	24		
Agueda.	"	24		

	Me	2a	3a	4a
<u>Alcorno</u>				
Alcorno.	Maro	27		
Alcorno.	Maro	2		
Alcorno.	"	3	1 ^a	78
Alcorno.	"	7		
Alcorno.	"	7		
Alcorno de la Virgen.	"	2	1 ^a	77-80
Alcorno.	"	12	"	81-82
Alcorno.	"	24		
Alcorno.	Maro	14		
Alcorno.	"	17	1 ^a	84-87
Alcorno.	"	22	"	88
Alcorno.	"	22	1 ^a	88-94
Alcorno.	Julio	17	1 ^a	121-124
Alcorno.	"	18		
Alcorno.	"	23	1 ^a	129
Alcorno.	"	30	"	136
Alcorno.	Agosto	3	"	140
Alcorno.	"	5		

<u>Lombes</u>	Mes	Dia	Part	Relo
Comunión de la V. M.	Mayo	1	1°	21-23
Comunión de la V. M.	"	25	1°	21-23
Comunión de la V. M.	Julio	22	1°	17-19
Comunión	Mayo	16	"	22-24
Comunión	Julio	12	"	22-24
Comunión	"	12	"	"
Comunión	"	15	"	"
Comunión	"	16	1°	24-26
Comunión	"	22	1° y 2°	27-29
Comunión de la V. M.	"	30	1°	28-30
Comunión	Julio	7	"	"
Comunión	"	7	"	"
Comunión	"	13	"	"
Comunión	"	24	1°	123-25
Comunión	"	25	"	123-25
Comunión	"	25	"	123-25
Comunión	"	28	"	123-25
Comunión de la V. M.	Agosto	1	"	123-25

<u>Lombes</u>	Mes	Dia	Part	Relo
Comunión	Agosto	8	2°	307-2
Comunión de la V. M.	"	27	"	"
Comunión	Septiembre	14	1°	178
Comunión	"	14	"	178
Comunión	"	22	"	192
Comunión de la V. M.	"	24	"	"
Comunión	"	25	"	"
Comunión	"	26	2°	350
Comunión	"	27	1°	192-2
Comunión	"	27	"	192-2
Comunión	Octubre	14	1° y 2°	203-260
Comunión	"	21	2°	362-2
Comunión	"	25	"	362-2
Comunión	"	27	1°	205-2
Comunión	"	30	"	205-2
Comunión	Noviembre	1	"	207
Comunión	"	8	"	"
Comunión	"	8	1°	219

Nombres			
	Mes	Die	Reb. Total
Castoreo	21	1°	219
Colombano.	21		
Cicuta virga, machi	21	1°	228-261
Almendra pata.	22	"	262-265
Cuscuta & Guisguis.	24	2°	267
Calathea virga, machi	25	"	267-276
Orizaba.	25	1°	276
Cuscuta	5		
Cuscuta de la liza	8	2°	278-286
Almendra virga, machi	21		
Cuscuta blanca.		2°	286-289

Nombres.			
Castoreo			
Colombano.			
Cicuta virga, machi			
Almendra pata.			
Cuscuta & Guisguis.			
Calathea virga, machi			
Orizaba.			
Cuscuta			
Cuscuta de la liza			
Almendra virga, machi			
Cuscuta blanca.			

<u>Nombres</u>	<u>Mes</u>	<u>Dia</u>	<u>Part</u>	<u>Notas</u>
<i>Eufasia.</i>	Enano	6		
<i>Encusucana.</i>	"	23	1°	7
<i>Conchano.</i>	Patron	9		
<i>Coctatica.</i>	"	10	1°	25.45
<i>Calatia.</i>	"	12	"	25.47
<i>Eufasia virgen.</i>	Abril	12		
<i>Enano.</i>	Mayo	3	1°	78
<i>Enano.</i>	"	10	"	80
<i>Enano.</i>	"	16	"	
<i>Enano.</i>	Junio	22	1° 2°	88, 100
<i>Eufasia obispo.</i>	Diciembre	13		
<i>Eufasia obispo.</i>	"	16		
<i>Enano.</i>	Agosto	1	1°	136
<i>Eufasia papagaito.</i>	"	2	1° 2°	136, 205
<i>Enano.</i>	"	8	2°	207
<i>Enano.</i>	"	16	1°	131
<i>Enano.</i>	"	19		
<i>Eufasia.</i>	Enero	1	2°	248

<u>Nombres</u>	<u>Mes</u>	<u>Dia</u>	<u>Part</u>	<u>Notas</u>
<i>Eufasia obispo.</i>	Enero	6		
<i>Eufasia obispo.</i>	"	14	1°	178-192
<i>Eufasia.</i>	"	16	"	192-195
<i>Eufasia virgen.</i>	"	20		
<i>Enano.</i>	Octubre	2		
<i>Enano.</i>	"	9		
<i>Enano.</i>	Diciembre	1	1°	207
<i>Enano.</i>	"	2		
<i>Enano.</i>	"	5		
<i>Enano.</i>	"	12	2°	230-235
<i>Eufasia obispo.</i>	Diciembre	1		
<i>Eufasia virgen y mate.</i>	"	10	1°	212
<i>Enano.</i>	"	12		
<i>Eufasia obispo.</i>	"	18	2°	207
<i>Enano.</i>	"	26		

<i>Nombre</i>	<i>Mes</i>	<i>Dia</i>	<i>Pah</i>	<i>Polo</i>
<i>Delis puchilero</i>	<i>Enero</i>	16	2°	322-323
<i>Delian</i>	"	20	1°	1-6
<i>Portuense de la pta</i>	"	21		
<i>Delian</i>	<i>Delian</i>	16		
<i>Delian de la</i>	<i>Marzo</i>	7	1°	12-13
<i>Delis puchilero</i>	<i>Abril</i>	23	"	66
<i>Portuense</i>	"	23	"	66
<i>Delis apuchil</i>	<i>Mayo</i>	1	"	72-73
<i>Delis papa</i>	"	30		
<i>Delian</i>	<i>Junio</i>	7	1°	86-87
<i>Delis</i>	"	16		
<i>Portuense</i>	"	16		
<i>Delis de la pta y de la</i>	"	13		
<i>Portuense de la pta</i>	"	20		
<i>Delian y de la pta</i>	<i>Julio</i>	10	1°	117-118
<i>Delis</i>	"	29	"	136-137
<i>Portuense</i>	"	29	"	136-137
<i>Delis de la pta</i>	<i>Agosto</i>	1	"	138
<i>Portuense</i>	"	18	"	166-167

<i>Nombre</i>	<i>Mes</i>	<i>Dia</i>	<i>Pah</i>	<i>Polo</i>
<i>Delian de la pta</i>	<i>Agosto</i>	20		
<i>Delis</i>	"	30	2°	349
<i>Delis</i>	<i>Septiembre</i>	19		
<i>Delis</i>	"	26		
<i>Portuense</i>	"	28		
<i>Portuense</i>	<i>Octubre</i>	4	2°	353-354
<i>Portuense</i>	"	4		
<i>Delis</i>	"	6	2°	359
<i>Portuense de la pta</i>	"	17		
<i>Delis apuchil</i>	"	22		
<i>Delian</i>	"	26		
<i>Delis puchilero</i>	<i>Noviembre</i>	1		
<i>Delis</i>	"	6		
<i>Portuense</i>	"	19		
<i>Delian</i>	"	23		
<i>Portuense</i>	"	26		
<i>Portuense</i>	"	27	1°	249-250
<i>Portuense</i>	<i>Diciembre</i>	16		
<i>Portuense de la pta</i>	"	18		

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Peso</u>	<u>Notas</u>
<i>Guiraca</i>	<i>Nov</i>	3		
<i>Guiraca ppa.</i>	<i>Oct</i>	13	1"	15-16
<i>Guiraca ppa. ppa.</i>	<i>Nov</i>	13		
<i>Guiraca</i>	<i>May</i>	10	1"	80-81
<i>Guiraca</i>		28		
<i>Guiraca</i>	<i>Nov</i>	8	1"	84
<i>Guiraca</i>		19		87
<i>Guiraca</i>	<i>Oct</i>	31		156
<i>Guiraca</i>	<i>Ag</i>	3		160
<i>Guiraca</i>		23		
<i>Guiraca</i>	<i>Sept</i>	9	1"	182
<i>Guiraca</i>		16		184
<i>Guiraca</i>		19		
<i>Guiraca</i>	<i>Oct</i>	1	2"	351
<i>Guiraca</i>		13		360
<i>Guiraca</i>	<i>Nov</i>	3	1"	202

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Peso</u>	<u>Notas</u>
<i>Helarion</i>	<i>Nov</i>	13	2"	323-324
<i>Helarion</i>		30		
<i>Helarion</i>	<i>May</i>	5		
<i>Helarion</i>	<i>Ag</i>	13	1"	110
<i>Helarion</i>		23		
<i>Helarion</i>	<i>Oct</i>	31		
<i>Helarion</i>		22		
<i>Helarion</i>	<i>Ag</i>	28	2"	211

<u>Nombres</u>	Mes	Dia	Arch	Volu
<i>Polian marit.</i>	Mayo	7	2°	362-397
<i>Polian elipso.</i>	"	27		
<i>Iran cor-pau elipso.</i>	"	27		
<i>Iran.</i>	"	28		
<i>Iranula.</i>	Julian	10		
<i>Iranula.</i>	"	16		
<i>Iranula marit.</i>	Mar	25	1°	66-70
<i>Iran sub-petala liliace.</i>	Mayo	6	"	78-79
<i>Iranula marit.</i>	"	7		
<i>Iranula.</i>	Julian	16	1°	86-11
<i>Iran pectinata.</i>	"	23		
<i>Iran liliace.</i>	"	24	1°	91-95
<i>Iran.</i>	"	26	"	98-102
<i>Iranula.</i>	"	28		
<i>Iranula.</i>	Julian	19	1°	121
<i>Iranula marit.</i>	"	26		
<i>Iranula.</i>	Agosto	2		
<i>Iranula.</i>	"	6		

<u>Nombres</u>	Mes	Dia	Arch	Volu
<i>Iranula</i>	Agosto	28	2°	318.
<i>Iranula elipso.</i>	Septiembre	2		
<i>Iranula.</i>	"	11	1°	178
<i>Iranula pectinata</i>	"	17		
<i>Iranula elipso.</i>	"	26	2°	310
<i>Iranula.</i>	"	28		
<i>Iranula.</i>	"	30	1°	20-202
<i>Iranula.</i>	Octubre	7	2°	319.
<i>Iranula pectinata.</i>	"	28	1°	201
<i>Iranula pectinata.</i>	"			

<u>Arbores</u>	<u>Mes</u>	<u>dia</u>	<u>Part</u>	<u>Nota</u>
<i>Longimanis prostrata</i>	Nov	19	2°	322.0
<i>Longimanis</i>	Nov	22		
<i>Longimanis</i>	Mar	12		
<i>Longimanis</i>	"	15		
<i>Longimanis</i>	Apr	11		
<i>Longimanis</i>	Jun	28		
<i>Longimanis</i>	Jul	5		
<i>Longimanis</i>	Ag	8	2°	322.0
<i>Longimanis</i>	"	10	1°	323.29
<i>Longimanis</i>	"	19		
<i>Longimanis</i>	Sept	1		
<i>Longimanis</i>	"	16	1°	321.0
<i>Longimanis</i>	"	27	"	322.0
<i>Longimanis</i>	Oct	2	2°	312
<i>Longimanis</i>	"	18	1°	322-205
<i>Longimanis</i>	"	30	"	306
<i>Longimanis</i>	Nov	6	"	319
<i>Longimanis</i>	"	26		

<u>Arbores</u>	<u>Mes</u>	<u>dia</u>	<u>Part</u>	<u>Nota</u>
<i>Longimanis</i>	Dec	2		
<i>Longimanis</i>	"	9	1°	321.29
<i>Longimanis</i>	"	12	"	322-329
<i>Longimanis</i>	"	17		

Sombres	Mes	Dia	Parte	Folio
Marina abad.	Enen	18	2°	326.
Marcela papa.	"	16	"	325.
Marla.	Tabaco	23	2°	328, 326.
Marla apud.	"	24	1°	328.
Marla bispina.	Marid	1	"	
Marina.	"	14	"	
Marla mangrove.	"	25	1°	328-71.
Marla abad.	Mayo	11	"	
Marina.	"	11	"	
Marcelina.	Junio	2	"	
Marina.	"	9	1°	328.
Modesto.	"	15	"	326.
Marina.	"	18	"	327.
Marcelina.	"	18	"	327.
Marina.	"	24	"	
Marcel de la.	"	25	"	
Marina.	Julio	2	"	
Marina viza.	"	12	1°	328-77.

Sombres	Mes	Dia	Parte	Folio
Marina viza.	Julio	18	1°	328-77.
Marcelina.	"	22	"	328-77.
Marcelina.	Agosto	1	"	328.
Marcelina.	"	12	"	
Marcelina.	"	17	2°	328.
Marcelina.	"	24	"	
Marcelina.	"	22	"	
Marcelina.	Septiembre	4	"	
Marcelina apud. mangrove.	"	21	1°	328-77.
Marcelina.	"	22	"	328.
Marcelina.	"	28	"	
Marcelina.	Octubre	4	1°	328.
Marcelina.	"	6	"	328.
Marcelina.	"	7	"	
Marcelina.	"	7	1°, 2°	328, 328.
Marcelina.	"	10	"	
Marcelina.	"	17	"	
Marcelina abad.	"	24	"	

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Polio</u>
<i>Alcalde</i>	Octubre	26		
<i>Alcalde</i>	"	30		
<i>Alcalde</i>	Noviembre	10		
<i>Alcalde de San</i>	"	11	1°	219-220
<i>Alcalde</i>	"	11	1° y 2°	219, 220
<i>Alcalde</i>	"	19		
<i>Alcalde</i>	"	25		
<i>Alcalde</i>	Diciembre	1		
<i>Alcalde</i>	"	16		
<i>Alcalde</i>	"	15		
<i>Alcalde</i>	"	18		

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Polio</u>
<i>Alcalde</i>	Mayo	12	1°	21-22 u
<i>Alcalde</i>	"	12		
<i>Alcalde</i>	"	12	1°	26 v
<i>Alcalde</i>	Junio	7		
<i>Alcalde</i>	"	28	1°	136 v
<i>Alcalde</i>	Julio	3		120
<i>Alcalde</i>	Agosto	8		177-177
<i>Alcalde</i>	"	11		182
<i>Alcalde</i>	Septiembre	29		
<i>Alcalde</i>	"	31		
<i>Alcalde</i>	Octubre	8	1°	219
<i>Alcalde</i>	Diciembre	6		211-261
<i>Alcalde</i>	"	25		

<i>Arbores</i>	Mes	Dia	Parte	Debi
<i>Arbores de San Sebastian</i>	Mayo	2		
<i>Arbores de San Juan</i>	"	3		
<i>Arbores de San Sebastian</i>	"	4		
<i>Arbores de la Iglesia</i>	"	13		
<i>Arbores del Panchito</i>	Julio	1	1°	116, 118
<i>Arbores de San Sebastian</i>	"	6	"	118, 119
<i>Arbores de San Sebastian</i>	Agosto	27		
<i>Arbores de la Iglesia</i>	"	22		
<i>Arbores de San Sebastian</i>	Septiembre	24	2°	239, 240
<i>Arbores de San Sebastian</i>	Octubre	8		
<i>Arbores de San Sebastian</i>	"	12		
<i>Arbores de San Sebastian</i>	Noviembre	7		

<i>Arbores</i>	Mes	Dia	Parte	Debi
<i>Arbores de San Sebastian</i>	Mayo	10		
<i>Arbores de San Juan</i>	"	14	2°	322, 324
<i>Arbores de San Sebastian</i>	"	26	1°	29, 30
<i>Arbores de San Sebastian</i>	"	27	"	22
<i>Arbores de San Sebastian</i>	Julio	2	"	34, 35
<i>Arbores de San Sebastian</i>	Agosto	7	"	52, 53
<i>Arbores de San Sebastian</i>	Septiembre	27	1° y 2°	36, 37, 38
<i>Arbores de San Sebastian</i>	Octubre	5		
<i>Arbores de San Sebastian</i>	"	11		
<i>Arbores de San Sebastian</i>	"	12	1°	84, 85
<i>Arbores de San Sebastian</i>	"	16		
<i>Arbores de San Sebastian</i>	"	31		
<i>Arbores de San Sebastian</i>	Noviembre	2		
<i>Arbores de San Sebastian</i>	"	9	1°	84
<i>Arbores de San Sebastian</i>	"	19	"	87
<i>Arbores de San Sebastian</i>	"	22	1° y 2°	88, 89
<i>Arbores de San Sebastian</i>	"	24	1°	91, 92
<i>Arbores de San Sebastian</i>	"	24	1°	94, 95

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Valor</u>
Petro.	Septiembre	29	1°	103.10
Pelle.	"	28	"	103.10
Pruce.	Julio	2		
Pruce. vago.	"	21	1°	122.1
Puntalón.	"	28	"	131.1
Puigros.	"	28		
Puerto.	Abril	6	1°	141
Puerto. vago.	"	31		
Pruce.	Septiembre	1		
Pelle.	"	11	1°	178
Puerto. vago.	"	23		
Puerto. vago.	Octubre	10		
Pruce.	Octubre	20		
Pelle. vago.	"	21		
Pruce.	"	22	1°	242.1
Pelle. vago.	Octubre	11		
Pruce. vago. vago.	"	21	2°	361.27

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Valor</u>
Pruce.	Octubre	15		
Pruce.	Noviembre	30		
Pruce.	Abril	30		
Pruce. vago.	Mayo	6		
Pruce.	Abril	22		
Pruce. vago.	Octubre	11		
Pruce.	"	31	2°	361

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Volu</u>
Resaca	Nov	12		
Resaca	Nov	28		
Resaca	Nov	29		
Resaca	Nov	30		
Resaca	Mayo	24	1°	83
Resaca	Nov	16		
Resaca	"	24		
Resaca	Nov	10		
Resaca	"	19	1°	127
Resaca	Agosto	9		
Resaca	"	13	1°	150.0
Resaca	"	27	"	162.0
Resaca	Octubre	1	1° 2°	202.511
Resaca	"	6		
Resaca	"	9		
Resaca	"	23		
Resaca	"	26		
Resaca	Nov	18	1°	235

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Volu</u>
Resaca	Nov	24		
Resaca	"	28		

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Volu</u>
Resaca	Nov	12		
Resaca	Nov	28		
Resaca	Nov	29		
Resaca	Nov	30		
Resaca	Mayo	24	1°	83
Resaca	Nov	16		
Resaca	"	24		
Resaca	Nov	10		
Resaca	"	19	1°	127
Resaca	Agosto	9		
Resaca	"	13	1°	150.0
Resaca	"	27	"	162.0
Resaca	Octubre	1	1° 2°	202.511
Resaca	"	6		
Resaca	"	9		
Resaca	"	23		
Resaca	"	26		
Resaca	Nov	18	1°	235

<u>Nombres</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Volio</u>
<i>Amore.</i>	<i>Mayo</i>	5		
<i>Amore.</i>	"	8	2°	331
<i>Amore.</i>	"	17	"	331
<i>Amore.</i>	"	20	1°	1-6
<i>Amore.</i>	"	31		
<i>Amore.</i>	<i>Julio</i>	9		
<i>Amore.</i>	"	19		
<i>Amore.</i>	<i>Mayo</i>	1	1°	320-300
<i>Amore.</i>	"	2		
<i>Amore.</i>	<i>Julio</i>	7		
<i>Amore.</i>	"	10		
<i>Amore.</i>	"	15		
<i>Amore.</i>	"	25	1°	130/160
<i>Amore.</i>	"	27		
<i>Amore.</i>	"	29		
<i>Amore.</i>	"	29	1°	331
<i>Amore.</i>	"	30		331
<i>Amore.</i>	<i>Agosto</i>	6		1-6

<u>Nombres</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Volio</u>
<i>Amore.</i>	<i>Agosto</i>	11		
<i>Amore.</i>	"	22	2°	268
<i>Amore.</i>	"	29	"	269
<i>Amore.</i>	<i>Septiembre</i>	7		
<i>Amore.</i>	<i>Octubre</i>	7	2°	301
<i>Amore.</i>	"	8		
<i>Amore.</i>	"	22		
<i>Amore.</i>	"	23	2°	362
<i>Amore.</i>	"	27	1°	205.01
<i>Amore.</i>	"	28	"	205-205
<i>Amore.</i>	<i>Noviembre</i>	8	"	219
<i>Amore.</i>	"	9	"	219
<i>Amore.</i>	"	22	"	261
<i>Amore.</i>	<i>Diciembre</i>	21	2°	320-321

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Nota</u>
Toro.	Nov	23	1°	20-21
Toro.	"	21	"	"
Trucha de Aguan.	Marzo	7	2°	241
Trucha.	"	24	"	"
Trucha.	"	20	"	"
Trucha.	Mayo	3	1°	24-26
Trucha de la Lata.	"	9	"	"
Trucha.	"	13	"	"
Trucha.	Junio	22	1°, 2°	28, 29
Trucha de la Lata.	Julio	3	"	Trucha de la Lata de la Lata.
Trucha de la Lata de la Lata.	"	4	"	"
Trucha de la Lata de la Lata.	"	11	1°	21
Trucha de la Lata de la Lata.	Agosto	4	2°	26-27
Trucha de la Lata de la Lata.	"	6	1°	24-25
Trucha.	"	11	"	14-15
Trucha.	"	11	"	"
Trucha.	"	22	2°	26
Trucha.	"	22	"	"

<u>Nombre</u>	<u>Mes</u>	<u>Dia</u>	<u>Parte</u>	<u>Nota</u>
Trucha.	Septiembre	23	"	"
Toro.	"	24	"	"
Trucha de la Lata.	Octubre	1	1°	20-21
Trucha.	"	3	"	"
Trucha de la Lata.	"	7	1°	21
Trucha de la Lata de la Lata.	Diciembre	6	2°	24
Trucha de la Lata de la Lata.	"	17	"	"
Trucha de la Lata de la Lata.	"	21	1°	20-21
Trucha de la Lata de la Lata.	"	22	"	"
Trucha de la Lata de la Lata.	"	29	"	"
Trucha de la Lata de la Lata.	"	30	2°	27
Trucha de la Lata de la Lata.	Mayo	25	1°	23-24
Trucha de la Lata de la Lata.	Septiembre	20	"	"

<u>Nombres</u>	<u>Mes</u>	<u>2a</u>	<u>Pach</u>	<u>Polo</u>
Vicente machi	Novo	22	1°	12-18
Valeria elipso	"	29		
Victor	"	31		
Valentin	Diciem	14		
Vital	"	14		
Victor	Marzo	6		
Victorino	"	6		
Valeriano	Abril	14	1°	45-66
Vital machi	"	28	"	71
Victor	Mayo	14	"	82
Valerio	Junio	14	"	
Vito	"	11	1°	84
Victorino machi	Septiembre	5		
Valeriano	"	11		
Valeriano	"	17		
Victor	"	20		
Vedado	Octubre	1, 2	202, 211	
Vicente	"	1		

<u>Nombres</u>	<u>Mes</u>	<u>2a</u>	<u>Pach</u>	<u>Polo</u>
Vicente	Octubre	27	1°	201
Victor	"	30	"	206
Vital	Noviembre	3		
Valente	"	13		
Victoria	"	19	1°	224
Vital	"	27		
Valeriano	Diciem	15		
Victoria	"	23		
Vigil d. San José	"	24		
<hr/>				
Victor	Julio	10		
Victor	"	16		
Victor	Agosto	11		
Vito	Julio	5		
Vicente	"	9		

Vicente machi cubini a/pto M.

