



Under the direction of Ana Pereira Ferreira, Leonor Dias Garcia, Marcus Dores and Ofélia Sequeira

Between Lines and Notarial Marks
Documentation Sciences in rebuilding the past

Areia de escrever or arena scriptoria in the materiality of writing

The ink drying processes and their implications

Fernanda Olival, Margarida Nunes, Gláucia Wanzeller Martins, Teresa Ferreira, Ana Claro and Patrícia Moita

Publisher: Publicações do Cidehus
Place of publication: Évora
Published on OpenEdition Books: 28 mai 2024
Series: Biblioteca - Estudos & Colóquios
Digital ISBN: 978-972-778-388-5



<https://books.openedition.org>

DIGITAL REFERENCE

Olival, Fernanda, et al. "Areia De Escrever or Arena Scriptoria in the Materiality of Writing". *Between Lines and Notarial Marks*, edited by Ana Pereira Ferreira et al., Publicações do Cidehus, 2024, <https://doi.org/10.4000/11qir>.

This text was automatically generated on 5 juin 2024.



The PDF format is issued under the Creative Commons - Attribution - Pas d'Utilisation Commerciale - Pas de Modification 4.0 International - CC BY-NC-ND 4.0 license unless otherwise stated.

Areia de escrever or arena scriptoria in the materiality of writing

The ink drying processes and their implications

Fernanda Olival, Margarida Nunes, Gláucia Wanzeller Martins, Teresa Ferreira, Ana Claro and Patrícia Moita

AUTHOR'S NOTE

Work developed within the scope of the following projects, funded by the Fundação para a Ciência e Tecnologia (FCT, Portugal): PTDC/ART-HIS/32327/2017, UIDB/00057/2020 (<https://doi.org/10.54499/UIDB/00057/2020>); UIDB/04449/2020 (<https://doi.org/10.54499/UIDB/04449/2020>); UIDP/04449/2020 (<https://doi.org/10.54499/UIDP/04449/2020>); LA/P/0132/2020 (<https://doi.org/10.54499/LA/P/0132/2020>), UIDB/04666/2020, SFRH/BD/147528/2019, COVID/BD/153467/2023.

Introduction

- 1 Whenever a researcher commences a day of on-site work in an archive, they are greeted with a clean desk. However, by the day's end, having sifted through numerous early modern documents, they often observe small grains, resembling sand, on the table. This is a recurring phenomenon in numerous archives.
- 2 The primary objective of this paper is to investigate the reasons behind this occurrence. In other words, the goal is to analyse the composition of these "powders", elucidate the purpose of using this material in Portugal, and address the impact of this practice on preserving historical sources. These inquiries will be explored for the period from the 16th century to the first two decades of the 19th century, utilising a variety of historical sources such as narratives, treatises (especially those on calligraphy and descriptions of the physical world), administrative documentation (particularly from the Inquisition and various religious institutions), paintings,

museum pieces, and the sand grains themselves, collected from numerous contemporary documents.

- 3 These grains were considered privileged sources, primarily extracted from account books, particularly those of convents, monasteries, and other religious houses, for three reasons: their widespread geographical distribution, the detailed information some of these books provided regarding the procurement of writing materials for the institutions, and their accuracy and reliability in accounting matters, given that many books were subject to periodic inspections by superiors.¹ Additionally, the grains were obtained from the Central Council of the Portuguese Inquisition, known as *Conselho Geral* (GC), through letters sent by this council from Lisbon to the three metropolitan Tribunals of the Holy Office.
- 4 To address this complex research, an interdisciplinary team comprising a historian and palaeographer, a paper conservation scientist, geologists, and chemists handled the diverse materials and information collected. They sought and analysed qualitative, laboratory, and quantitative data on the use of this sand, often referred to as “writing sand” or “areia de escrever”.² The team integrated their knowledge and applied diverse methodologies to answer the presented questions. Specific methodologies will be detailed below.

1. The purpose and function of blotting sands

- 5 Sand or small powder grains appear to have followed the proliferation of paper as a writing support, although they can also be used with parchment. Nevertheless, treatises on calligraphy, particularly the most cited Italian and Castilian works from the 16th century,³ often expressed concern about feathers, paper, and ink, providing instructions and recipes, but not for sand. They do not make extensive references or comments about it.
- 6 For example, in 1524, Tagliente considered as essential instruments for writing: “feathers, penknife, ruler, compass, lead, square, ink, if he wishes to write with ink, and scissors, and good ink, and all these things are necessary for him to learn, or at least most of them”.⁴ In 1550, the Biscayan Juan de Yctar emphasized: “Among the necessary instruments with which those who wish to be a good scribe must be equipped are mainly ink, paper, quill, knives, compass, squares, juniper resin, and rules [system for creating lines]”.⁵
- 7 However, one notable exception from the available research is Johannes Christophorus Rieger’s text, *Introductio in notitiam rerum naturalium et arte factarum*,⁶ dated 1742, where he describes the composition of the “arena scriptoria” as a metallic powder and explains how it was produced.
- 8 In Portugal, administrative sources reveal the direct or indirect presence of sand when describing the necessities for writing. In 1591, the inquisitorial visitor’s entourage disembarked on the island of Madeira without the notary and his equipment, due to attacks on ships by English privateers. Consequently, the visitor purchased essential tools in Funchal, including paper, books, inkwell, feathers, a container for powder, scissors, penknife, thread, string, needles, sealing wax, ink, sand, and a box for storing books and papers.⁷ Similarly, the regulations of the Portuguese Inquisition in 1640 outline the equipment that should be present in the secret archive of each tribunal:

In the same secret archive, there will be two tables [...] with inkwells, scissors, penknives, sand, feathers, ink, thread, needles, wormwood, and paper in abundance

[...] as well as boxed chests to carry the dispatched processes to the *auto-da-fé*, a drawer box where the treasurer can collect the papers [...].⁸

- 9 Among the artefacts in Portuguese museums and early modern Portuguese paintings and engravings,⁹ sanders of various materials¹⁰ are abundant, with those made of lead considered ideal.¹¹ It was a recurrent object in depictions of people with some literacy or academic background until the beginning of the 19th century.
- 10 Curiously, despite its prevalence in material culture, sand is not mentioned in the few known Portuguese treatises on calligraphy from the early modern period, such as those by Giraldo Fernandes de Prado,¹² Manuel Barata,¹³ or the Jesuit António Pessoa (around 1648).¹⁴ Despite the implicit transnational dialogue and direct inspiration among these authors, the omission of sand raises questions. Was sand a material easily dispensed within the practice of writing? Was it readily available and inexpensive, or was its acquisition considered unnecessary? Could those aspiring to write simply collect sand from riverbanks or beaches for their sanders?
- 11 While these sands could serve a decorative purpose,¹⁵ their primary function was to facilitate the rapid drying of fresh ink. A longstanding concern was to ensure that the ink did not drip onto the paper, ensuring quick drying even if it was too runny, without causing smudges. Scribes and others utilised Arabic gum and even juniper resin to address this issue. Regarding the latter, Sebastian Covarrubias explained that paper was rubbed with juniper resin to prevent ink from running.¹⁶ Among other reasons, Arabic gum was added to the ink to increase its viscosity. Sand would function similarly to juniper resin, expediting the drying process.
- 12 Even with the knowledge of the use of blotting paper in Europe during that time, many people preferred sands.¹⁷ In fact, based on the available research, we have only gathered limited evidence on the use of blotting paper in Portugal during the considered period. The term “Papel de mata borrã. *Charta emporetica*” appears in the first printed dictionary of the Portuguese language,¹⁸ and “Mataborrão” (blotter) is found in 1647’s *Thesouro da lingua portuguesa*.¹⁹ In 1716, the word meant poor-quality paper in a repository of knowledge compiled by Portuguese Jesuit Father António Franco and published anonymously.²⁰ In the same year, Raphael Bluteau also defined it as “paper, which is called brown, & without glue, which takes in itself the superfluous ink of what has just been written, & serves to erase the stains, & filter the liquors”.²¹
- 13 Contrastingly, instead of blotting paper, we have ample evidence of the use of sands or “powders” to dry texts from an early period. Consider, for example, this passage from the years 1529–1530, taking into account that it relates to the adolescence of a king’s secretary, the son of another secretary:
- I was not yet fourteen years old when I first saw King D. João, the third, my Lord, who brought me up. It was during the signing of the dispatches for the letters to India. I was quite small, and there were numerous letters to manage. As King signed them and my father retrieved them from His Highness, I would collect them. I would then sprinkle powder, provided by the King (from the sander he had before him) to prevent smudging. I struggled to handle the task due to my youth and lack of experience. I recall King finding much amusement in observing my efforts, acknowledging my earnest attempts to conquer the challenge. Although I did my best to overcome the challenge, the task itself overcame me.²²
- 14 In this case, it is evident how crucial this “powder” or sand was in the process of drying the writing to prevent blotting.
- 15 By examining how historical sources designated sand – with mentions of sand purchases for writing, black sand for desks, and sand for letters²³ –, along with the

contextual details, prices, and involved units of capacity, distinguishing whether religious houses were acquiring sand for writing or for construction purposes becomes relatively straightforward. Moreover, religious institutions were known to purchase silver sand, possibly for sanding tin, as detailed in the Hieronymus Convent of Hawthorn in Évora in 1593.²⁴ In instances related to construction projects, the units of capacity differ significantly from those outlined in Table 1. Terms such as “moios”,²⁵ “cargas”,²⁶ “carradas”,²⁷ and “barcos”²⁸ were utilized. Notably, writing sand is associated with smaller quantities but higher prices, compared to sand procured for construction purposes.

- 16 Shifting our focus to the acquisition of writing sand, the largest quantity obtained in a single transaction within our sample was a bushel (equivalent to one “alqueire”, or twenty “arráteis”) for the Convent of Tomar in 1553.²⁹ The “arrátel” (approximately 0.468 kilograms) emerged as the most frequently mentioned measure in the analysed sources. While notable religious institutions or those closely associated with education, such as the Jesuit College of Porto, could make bulk purchases, it became customary in the 18th century for individuals to acquire just one “arrátel” or even less from the market. If we exclude those engaged in writing as a full-time occupation or the major institutions of the kingdom, the consumption of this material likely proceeded at a leisurely pace.
- 17 According to our findings, religious houses not directly linked to educational purposes acquired writing sand once a year in the studied sample. An experiment with an account book from the Convent of Tentúgal (comprising 421 folios, similar in size to A4 format)³⁰ enabled us to estimate that, upon complete perusal, approximately 30 grams of sand used for drying the writing could be collected. This quantity represents the minimum required. While the actual amount could have been higher, perhaps double, considering that not all grains have endured over time, it is also probable that any surplus grains were promptly gathered for reuse, bringing the total quantity close to the aforementioned 30 grams as a minimum. Consequently, based on the data gleaned from this particular book, one might infer that, on average, one “arrátel” could facilitate the drying of folios in about eight books or a maximum of approximately fifteen similar books. However, this conclusion should be viewed with caution, as it arises from a singular case study, and the presence of heavier minerals in the sand could impact its weight.

Table 1. Acquisition of writing sands in various places in Portugal: Quantities and prices (in “réis”) (1550–1794)

Religious house	Years	Writing sands – unit of capacity mentioned	Quantity bought	Price of each unity (in réis)	Source
Convent of Tomar	1550	Quarter (“quarta”)	3	20	ANTT, <i>Ord. Cristo, Conv. Tomar</i> , L.º 246, f. 14v
Convent of Tomar	1553	Bushel (“alqueire”)	1	120	<i>Ibidem</i> , f. 134
Jesuit College in Porto	1719	«	0.5	480	BNP, Cód. 4512, f. 263
Convent St. Paul the First Hermit at Serra d’Ossa	1704	(“arrátel”)	5	10	BPE, <i>Conv. S. Paulo da Serra d’Ossa</i> , L.º 12
	1786	«	1	?	<i>Ib.</i> , L.º 20, f. 90v, 159v, 180v, 241v, 276.
	1790–1	«	0.5, 1	60	
	1793–4	«	1, 2	80	
Convent of St. Francis in Estremoz	1737	«	1	40	BPE, <i>Conv. S. Francisco de Estremoz</i> , L.º 3, f. 157
Convent of Hawthorn in Évora	1755	«	1	30	BPE, Cód. CLXVII/1–10, f. 29, 406.
	1759	«	2	30	
Convent of S. Domingos in Évora	1755	«	3	30	BPE, Cód. CLXVII/2–20, f. 4
Jesuit College in Porto	1716	(“Canada”)	3	80	BNP, Cód. 4512, f. 258v

- 18 As evident in Table 1, the pricing of writing sand exhibited considerable variability, with no accompanying information on quality factors such as grain fineness, colour intensity, or lustre – elements that could undoubtedly impact prices. To comprehensively understand the price trends, it is crucial to gather additional data from various localities. However, even with the current data, we can highlight that a common price in Évora during the latter half of the 1750s was 30 “réis” per “arrátel”, which can be considered relatively affordable. To put it into perspective, during the same period, the daily wage of a tailor in Évora could afford 5 “arrátéis”, while a mason could afford 9 “arrátéis”.³¹ Additionally, exploring an earlier period in Spain, specifically in 1729, the Spanish polymath Benito Jerónimo Feijoo described these powders as having a modest price, characterizing them as an economical commodity.³² Unfortunately, it remains unknown whether these sands amounted to the reuse of ilmenite waste or not.

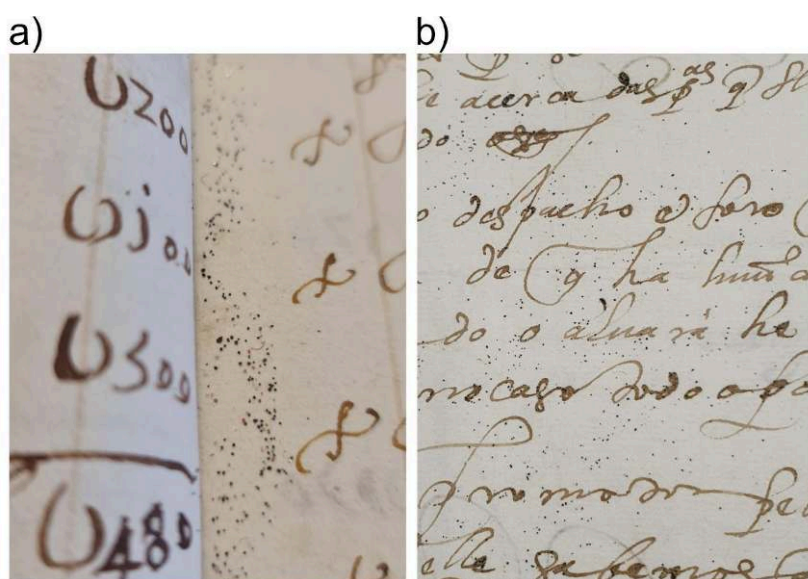
2. Blotting sands in the laboratory

2.1. Sampling

- 19 As explained, blotting samples were sampled from handwritten account books (16th–19th century) belonging to Portuguese religious houses, including from the island of Madeira. Besides, documentation of the Portuguese Inquisition was also inspected and sampled, namely, the correspondence from the General Council of the Holy Office (GC) to the Tribunals of Évora (TE), Lisbon (TL), and Coimbra (TC).

- 20 Loose blotting sands, exemplified in Figure 1, were collected *per folium* by positioning the books on a bookstand with an inclination of 45 degrees. An individual piece of paper was set below each book to collect the blotting sands, which were then transferred into Eppendorf tubes. In cases where this methodology was insufficient to attain the required amount for each sample, another procedure was implemented: the books were placed horizontally and a soft brush was used to sweep the blotting sands into Eppendorf tubes. Each sample was linked to a specific institution and time period in a data set. For clarity, the *criterium* followed in this work was to only present a few representative samples of blotting sands from selected documents, ensuring a palette of materials then used.

Figure 1. Images illustrating loosened blotting sands on the surface of handwritten records from: a) Monastery of St Clare (Porto), ANTT, L.º 67, f. 33v (1655); b) correspondence from the GC to Évora's Inquisition Tribunal, ANTT, *Inquisição de Évora*, L.º 72, f. 127v (1572)



2.2. Methodology and analytical characterisation

- 21 In situ observations of documentation containing blotting sands were carried out with a digital handheld microscope AM7515MZT Dino-Lite Edge, with a resolution of 5 Mpx and in the 20× to 200× magnification range. A 3D Hirox RH-2000 digital microscope with an MXB-5040RZRZ revolver zoom lens in the 140× to 400× magnification range, with top light illumination, was used to acquire high-resolution digital images from the samples' surface.
- 22 Non-destructive (in situ probing) techniques were used for the mineral chemistry study, namely Variable Pressure Scanning Electron Microscopy coupled with Energy-Dispersive X-ray Spectroscopy (VP-SEM/EDS) and micro-Raman spectroscopy (μ -Raman). These techniques involved using electrons and photons, respectively, to interact with the sample, deriving analytical information. In addition, SEM was used for a more in-depth morphological evaluation of the sand grains, and Micro-Fourier Transform Infrared Spectroscopy (μ -FT-IR) was used to characterise the organic materials.

23 For the elemental characterisation, a variable pressure Hitachi S-3700N SEM coupled with a Bruker XFlash[®] 5010 SDD EDX spectrometer with a detector resolution of 123 eV at the Mn K α energy line was used. A pressure of 40 Pa was kept in the chamber, and an accelerating voltage of 20 kV was chosen for the chemical analysis and imaging in the backscattered mode (BSE). Esprit1.9[®] software was used for the compositional studies. Molecular characterisation was done based on Raman and IR spectroscopies. Raman analyses were carried out with a HORIBA XPlora[™] spectrometer equipped with a diode-type laser at 785 nm and coupled with an Olympus microscope with a 50 \times objective (NA 0.75) to focus the laser. The laser power on the sample surface was 1.1 mW, and the spectra were recorded in the 100–3000 cm⁻¹ region (10 to 25 accumulated scans, 5 to 25 s exposure time, 1 cm⁻¹ spectral resolution). The instrument was calibrated using the SI standard (520.6 \pm 0.1 cm⁻¹). IR analyses were conducted with a Bruker Hyperion 3000[®] controlled by OPUS 7.2 software equipped with a Mercury-Cadmium-Telluride (MCT) detector. Transmission and Attenuated Total Reflectance (ATR) modes were used for analysis. The former was performed using a 15 \times objective and a compression microcell EXPress 1.6 mm, STJ-0169, while the ATR analyses were conducted on an 80 μ m diameter Germanium crystal with a 20 \times objective (4 cm⁻¹ spectral resolution with an average of 64 scans within the IR region of 4000–600 cm⁻¹). Spectra interpretation was made based on the IRUG database and published literature.

2.3. Analytical results

2.3.1. Morphological aspects & composition of the blotting materials

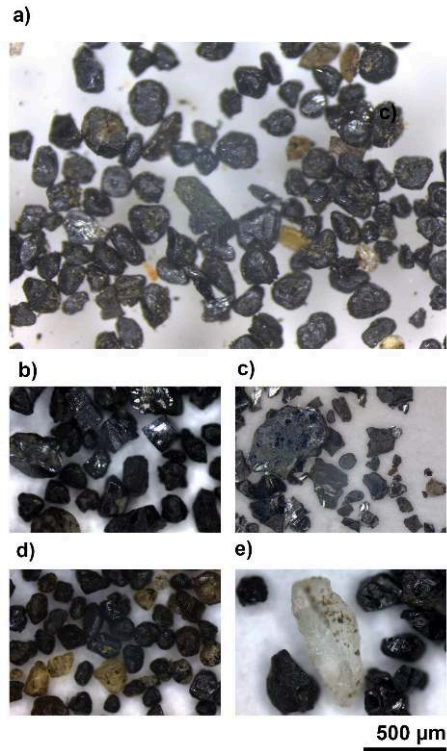
24 Investigating the type of materials used as blotting sands is of utmost importance to deepen our knowledge of past writing materials and techniques. Examples of blotting sands found on some of the handwriting documents studied are illustrated in Figure 2.

Figure 2. Blotting sands deposited on the handwritten records from: a) Monastery of St Clare (SC, Porto), ANTT, L.º 62, f. 62v (1631); b) SC, Porto, ANTT, L.º 64, f. 61v (1642); c) Monastery of the Mother of God (MD, Vinhó), BNP, Co., Cx. 12, M4, D34, f. 17v (1798); d) correspondence from the GC to Coimbra's Inquisition Tribunal, ANTT, *Inquisição de Coimbra*, L.º 31, f. 210r (1722); e) correspondence from the GC to Évora's Inquisition Tribunal, ANTT, *Inquisição de Évora*, L.º 40, f. 273v (1694); f) correspondence from the GC to Lisbon's Inquisition Tribunal, ANTT, *Inquisição de Lisboa*, L.º 160, f. 11v (1784); g) and h) Convent of St Benedict, BNP, Co. Org. Cx. 18, D5 (1743)



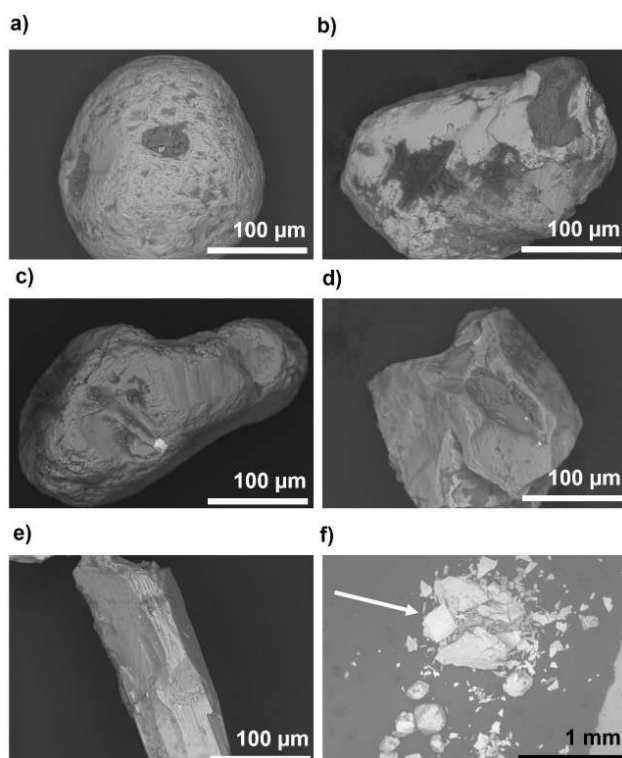
- 25 These particles were commonly sprinkled on the writings while the ink was still fresh, thus hastening the drying process. It was a widespread and common practice in Portugal and Spain, and is also documented in some central and north-western European countries, such as Switzerland and Germany, using current geography.³³
- 26 “Blotting sands” encompass a range of materials, although the assemblage examined in this study is dominated by mixtures of minerals grains (Figure 2a–2f). In a few cases, these mineral mixtures were found together with organic materials (Figure 2g and 2h).
- 27 Concerning the mineral fraction, the samples comprised small-sized grains (~0.20–0.45 mm) clearly dominated by black sands (Figure 3a–3c). Most grains showed a black and grey colour with a metallic lustre. Moreover, a closer look shed light on a few translucent grains with distinct colours ranging from light brown to grey and yellow with a vitreous-greasy lustre, i.e., glass-grease like aspect, respectively (Figures 3c and 3d).

Figure 3. Digital images of the blotting sands showing the presence of different minerals among the samples' set: a) black sands and b) mixture of black and greyish grains from St Monica Convent (SMo, Évora), BNP, Co., Cx. 8, M6 (1816); c) yellowish grains from a sample of the GC's correspondence to Coimbra's Inquisition Tribunal, ANTT, *Inquisição de Coimbra*, L.º 79, (1700); d) translucent grain in a BNP sample, Cod. 8448, D3 (1780)



- 28 Studying the grain's size and shape is crucial to better understand the mineral's life history. When transported away from the parent rock, the sediments undergo a progressive morphological alteration due to physical interactions (abrasion). The resulting grains morphology is commonly described as "textural maturity", i.e., "the degree to which physical characteristics of grains and populations of grains approach the ultimate end product".³⁴ The degree of these alterations is linked strictly to the mineral's chemical composition and crystal lattice; however, irrespective of their nature, well-rounded and rounded grains are associated with medium to long-distance transport and correspond to the so-called "mature sediments".³⁵ On the other hand, sub-angular to angular grains indicate sediments with a low textural maturity.
- 29 We have investigated the mineral morphology to get more insights into their textural maturity. OM (optical microscopy) and SEM observations were conducted to study the dimension and morphological characteristics of the sample's grains. In Figures 4a–4c, BSE micrographs (a particular type of images obtained with a SEM microscope) revealed that the grains present a high occurrence of well-rounded to sub-rounded shapes when considering the sharpness of the grain corners. Nevertheless, more angular grain shapes that can be classified as sub-angular to very angular were also observed (Figures 4d and 4f), but less frequently. Regarding the grains' sphericity (i.e., how much a grain shape approximates that of a sphere³⁶), Figure 4 exemplifies both high (Figure 4a) and low (Figure 4e) spherical shapes with the high spherical grains more often observed.

Figure 4. BSE micrographs illustrating the blotting sands' textural properties: a), b) well-rounded grain to rounded grains, and c) sub-rounded grain with pits, in a sample from St Monica Convent (SMo, Évora), BNP, Co., Cx. 8, M6 (1816); d) sub-angular, e) angular, and f) very angular grain (white arrow), in a sample from St Francis Convent (SF, Porto), BNP, Co., Cx. 15, M1, D13.4, f. 22 (1811)

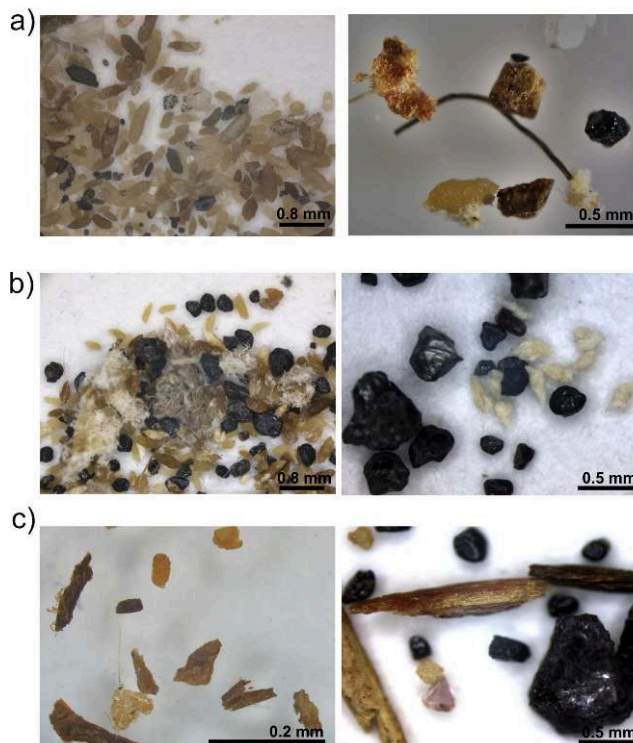


- 30 The morphological grain evaluation showed that the samples mainly comprise mature sediments with high sphericity, suggesting that the grains underwent prolonged abrasion during transportation after erosion due to mechanical weathering. Grain-to-grain collisions and chemical processes are likely responsible for this dominant morphology.
- 31 The combined use of VP-SEM/EDS and Raman spectroscopy yielded a limited mineralogical composition range for the blotting sands, dominated by iron-containing minerals, such as Fe-Ti oxides (ilmenite), followed by Fe oxides (e.g., haematite, magnetite). These minerals have a characteristic metallic lustre and, once deposited, they confer a shining appearance to the writings. Hence, one might hypothesise that the sands were used to dry and also embellish the writings.
- 32 Moreover, iron minerals with magnetic properties are likely to exist within the iron oxide ore; however, they could not be identified accurately by Raman spectroscopy. A straightforward but empirical approach was based on using a hand-magnet to evaluate the sands' magnetic behaviour. Approximately 10 to 30% of each sample was attracted to the magnet, confirming that minerals with magnetic properties are also present. Magnetite, maghemite, or even single-mineral grains hosting these minerals, like haematite grains hosting magnetite and titanomagnetite, are good candidates for the magnetic behaviour observed.³⁷
- 33 Silicates, such as almandine, quartz and zircon, were also identified. Almandine and quartz were frequently observed, unlike zircon. Almandine was found colourless, but also in light rose and brownish colours, while quartz occurred mainly in white and

yellowish hues, with colourless grains being sometimes noticed. Zircon grains occurred mainly in a reddish-brown colour. These silicates showed a vitreous lustre. Ilmenite, Fe oxides (haematite) and silicates (almandine and quartz) can be considered the major group of minerals within the samples, since they were generally found in higher amounts and in the high frequency of occurrence per sample.

- 34 A minor group of minerals, dominated by Ti oxides in the form of rutile and anatase, is observed in a lower frequency of occurrence. Other minerals, such as phosphates (i.e., apatite, REE-rich minerals), carbonates (e.g., calcite, dolomite) oxides (e.g., cassiterite) and sulphide (galena), were sparsely identified. This last group of minerals differentiates the blotting sands from the religious houses, showing a broader diversity than that observed in the samples collected from the Tribunals of the Inquisition samples.
- 35 As previously said, some blotting sands minerals were mixed with minor fractions of organic materials (Figure 5a–5c). Curiously, this typology of blotting sands was only found in the documents of the religious houses. No evidence of organic materials was observed in the Inquisition documents. Some examples of deliberately added to the minerals are small-sized gum particles, paper cocoons, and bone shavings. The materials were inspected by OM and SEM and identified through FT-IR spectroscopy (data not shown). Amongst the organic materials, gum was found in higher amounts and frequency of occurrence, followed by paper cocoons. Oppositely, bone shavings were scarcely observed.

Figure 5. a) OM image of gum particles together with sand grains and few textile fibres (*left*) found in a sample from the convent of Order of St Benedict (Lisbon), BNP, Co., Cx. 18, D5 (1743) and insect (*right*); b) mixture of sand grains together with gum particles, paper cocoons and paper fibres (*left*) and an OM magnification (*right*) of the paper cocoons mixed with sand grains in a sample from the Monastery of St Clare (Funchal, Madeira); c) OM image of a sample from the Convent of Our Lady of Incarnation (OLI, Funchal, Madeira), ANTT, L.º 10 (1676), showing a mixture of organic materials (*left*) where bone shaves (*right*) were also observed



- 36 According to the literature,³⁸ sandarac resin and cuttlefish bones were used as pounce materials. This procedure (to pounce, a bastardisation of the French *pumice*³⁹) was performed by sprinkling the pounce materials and rubbing them to soften the supports and aid uniformity, improving the ink's adherence before writing.⁴⁰ Pounce effectively made the paper less absorbent, avoiding ink bleeding.⁴¹ Nevertheless, gum particles were only found mixed with the minerals and not alone in the paper, which critically points out that they were deliberately added to the minerals to produce different blotting sands.
- 37 The use of small paper cocoons is not surprising, considering that it is an absorbent material, which would promote ink absorption, thus shortening the drying time of the ink. As far as we know, its usage as blotting material is not reported in the literature.

2.3.2. Processing methods, provenance insights and selection criteria

- 38 As previously mentioned, these blotting sands were generally characterised as texturally mature sediments due to the grains' small size (~0.20–0.45 mm) and rounded to well-rounded shapes. It is known that a large concentration of heavy minerals (black sands) presenting the aforesaid textural properties is not a naturally-occurring group in geographical settings, including Portugal. Thus, these results suggest careful selection processes were undertaken to gather the blotting sands. For instance,

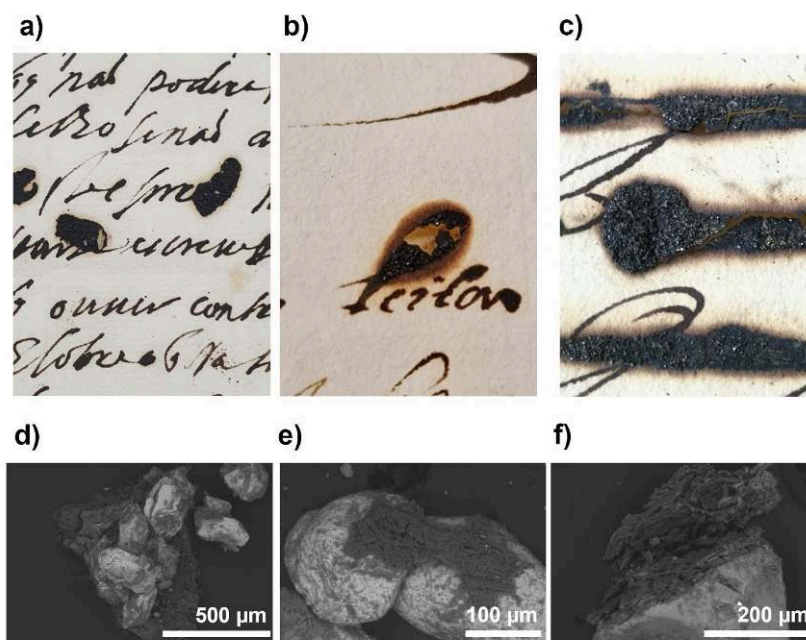
processing techniques, such as sieving and panning, were used. According to the literature,⁴² ordinary sand comprises minerals such as feldspars, mica and iron ores, with quartz as the dominant constituent. Silicates and calcareous minerals have a lower density than heavy minerals. Processing procedures like mechanical panning, which involves collecting the sands into a pan and submerging them in water with the pan vigorously twisting to promote the heavier minerals to settle at the bottom (i.e., gravity separation by density), was probably used.⁴³ This technique would provide a final product rich in heavy minerals with fine granulometry. Already used in the 16th century⁴⁴, mechanical panning was commonly associated with gold recovery. Nonetheless, it could also be applied when selecting heavy minerals for blotting sands. Importantly, in Germany, 18th-century encyclopaedias described refinements and other procedures to select and produce writing sand, such as grinding, washing, sieving, annealing, freezing and thawing, boiling in potassium dye, and leaching with acetic acid.⁴⁵ Doctor Johann Christoph Rieger (Prussia, c. 1696 – Haia, 1774) makes a similar description in his *Introductio in notitiam rerum naturalium et arte factarum*,⁴⁶ published in 1742 and already mentioned in this article.

- 39 Assignment of the most probable geographical origin for these blotting sands is a very ambitious and complex task due to the remarkable similarity in their morphology and composition. Nevertheless, some considerations can be drawn. Firstly, considering the Inquisition documents, the analytical study suggested that the blotting sands derived from deposits with similar provenance. Grain-to-grain collisions in an aqueous environment during medium-to-long-distance transportation or intense and prolonged wave reworking are likely responsible for the dominant morphology. Hence, depositional environments like beach deposits, stream channels, lakes or the mouth of the rivers could be pointed out as the sediments' source. For example, the sedimentary deposits in the Tagus River margins, enriched in heavy minerals, could be a potential source. Moreover, according to the literature, deposits of variable quantities of heavy minerals were found in some Portuguese beaches (Praia Grande, Sintra, Lisbon, and S. Torpes, Sines, Setúbal). Considering the geological studies on some beaches in Setúbal and Lisbon regions and their geographical vicinity to the capital, it is possible that these beaches were the suppliers for the blotting sands used by the Inquisition.
- 40 Regarding the blotting sands from the religious house's documents, morphological and mineralogical differences were found, differentiating these sands as to their origins from those of the Inquisition and even among themselves. Correlations between the blotting sands' properties and composition and the geological contexts of the religious houses seem to indicate that, in most cases, the blotting sands had a local origin. The blotting sands from the island of Madeira was a particular case that left no doubt. The grains used in the convents from Funchal presented characteristic properties, strongly suggesting that the sands were locally collected. In other words, the sediments were less mature when compared to those from mainland Portugal. Additionally, the composition of the sands from both the convent of Our Lady of Incarnation and St Clare (Funchal) showed high similarity.
- 41 Ultimately, the beautiful black colour and shiny appearance of these materials may have played a key role in their choice. While drying the ink, they could simultaneously highlight the writings. One argument favouring the Portuguese taste is that the uniformity of the blotting sands used in the country contrasts with the vast diversity of materials found in central Europe (i.e., Switzerland and Germany) and western Asia (e.g., Yemen).

3. Conservation aspects

- 42 One of the core objectives of this study was to catalyse the development of strategies related to the preservation and conservation of written heritage that involves blotting sands.
- 43 Regarding conservation practices, there are no clear guidelines on what to do and how to proceed when handling blotting sands accumulated on the spine-folds of the gatherings or adhering to the writings.⁴⁷ Should these tiny particles be kept or removed when developing conservation treatments on written heritage? What conservation procedures can or should be performed when working on items with blotting sands?
- 44 The accumulation of blotting sands on the writings may cause damaging effects on the writing support. During the period under study (16th–19th century), the ink in vogue was the iron-gall ink, an indelible black ink that promoted the degradation of the writing supports, mainly because of its high acidity.⁴⁸ For that reason, these documents are often very fragile, presenting conservation issues, such as the embrittlement of the support, gaps, and fissures. The accumulation of blotting sands will exert an extra weight on the paper's surface, contributing to the physical decay of the supports (Figures 6a–6b). However, their removal during conservation works might promote additional abrasion and subsequent disintegration. Fortunately, in most cases, blotting sands are not massively found covering the writings, and only some grains still adhere to the ink surface.
- 45 Besides, loose sand grains drag fibres and even small pieces of writing support and ink (Figures 6d–6f), damaging the paper surface by leaving gaps or fissuring the areas from where they were released (Figure 6). An additional conservation issue is that the sand particles can accumulate in the spine-folds and sewing structure, leading to undesired long-term effects.

Figure 6. Examples of writings showing a high amount of blotting sands adhered to the support presenting gaps and fissures: a) correspondence from the GC to Coimbra's Inquisition Tribunal, ANTT, L.º 22, f. 85v; b) Monastery of St Clare (SC, Porto), ANTT, L.º 73, f. 133v; c) BNP, Co., Cx. 10, M2, D5; d)–f) BSE micrographs illustrating representative loose blotting sands with adhered paper fibres, ink and dust



- 46 From their practical experience, the authors consider that blotting sands adhered to the writing texts should not be removed to avoid damaging the support and losing historical information. Conversely, the loose blotting sands should be carefully removed while handling the documents, then preserved and identified, thus ensuring the possibility to conduct further research. Blotting sand removal addresses ethical dilemmas that should be considered and discussed with a broader audience with different expertise.

Final remarks

- 47 Similar to sands used for silver sanding and tin, there were also sands custom-built for writing, specifically processed to dry ink and prevent smudging. These were aptly termed writing sands or “arena scriptoria” in Latin. This phenomenon was not exclusive to a particular region of Europe in the Early Modern times, as Johannes Amosius Comenius succinctly noted in 1658: “Scripturam siccamus, chartâ bibulâ, vel arenâ scriptoriâ, ex Thecâpulverariâ”.⁴⁹ In Spain, as early as Covarrubias’ dictionary in 1611, a distinct term existed for these sands: “polvos de cartas”,⁵⁰ an expression also acknowledged in Portugal.
- 48 This paper reveals that surveys on blotting sands yielded unforeseen findings, challenging existing literature. The study identified an unexpected, standardised assemblage of blotting sands, a stark departure from the diverse materials used in different parts of Central Europe, such as the areas of present-day Switzerland and Germany. Given this revelation, it is unsurprising that the selection of these materials was guided by diverse criteria in different locations. Were these criteria influenced by

raw material availability, economic considerations, matters of decorum, or the drying effectiveness of the sands? While the hypothesis regarding drying effectiveness may hold merit, further research is required to delve deeper into this subject.

- 49 Given the meticulous selection of grains involved in these sands, understanding who treated the product for market readiness becomes important. Uncovering patterns in the types of blotting sands used in various regions, such as the Iberian Peninsula, could shed light on the demand for these writing tools, possibly driven by adjustments in handwriting practices or other factors. Exploring whether similar materials were used in these regions can provide additional insights.
- 50 Furthermore, blotting sands played a crucial role in writing practices, and historical studies should allocate more attention to this material. Examining the purchasing practices of these sands is essential while studying the history of writing and consumption patterns of writing tools across different European regions. This approach involves investigating the types of materials, quantities, trade units, costs, and prices within this context. Deepening our understanding of these dynamics opens avenues for investigating materials' availability and the criteria used by vendors and other partners in their selection.
- 51 In conclusion, literature addressing the usage of writing tools should expand to incorporate perspectives on blotting sands. A forthcoming interdisciplinary study, encompassing materiality, history, and conservation, should also include into these topics the materials, writing practices, trade, and consumption patterns of blotting sands within the European context. Moreover, deepening our knowledge of these materials is vital for addressing conservation challenges. We have led off with this work, paving the way for future studies.

BIBLIOGRAPHY

- AZÉMARD, Clara; MÉNAGER, Matthieu; VIEILLESZAZES, Cathy (2017) – On the tracks of sandarac, review and chemical analysis. *Environmental Science and Pollution Research* [online]. Vol. 24, no. 36: pp. 27746–27754.
- BARATA, Manuel (1590) – *Exemplares de diversas sortes de letras tirados da Polygraphia de Manuel Baratta, escriptor português acrescentados pelo mesmo autor... Acostados a eles hum Tratado de arismética e outro de Ortographia portuguesa*. Lisboa: Antonio Aluarez.
- BLADO, Antonio (1548) – “De gli instrvmenti”. In Giovanni Battista Palatino – *Libro di M. Giouambattista Palatino, cittadino romano: nel qual s’insegna a scriuer ogni sorte lettera, antica, et moderna, di qualunque natione, con le sue regole, et misure, et essempi: et con un breue, et util discorso de le cifre*. [S.l.]: [s.n.].
- BLAKE, Liza (2018) – Pounced Corrections in Oxford Copies of Cavendish’s *Philosophical and Physical Opinions*; or, Margaret Cavendish’s Glitter Pen. *New College Notes* [online]. Vol. 10, no. 6. Available at <https://tspace.library.utoronto.ca/handle/1807/110954>
- BLUTEAU, Rafael (1716) – *Vocabulario Portuguez e Latino*. Lisboa: Oficina de Pascoal da Sylva, vol. V.

- CAMPOS DE ANDRADA, Ernesto (ed.) (1937) – *Relações de Pero de Alcáçova Carneiro Conde da Idanha do tempo que êle e seu pai, António Carneiro, serviram de secretários (1515 a 1568)*. Lisboa: Imprensa Nacional de Lisboa.
- CARDOSO, Jerónimo (1569–1570) – *Dictionarium latino lusitanicum & vice versa lusitânico latinu[m]...*, Conimbricæ: excussit Joan. Barrerius.
- COMENIUS, Johannes Amosius (1658) – “We dry the texts with absorbent paper or with writing sands from the sanders”. *Orbis sensualium pictus. Die sichtbare Welt...*, cap. XCI. Noribergæ, Tyois & Sumptibus Michael Endter.
- COVARRUBIAS HOROZCO, Sebastián (1611) – *Tesoro de la lengua castellana, o española*. Madrid: Luis Sanchez.
- DOVER, James H.; BERRY, W. B. N.; ROSS, JR., R. J. (1980) – *Ordovician And Silurian Phi Kappa and Trail Creek Formations, Pioneer Mountains, Central Idaho—Stratigraphic and Structural Revisions, and New Data on Graptolite Faunas*. Washington: United States Government Printing Office.
- FEIJOO, Benito Jerónimo (2003) – *Teatro crítico universal, o discursos vários en todo género de matérias, para desengano de errores comunes*. Madrid: CORDE – Real Academia Española (Madrid).
- FRIEDMAN, Hershel (2022) – Panning. *The Mineral and Gemstone Kingdom* [online]. [Consult. 20 February 2023]. Available at https://www.minerals.net/mineral_glossary/panning.aspx
- GIAMBASTIANI, Kurt (2016) – Paper, Ink, Sand, Pounce. Kurt R.A. *Giambastiani: Words and Works from a Seattle Author* [online]. Seattle [consult. 19 February 2023]. Available at <https://seattleauthor.com/2016/07/06/paper-ink-sand-pounce/>
- GRACE, John R.; EBNEYAMINI, Arian (2021) – Connecting particle sphericity and circularity. *Particuology* [online]. Vol. 54: pp. 1–4.
- HOU, Baohong; KEELING, John; VAN GOSEN; Bradley S. (2017) – Geological and Exploration Models of Beach Placer Deposits, Integrated from Case-Studies of Southern Australia. *Ore Geology Reviews* [online]. Vol. 80: pp. 437–459.
- JUBB, Aaron M.; ALLEN, Heather C. (2010) – Vibrational Spectroscopic Characterization of Hematite, Maghemite, and Magnetite Thin Films Produced by Vapor Deposition. *ACS Applied Materials & Interfaces* [online]. Vol. 2, no. 10: pp. 2804–2812.
- MARTÍNEZ PEREIRA, Ana (2006) – *Manuales de escritura de los siglos de oro: Repertorio crítico y analítico de obras manuscritas e impresas*. Mérida: Editora Regional de Extremadura.
- MILKE, Ralf (2012) – Geomaterials in the manuscript archive: the composition of writing sands and the regional distribution of writing-sand types in SW-Germany and northern Switzerland, 14th to 19th century. *European Journal of Mineralogy* [online]. Vol. 24, no. 4: pp. 759–770.
- NUNES, Margarida; OLIVAL, Fernanda; MITCHELL, Scott G.; CLARO, Ana; FERREIRA, Teresa (2023) – A holistic approach to understanding the iron-gall inks in the historical documents of the Portuguese Inquisition (1570–1790). *Micron* [online]. Vol. 165: 103396.
- OLIVAL, Fernanda; SEQUEIRA, Ofélia; BRANCO CORREIA, Fernando (2023) – “Transcrição dos Tratados”. In Claro, Ana; Ferreira, Teresa; Reis Miranda, Tiago C. P. dos; Nunes, Margarida (eds.) – *Ortographia Arithmetica e Sciencias: três tratados do P.^e António Pessoa, S.J. (c. 1648)*. Lisboa: Scribe, pp. 193–264.
- PALATINO, Giovanni Battista (1548) – *Libro di M. Giouambattista Palatino, cittadino romano: nel qual s’insegna a scriuer ogni sorte lettera, antica, et moderna, di qualunque natione, con le sue regole, et misure, et essempli: et con un breue, et util discorso de le cifre*. S.l: s.n.

- PEREIRA, Bento (1647) – *Thesouro da lingua portuguesa*. Lisboa: na oficina de Paulo Craesbeeck & à sua custa.
- PETTIJOHN, Francis (1949) – *Sedimentary Rocks*, 3rd ed. New York: Harper and Row.
- POMEY, François-Antoine; ÁLVARES, Manuel (1716) – *Indiculu universal: contém distinctos em suas classes os nomes de quazi todas as couzas, que há no mundo, & os nomes de todas as artes, & sciencias*. Évora: Officina da Universidade.
- PRADO, Giraldo Fernandes de (2019) – “Caligrafia”. In Monteiro, Patrícia; Serrão, Vítor (coord.) – *Primeiros tratados de pintura*. S.l: Círculo de Leitores, pp. 285–367.
- Prices, Wages and Rents in Portugal 1300-1910* (s.d.) [online]. Lisboa [consult. 21 February 2023]. Available at http://pwr-portugal.ics.ul.pt/?page_id=64
- REGOURD, Anne; SCHEPER, Karin (2018) – Shifting sands of writing inks in Yemen: The occurrence of Sparkling Particles in Yemeni Manuscripts. *Chroniques du manuscrit au Yémen* [online]. Vol. 7, no. 26: pp. 141–183. Available at <https://hdl.handle.net/1887/81341>
- RESENTINI, Alberto; ANDÒ, Sergio; GARZANTI, Eduardo (2018) – Quantifying Roundness of Detrital Minerals By Image Analysis: Sediment Transport, Shape Effects, and Provenance Implications. *Journal of Sedimentary Research* [online]. Vol. 88, no. 2: pp. 276–289.
- RIEGER, Johannes Christophorus (1742) – *Introductio in notitiam rerum naturalium et arte factarum*. Hagae Comitum, Apud Petrum Gosse, vol. I.
- TAGLIENTE, Giovanni Antonio (1524) – *Lo presente libro Insegna La vera arte delo Excellente scriuere de diuerse varie sorti de litere... Opera del Tagliente... (intagliato per Eustachio Cellebrino da Vdene)*. Veneza: s.n.
- TAN, Wei [et al.] (2016) – Mineralogy and origin of exsolution in Ti-rich magnetite from different magmatic Fe-Ti oxide-bearing intrusions. *The Canadian Mineralogist* [online]. Vol. 54, no. 3: pp. 539–553.
- YCTAR, Juan de (1550) – *Arte subtilissima, por la qual se enseña a escreuir perfectamente hecho y experimentado, y agora de nueuo añadido, por Juan de Uciar vizcayno*. Zaragoza: Pedro Bernuz.

FOOTNOTES

1. One example among many: Biblioteca Pública de Évora (BPE), Cód. CLXVII/1–10, f. 105 (in the year 1760).
2. BPE, Cód. CLXVII/1–10, f. 302; BPE, Cód. CLXVIII/1–2, f. 60.
3. For an inventory, see: Martínez Pereira, 2006, 121–478.
4. Tagliente, 1524, f. 21v: “Penne, temperatore, riga, compasso, piombo, squadra, vernice, se con vernice vorai scrivere, et forfice, et bono ingiostro, e tutte queste cose te sono necessarie al tuo imparare o vero la maggiore parte de essi”.
5. Yctar, 1550, f. 68: “Entre los instrumentos necesarios, y de que se deue de proueer qualquiera que se precia de ser buen escriuano: son principalmente, tinta, papel, plumas, cuchillos, compas, esquadra, glassa [goma de enebro], y reglas .&c”.
6. Rieger, 1742, *sub voce* “arena”.

7. Arquivo Nacional Torre do Tombo (ANTT), *Inquisição de Lisboa*, L.º 789, f. 62v–69.
8. *Regimento da Inquisição de 1640*, L.º 1, tít. II, § 6: “No mesmo secreto estarão duas mesas [...] com tinteiros, tesouras, canivetes, areia, penas, tinta, linhas, agulhas, obreia e papel em abundância [...] e bem assim arcas encoiradas para levar ao auto-de-fé os processos despachados, um caixão de gavetas em que o tesoureiro possa recolher os papéis [...]”.
9. An example: National Museum of Ancient Art [Lisbon], Inventory Number: 22386 TC. See also: Francisco António da Silva Oeirense, *Francisco Gomes da Silva* [Visual gráfico] / F.A. Silva Oeirensis *ad vivum delineavit*; *Dominicus Jozeph da Silva sculpsit*. [S.l.]: [s.n.], 1822 (BNP, Colecção de retratos dos Heróis de 1820).
10. Alberto Sampaio’s Museum, in Guimarães, Inventory Number: MAS OD 4, MAS OD 5 and MAS OD 6; Museum of Lamego, Inventory Number: 17761 TC.
11. Blado, 1548; Palatino, 1548; Juan de Yctar, 1550, f. 62v.
12. Prado, 2019, 285–367.
13. Barata, 1590.
14. BPE, *Manizola*, Cód. 99, published in Olival *et al.*, 2023.
15. Blake, 2018, 3.
16. Covarrubias Horozco, 1611, s.v. “Grasa”.
17. Milke, 2012, 759.
18. Cardoso, 1569–1570.
19. Pereira, 1647.
20. Pomey *et al.*, 1716, 436.
21. Bluteau, 1716, *sub voce* “mataborrão”: “Papel, a que chamão pacento, pardo, & sem cola, que toma em si a tinta supérflua do que se acabou de escrever, & serve de apagar borroens, & filtrar licores”.
22. Campos de Andrada, 1937, x: “Não era ainda de catorze anos quando vi pela primeira vez a El-Rei DJoão, o terceiro, meu Senhor, que me criou, e foi em uma assinatura das vias das cartas da Índia; e era eu tão pequeno e as cartas tantas, que, quando as El-Rei assinava e meu pai as tirava a Sua Alteza, depois de as ter assinadas, as recolhia eu, e lançava pó que El-Rei me dava da poeira que tinha ante si, para se não borrarrem os sinais, que me não podia eu bem valer para as poder recolher bem. E lembra-me que ria El-Rei muito de como eu me afadigava com êste trabalho, por me achar tão novo e desacostumado nêle, vendo que, fazendo eu tudo o que podia para o vencer, o mesmo trabalho me vencia a mim”.
23. For instance, BNP, Cód. 4512, f. 263: “Por meio alqueire de areia para as cartas ----- 240” [réis], in the year 1719.
24. BPE, Cód. CLXVIII/1–34, f. without number.
25. BPE, *Convento de São João da Penitência de Estremoz*, L.º 13, f. 35, L.º 38, f. 4v and 155, L.º 49, f. 235v; BPE, Cód. CLXV/1–34, f. 31v.
26. BPE, Cód. CLXVII/1–7, fl. 172; BPE, Cód. CLXVII/1–8, fl. 11, 20v, 30v, 33, 50, 54v, *passim*; BPE, *Convento de Santa Catarina de Sena*, L.º 45, f. 13v.

27. BPE, *Convento de Santa Catarina de Sena*, L.º 45, f. 13v; ANTT, *Ordem dos Carmelitas Descalços, Convento de Nossa Senhora da Conceição de Lisboa*, liv. 1, f. 5.
28. ANTT, *Ordem do Carmo, Província, Conv. N. Sr.ª Carmo de Lisboa*, Mç. 4–6.
29. ANTT, *Ord. Cristo, Conv. Tomar*, L.º 246, f. 134: 120 reais, “que pagaram de um alqueire de areia preta que se comprou para escrever”.
30. ANTT, *Ord. do Carmo, Conv. de N. S. da Natividade de Tentúgal*, L.º 39.
31. For measurement equivalents and wages, we consulted the project *Prices, Wages and Rents in Portugal 1300–1910*.
32. Feijoo, 2003, 173.
33. Feijoo, 2003, 173; Milke, 2012, 759.
34. Pettijohn, 1949.
35. Resentini *et al.*, 2018.
36. Grace, 2021.
37. Jubb *et al.*, 2010, 2804; Tan *et al.*, 2016, 539.
38. Covarrubias Horozco, 1611, s.v. “Grasa”; Azémard *et al.*, 2017, 27746; Blake, 2018, 3..
39. Giambastiani, 2016.
40. Pereira, 1647, *sub voce* “Mataborrão”; Bluteau, 1716, *sub voce* “mataborrão”.
41. Pomey *et al.*, 1716, 436.
42. Hou *et al.*, 2017, 437.
43. Dover *et al.*, 1980; Friedman, 2022.
44. Dover *et al.*, 1980.
45. Milke, 2012, 759.
46. Rieger, 1742, *sub voce* “arena”.
47. Regourd *et al.*, 2018.
48. Nunes *et al.*, 2023.
49. Comenius, 1658.
50. Covarrubias Horozco, 1611, s.v. “Polvos de cartas”.

ABSTRACTS

Com a investigação desenvolvida por esta equipa interdisciplinar, confirma-se a existência de uma areia processada para secar os textos nos séculos xvi–xix, em Portugal. Embora semelhante ao que aparecia em outros pontos da Europa, tinha as suas especificidades. Era a «areia de escrever», que muitos conventos e casas religiosas da época adquiriam. A sua composição podia variar, sendo constituída essencialmente por minerais (sobretudo ilmenite), a que se podiam juntar resíduos orgânicos.

Estas areias representam hoje uma importante fonte histórica que tem sido negligenciada. Retirá-las pode implicar danos na mancha de texto e coloca sérios problemas éticos.

The research conducted by this interdisciplinary team corroborates the existence of a distinct type of sand used for drying texts in Portugal during the 16th to 19th centuries. Although it shares similarities with materials found in other parts of Europe, these sands exhibit specific characteristics. Referred to as “writing sand”, it was frequently acquired by many convents and religious houses of that period. Its composition varied, primarily comprising minerals (mostly ilmenite), with the potential addition of an organic component.

These sands represent a valuable historical source that has been overlooked. In terms of manuscript preservation, removing them may result in damage to the written text and pose significant ethical concerns.

INDEX

Keywords: materiality of writing, sanders, writing sand, ink drying, document preservation

Palavras chaves: materialidade da escrita, areiros, areia de escrever, secagem da tinta, preservação documental

AUTHORS

Fernanda Olival
CIDEHUS
University of Évora, Portugal

Margarida Nunes
HERCULES Laboratory / IN2PAST
University of Évora, Portugal

Gláucia Wanzeller Martins
HERCULES Laboratory / IN2PAST
University of Évora, Portugal

Teresa Ferreira
HERCULES Laboratory / IN2PAST
Chemistry and Biochemistry Department, Sciences and Technology School
University of Évora, Portugal

Ana Claro
CHAM – Centre for the Humanities
College of Social and Human Sciences
University of Évora, Portugal

Patrícia Moita

HERCULES Laboratory / IN2PAST
Geosciences Department, Sciences and Technology School
University of Évora, Portugal