

Comparative Oriental Manuscript Studies

An Introduction

Comparative Oriental Manuscript Studies

An Introduction

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Preface

The present introductory handbook on comparative oriental manuscript studies is the main achievement of the Research Networking Programme ‘Comparative Oriental Manuscript Studies’ (COMSt), funded by the European Science Foundation from June 2009 to May 2014. Within the framework of the five-year programme, several hundred scholars from ‘central’ as well as ‘marginal’ fields related to manuscript study and research had the opportunity of exchanging ideas and discussing diverse approaches, looking for common ground and a better understanding of the others’ reasons and methodology in manuscript studies: from codicology to palaeography, from textual criticism and scholarly editing to cataloguing as well as conservation and preservation issues, and always taking into account the increasing importance of digital scholarship and the natural sciences.

Out of the larger community of COMSt members and associates, a smaller group of scholars and experts have enthusiastically accepted the challenge of contributing one or more pieces to this handbook, being convinced of the importance of presenting in a compact form not only the state of the art but a coordinated reflection on a wide range of selected themes on comparative manuscript studies. Working together, sometimes in unpredictable grouping constellations, they carried out their task to the best of their abilities. For all this, all those who have *volunteered* to contribute to this enterprise deserve the deepest gratitude.

The handbook is the result of joint and cooperative work both within each of the five Teams of the programme and across the Teams. Each Team was directed and coordinated by a Team-Leader (and in some cases by a Co-Leader) who assumed the major responsibility of the work. The central management of the project was provided by the Project Coordinator in Hamburg, and the general supervision, by an international Steering Committee representing the countries and their respective funding institutions (national research councils and/or academies as well as single universities in some cases) which made the COMSt project possible through the European Science Foundation. They are, in alphabetical order, Belgium, Cyprus, Denmark, France, Germany, Greece, Israel, Italy, the Netherlands, Norway, Slovakia, Sweden, and Switzerland. It has been my honour to chair the Steering Committee since December 2009, when my predecessor and co-applicant for the COMSt project, Siegbert Uhlig, resigned. During the second phase of the project, which was more directly focused on the preparation of the handbook, an Editorial Board composed of the Team Leaders and a few members of the Steering Committee took the most important decisions related to this task. Throughout the project runtime, the organizational umbrella was provided by the European Science Foundation as the funding institution and by its Standing Committee for the Humanities.

Peer reviewing was a major asset of the network. Besides undergoing the obligatory mid-term and final evaluations by the European Science Foundation, the COMSt programme continuously subjected itself to an internal review process. It is now time to face a more crucial trial, namely the verdict of our readers as to whether the cooperative and comparative approach is indeed so sound, fruitful and useful that it might set standards for future research. What is certain even now is that many people who have taken part in COMSt share the feeling that the scholarly and human experience acquired during this project will last a long time.

Some explanation is due to the larger community of all those who have participated in COMSt activities in the last few years on how the work was actually conducted. We may certainly state that neither the Steering Committee nor the Editorial Board have ever reduced ‘formalities’ in the technical sense to ‘simple formalities’. In projects such as COMSt, formalities are matters of substance indeed, and they were approached accordingly. Every application for a workshop or a travel grant, report, minutes, every draft submitted for the present volume, all were openly and thoroughly discussed, without any pre-determined result. There may be projects where any question is settled in a two-minute discussion, or even without any discussion at all. In the case of COMSt, this was never the case—even if in some cases this might have caused some inconvenience. True collegiality—sharing responsibilities, the search for unanimity wherever possible or at least for widely shared compromises, without concealing divergences and open questions—has always been the leading work principle in COMSt.

The community of scholars that cooperated in the Comparative Oriental Manuscript Studies Research Networking Programme was inspired right from the beginning by the common expectation that an agreed approach can provide a significant contribution to progress in manuscript research, both on a general, interdisciplinary level and with regard to the individual disciplines of manuscript book culture; this community has therefore volunteered to accomplish a common task deemed important and urgent. The academic backgrounds of the COMSt members are different but, along with their respective differences and various ideas and attitudes, they have shared some basic convictions, which in some cases were challenged or looked upon in a new or different light in the course of these years. The intensive activity of exchanging ideas, experiences and points of view has eventually served to create a common language and to focus on the topics that were selected as relevant and crucial in the comparative perspective. The many core-points where the practice of the COMSt activity and interchange deployed its fruitful results with regard to achievements and contents, reveal themselves in the chapters of the present manual.

Not only do COMSt associates come from different nationalities and research disciplines, they differ also in regard to their formal academic role and status: there are full professors, *professores emeriti*, even *honoris causa laureati*, members of venerable academies, side by side with young emerging researchers, as well as non-academic professionals who mostly work outside the narrower university circles. As a result, new ideas and research concepts have been developed by many, if not all, participants and contributors. Moreover, some of the early stage researchers involved may even have acquired better career chances thanks to their active participation and to the contacts established through the programme.

The differences regarded also the degree of challenge involved, even for people with the same or similar academic status. For some of them, being involved in a project with a comparative perspective of this type may have been just one more among many contributions already delivered within the framework of international and cooperative endeavours. This is true for those whose discipline was well advanced before in terms of available handbooks, comprehensive syntheses, introductory works, as well as methodological standardization, or first-hand work carried out in the field—for example, some codicologists who were in the forefront of our work, and generally participants coming from fields with a stronger methodological orientation. For them, contributing might have meant mainly a question of selection, or of putting new accents and fine-tuning. For those who best interpreted their project role, the COMSt project was another intriguing challenge. Others, however, had to start from next to nothing in some cases, building upon scant information available only in less accessible languages, or upon very elementary previous research, or working with a highly restricted profile and with special linguistic prerequisites. The COMSt undertaking was anything but a minor task. Contributing to this endeavour meant the collecting of data scattered across a number of publications and selecting and narrowing down all essential data to a concise synthesis, in a clear and comprehensible form of presentation and, what was even more crucial, in a comparative perspective. In many cases this implied undertaking first-hand research *ad hoc*, starting from catalogues or, in some cases, from the manuscripts themselves, sometimes even from still unexplored collections requiring hard field work.

Another important factor to be considered was the need, agreed by the members, to produce an introductory handbook that could be used by a wide audience, by students as well as by established scholars on manuscripts in different fields looking for reliable and up-to-date information. The profile of the handbook therefore remains that of a didactic and elementary work, with the ambition to cover, with a consistency and coherence never attempted before, the whole spectrum of manuscript cultures envisaged by COMSt (see below for this). Starting from the example of some comprehensive comparative handbooks of the last decade, each one with its own merits (for example Maniaci 2002a; Agati 2003; Géhin 2005; Agati 2009), our intention was to go beyond them in focusing on oriental manuscript cultures in an unrestricted perspective, where the consideration of ‘materiality’ is not intentionally regarded as opposed or detrimental or alternative to textual investigation, and vice versa, and where everything is put at the service of a better ‘understanding’ of manuscript cultures (including the textual heritage they carry).

This handbook is neither intended to be exclusively a *Nachschlagewerk* nor a *Sachlexikon* nor an *Encyclopaedia*. Articulated in chapters, it still aims at being, especially in its introductory sections, a book that can be read from the beginning to the end. As we all well know from our own experience, it is anything but a simple task to avoid specialisms and, at the same time, not to miss the most essential data. Since the very beginning of our work, we have attempted not to include and consider in our handbook every single detail for every manuscript culture considered, but only and precisely those which appeared important in the light of our comparative (or even contrastive) perspective, aiming at a comparison against a vast and various background.

Thinking more broadly, our project was also a serious attempt to defend and preserve the COMSt-related fields within the academic world. We know that disciplines and fields are often determined and justified by the mere existence of an easily accessible handbook or, in the better cases, sets of handbooks, textbooks, series and journals. The lack of comprehensive introductory works which are reliable, up-to-date, of broad interest and accessible to a wide audience and might be used in teaching, has a direct impact on the survival of the ‘small subjects’ most of the COMSt-related disciplines pertain to. The decision to make the COMSt handbook freely accessible online and printable on demand in a paper version at an affordable price was strategic in this respect, and not just meant to meet the prescriptions of the European Science Foundation. We deliberately declined to produce an extremely expensive work that might be bought only by a few libraries and research institutions; on the other hand, a plain electronic edition only to be accessed and downloaded as a PDF file was not regarded as a desirable solution either. Dealing with two millennia of manuscripts and codices, we did not want to dismiss the possibility of circulating a real book in our turn.

It remains, hopefully, only to say,

Lector intende: laetaberis.

Alessandro Bausi

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There are many persons and institutions who must be thanked for their work in the COMSt project, including people who advised early in the application phase. The first is Siegbert Uhlig, who was the main applicant in the earliest phase of the project, doing everything to prepare and submit a successful application. He also acted at the very beginning as the Chair of the Steering Committee. At the very beginning, and in all subsequent phases of the project, in her new capacity of COMSt Coordinator, Eugenia Sokolinski displayed her skills and dedication: she must be deeply thanked for her competence in all matters of the managing of the project, from practical organization to the redaction of minutes, reports and budget planning, and for editing and typesetting all COMSt publications, including all the issues of the *COMSt Newsletter* as well as this handbook.

Some of the COMSt members volunteered beyond the limit of their individual contributions to the manual. Besides the general and chapter editors, the language tradition editors Bernard Outtier and Lara Sels deserve a particular mention. I am deeply grateful to Stephen Emmel and Ralph Cleminson for the thorough English language revision and to Sever Voicu for the control of the final bibliography to this volume. I would also like to thank Cristina Vertan for setting up the bibliographic database and Sophia Dege for her assistance in the consistency checking of the bibliography.

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I have certainly forgotten or unwittingly omitted too many important points, and for this I sincerely apologize.

Alessandro Bausi

Notes to the reader

A series of editorial choices have shaped the present handbook. While most are clear and transparent, some may need explanation.

The language of the book is British English, in the standard suggested by the *New Oxford Style Manual* (Oxford: Oxford University Press, third impression, 2012). The style is reflected in the orthography (including capitalization) and punctuation throughout the volume.

Some exceptions to the Oxford style have been necessary. A notable exception is the bibliographic format: for the sake of clarity and economy, we have adopted the author–date referencing method in the text; the works cited are listed alphabetically by author in the general bibliography at the end of the volume. For works with three or more authors, citations have been abbreviated to the name of the first author followed by ‘et al.’; in the final bibliography, the names of the co-authors are provided between a pair of curly brackets. In order to keep works by the same author together in the bibliography, the spelling of names has been standardized, with the variants provided in square brackets. Authors bearing the same surname appear separately in the final bibliography; in order to help the readers identify the right title, the initial or, if this is not sufficient for the disambiguation, an abbreviation of the first name is supplied after the surname whenever the work is cited in the handbook.

In order to increase the readability of the volume, and underline its handbook character, it has been decided not to use footnotes, with the exception of acknowledgements at the beginning of some chapters or sections. Usability was also the reason behind the decision to keep the number of abbreviations to a minimum; the list of abbreviations used can be found on p. xxi. Practical use is further facilitated by a number of internal cross-references to paragraphs or chapters within the handbook.

The authors and editors have tried hard to illustrate aspects that may be difficult to put in words by appropriate figures and tables. The overwhelming majority of images in this volume are previously unpublished. The illustrations are numbered continuously, the designation always beginning with the number of the chapter and the subchapter in which the figure is to be found (for example the first figure in Chapter 1, subchapter 9, is referred to as fig. 1.9.1, etc.). The maps showing the approximate extent of the individual manuscript traditions in the General introduction § 3 are numbered continuously as Map 1, Map 2, etc. A list of all figures, tables, and maps is included on p. xxiii.

The readers are further assisted by the indexes of languages and traditions, place names, persons and works, institutions and projects, and manuscripts and manuscript collections. The general index concludes the volume.

Abbreviations

AG	Georgian era	fig. (figs.)	figure(s)
AH	<i>anno Hegirae</i>	i.e.	<i>id est</i> , that is
BCE	Before Common Era	l. (ll.)	line(s)
c.	circa	lit.	literally
C	Celsius (degrees centigrade)	m	metre(s)
CE	Common Era	mm	millimetre(s)
Ch.	Chapter	MS (MSS)	manuscript(s)
cf.	confer	n. (nn.)	note(s)
cm	centimetre(s)	nm	nanometre(s)
cp.	compare	no. (nos.)	number(s)
d.	died	p. (pp.)	page(s)
ed.	editor, edited	pl. (pls)	plate(s)
e.g.	<i>exempli gratia</i> , for example	r	<i>recto</i>
et al.	<i>et alii</i> , and others	š.	Šamsī (solar Hegira)
etc.	<i>et cetera</i> , and so on	v	<i>verso</i>
f. (ff.)	folium (folia)	vs.	versus

For the abbreviations of the names of contributors see Copyright page.

For the abbreviations of libraries and collections, see Indexes: Collections and manuscripts.

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Map 2 Centres of Armenian manuscript production © Eugenia Sokolinski 2014.
Map 3 Centres of Avestan manuscript production © Eugenia Sokolinski 2014.
Map 4 Area of Coptic manuscript production © Eugenia Sokolinski 2014. Data source: Bagnall – Rathbone 2004, 20.
Map 5 Centres of Ethiopic manuscript production © Eugenia Sokolinski 2014. Main data source: Uhlig – Bausi 2014, 622.
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Map 7 Centres of Byzantine Greek manuscript production © Eugenia Sokolinski 2014.
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- Fig. 4.2.2.1 Villefroy in Montfaucon 1739, 1017, detail.
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Chapter 5

- Fig. 5.4.1 Detached cover: Use and misuse of manuscripts can cause the joints of the binding to split. This often results in the detachment of a cover from the rest of the book, as shown here. Leiden, Leiden University Library, Or. 194, photograph by KS.

- Fig. 5.4.2 Mould: The stain on the paper indicates that it was once wet in this area, and the associated purplish colour is the result of mould attack. Private collection, Istanbul, photograph by PH.
- Fig. 5.4.3 Insects: The visible channels and holes in the text block are created by insects as they eat their way through the support. Private collection, Istanbul. Photograph by PH.
- Fig. 5.4.4 Rodent damage in an Ethiopic manuscript. Bite marks on parchment are clearly visible; the leaves have been partially destroyed. Northern Ethiopia, 2011, photograph by EBW.
- Fig. 5.4.5 Iron gall ink: Characteristic browning of the support behind where ink was applied on the other side of the leaf indicates the deterioration of the paper in these areas. When the manuscript is used, cracks and breaks can occur in the weakened and brittle support and result in losses over time. Private collection, Istanbul, photograph by PH.
- Fig. 5.4.6 Copper corrosion: Browning of the support is visible behind a framing line drawn on the other side of the leaf with copper-containing paint. When the leaf was turned, the paper cracked along this weakened line. Small losses have been sustained along the edge of the break and eventually the whole section framed by the painted line may break out of the leaf and be lost. Private collection, Istanbul, photograph by PH.
- Fig. 5.4.7 Bleed: Many inks or paints can be reactivated by water in liquid form or high environmental humidity which causes them to spread across the support. Private collection, Istanbul, photograph by PH.
- Fig. 5.4.8 Transfer: The binder which causes ink or paint to adhere to the support can be softened by high environmental humidity, causing it to adhere to another object when it is pressed against the softened media. In this case, the painted red circle across some of the letters was transferred from an illumination on the facing page in the manuscript. Private collection, Istanbul, photograph by PH.
- Fig. 5.4.9 Flaking media: Ink (and paint) made with insufficient binder or binder that has weakened with age is prone to flaking losses, as can be seen in the letters in this sample of calligraphy. Private collection, Istanbul, photograph by PH.
- Fig. 5.4.10 Multiple damage: As is typical, a single page in a manuscript often shows many different types of damage. In this case, from a manuscript on a paper support, some of the damage that is apparent includes water and mould stains, transfer of ink from the opposite page, and insect damage and old repairs near the gutter. Leiden, Leiden University Library, Or. 107, photograph by KS.
- Fig. 5.7.1 Opening a manuscript on a support created from soft foam cushions, photograph by MMy.
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- Fig. 5.7.3 Coding the preservation state of manuscripts by signal stripes, photograph by MMy.
- Fig. 5.7.4 One and the same page photographed with raking light (above) and balanced light (below), photograph by MMy.
- Fig. 5.7.5 The prism effect, photograph by MMy.
- Fig. 5.7.6 Digitization protocol.
- Fig. 5.7.7 Digitization workflow chart.
- Fig. 5.7.8 Digitization studio set up in a cave. Northern Ethiopia, 2011, photograph by EBW.
- Fig. 5.7.9 Keeper of a church's manuscript collection instructed by a book conservator. Northern Ethiopia, 2013, photograph by EBW.

as watermarks, such as crescents) annihilated most Arab paper making, but the extent of its export, the routes of its diffusion, the ratio of its use in comparison with oriental paper, and the diffusion of specific watermarks remain aspects that require much clarification.

A feature whose origin, manufacture and function are still matters of dispute among scholars is the occasional presence of a 'zigzag' mark, variable in design (a broken line, a series of comb teeth, etc.), visible either under raking light or against backlight. The zigzag mark, first documented in a mid-twelfth-century Andalusian codex, might not be an exclusive feature of Iberian paper production, as has long been believed, and is occasionally found also on watermarked paper.

During the nineteenth and early twentieth centuries, machine-made paper also came to be used in those traditions where manuscript books were still being produced.

1.1.4. Inks (IR)

According to its generic recipe, one of the oldest writing and drawing pigments was produced by mixing soot with a binder dissolved in a small amount of water. Thus, along with soot, binders such as gum arabic (ancient Egypt) or animal glue (China) belong to the main components of soot inks. From Pliny the Elder's detailed account (*Naturalis historia*, XXXV.25), we learn that, despite its seeming simplicity, the production of pure soot of high quality was not an easy task in Antiquity.

Purely organic or tannin inks are solutions of tannins extracted from various plants. The best known among them is the thorn ink, or Theophilus's ink, whose elaborate recipe is recorded in Theophilus's twelfth-century work *De diversis artibus* 49–51.

Iron-gall inks were certainly among the most commonly used writing materials and dominate the black-to-brown palette of many manuscripts. Though the origin of the use of a mixture of iron salts and tannins to produce a blackening fluid can be traced back to Antiquity (Pliny, *Naturalis historia*, XXXIV.43, 48), the earliest evidence of recipes that unambiguously mention a reaction between iron sulphate and tannins does not appear before the twelfth century (Zerdoun Bat-Yehouda 1983, 218–224). Iron-gall inks are produced by mixing natural iron vitriol with gall extracts. Iron(II) sulphate (also known as 'green vitriol' because of its colour and its glassy appearance) is the most frequently named ingredient in ink formulas. In mediaeval writings, however, other names like *atramentum* and *chalcantum*, derived from ancient sources, are often used. Galls are diseased formations on the leaf buds, leaves, and fruits of various species of oak, caused when parasitic wasps deposit their eggs in them; they contain gallic acid and a number of other tannins, in varying quantities. When iron(II) sulphate and gallic acid are mixed, initially a colourless, soluble complex results; its oxidation through contact with air results in a black, water-insoluble pigment. Historical inks usually contain organic materials such as tannins, as well as a water-soluble binding agent, for example gum arabic. Solvents like water, wine, or vinegar were used to take extracts from the galls. Since the ingredients are mostly naturally occurring raw materials, the inks display a very heterogeneous composition.

In addition to inks of pure types, mixed inks containing components of different types are well known. The study of manuscript inks requires the use of instrumental analyses (on which see also General introduction § 2.2).

1.1.5. Pigments and dyes (OH–RN)

Iron oxide minerals such as red ochre ($\text{Fe}_2\text{O}_3 \times \text{H}_2\text{O} + \text{clay} + \text{silica}$), haematite (Fe_2O_3) or goethite (FeOOH) belong to the oldest pigments; in Europe they were used since prehistoric times. Due to the variety of colours of iron oxides, there exist many recipes for the preparation of book illumination, whose use has been confirmed in manuscripts from Late Antiquity (Oltrogge – Hahn 1999); their early use has also been proved for Egypt, Mesopotamia and Asia. The pigments were prepared by cleaning, grinding and wet-sifting the minerals; red ochre can also be manufactured synthetically by heating yellow earth at 800°C (Theophrastus, *De lapidibus*).

Cinnabar or vermilion, using either natural (Liu 2005) or synthetic mercury sulphide, was also very commonly used in ancient times. The pigment was prepared artificially by sublimation, heating the pulverized mineral in the air. In the dry-process method, grinding liquid mercury with sulphur results in black mercury sulphide, the compound known in Antiquity as black *Aethiops mineralis*. Heating this compound up to 580°C for one hour in a large-mouthed earthen pot covered with an iron pan leads to formation of red cinnabar on the rim of the pot and on the iron pan cover. In the wet-process method, red mercury

sulphide is precipitated from a solution of a salt of mercury by gaseous H_2S under slow heating. Another important red pigment is 'red lead' (Pb_3O_4), a synthetic pigment usually prepared by heating 'white lead' in an oxidizing environment (Pliny the Elder, *Naturalis historia* XXXV).

A yellow pigment known as 'massicot' is obtained by gently roasting white lead, with or without the addition of tin. In addition to yellow ochre (hydrated iron oxide) and massicot, arsenic sulphide-based pigments, natural and artificially produced orpiment (As_4S_6) and realgar (AsS) were also used. Orpiment was manufactured in a dry process by means of sublimation, or by a wet process using arsenic compounds in reaction with hydrogen sulphide. Adulteration of orpiment was usually made by mixing gall of fish, chalk and vinegar. Realgar exhibits a reddish to orange colour.

Copper-based pigments were widely used for green and blue colours since ancient times. The blue mineral azurite ($\text{CuCO}_3 \times \text{Cu(OH)}_2$) and green malachite ($2\text{CuCO}_3 \times \text{Cu(OH)}_2$) belong to the copper carbonates. Paratacamite ($(\text{Cu,Zn})_2(\text{OH})_3\text{Cl}$) has been detected in wall paintings from the fifth to eighth centuries in East Turkestan (Kühn 1988). One prominent artificial green pigment is verdigris ($\text{Cu}(\text{CH}_3\text{COO})_2$), a reaction product from copper salts with acetic acid or vinegar. In addition, copper silicate (*chrysocola*, $\text{CuSiO}_3 \times n\text{H}_2\text{O}$) was used as a painting material in East Turkestan and Egypt (Kühn 1988). Since these pigments are complex weathering products, their main preparation technique consists in cleaning or separating the pigments from other minerals. Green was also produced by mixing blue indigo with yellow pigments. Synthetic blue pigments are 'Egyptian blue' ($\text{CaCuSi}_4\text{O}_{10}$) and 'China Han blue', a barium copper sulphate ($\text{BaCuSi}_2\text{O}_6$). Egyptian blue was prepared by heating together a calcium compound with a copper alloy, silica (sand), and soda or potash as a flux at 850–1000°C. The glassy product was then ground and refined for purification (Vitruvius, *De architectura*, VII.11). The mineral lazurite, a sodium aluminosilicate ($(\text{Na,Ca})_8[\text{Si,AlO}_4]_6(\text{S,SO}_4)_2$), can be extracted from the stone lapis lazuli. It contains additionally calcite, pyrite and other minerals. Deposits in the Hindu Kush mountains in Afghanistan (Oxus River, Amu Darya, near Sar-e Sang/Kokcha Valley in Badakhshan) are the main source. It is mined in open pits by heating rocks and then cooling them with water (Marco Polo, *Il Milione*, 46). It is prepared in order to intensify the colour by heating it several times, cooling it with vinegar, pulverizing it, and sieving it and repeatedly washing it out with water or vinegar as sedimentation. The powder is then kneaded together with resin or gum and linseed oil under cold water. With warm water, pigment particles come out of the wax pellets, which are finally washed and dried again. The early use of lapis lazuli as a pigment is attested in Central Asia (Riederer 1977). French ultramarine is a synthetic pigment that can be produced by heating clay (Ca, Si, Al), sulphur and soda together. In Europe during the Middle Ages, Egyptian blue was replaced by lapis lazuli (Gaetani et al. 2004).

White lead ($2\text{PbCO}_3 \times \text{Pb(OH)}_2$) is the best known artificial white pigment since Antiquity. The basic lead carbonate was produced by the influence of vinegar present in the atmosphere on metallic lead. White lead, as well as the mineral cerrusite (PbCO_3), were also used for the production of 'red lead' by heating. White chalk (CaCO_3) and gypsum (CaSO_4) were used as pigments not only for painting but also for priming.

The colouring component of 'plant black' or 'bone black' is carbon (see Ch. 1 § 1.1.4).

Not only minerals, but also metals were used for book illumination. Gold is applied as a kind of ink often on a base coat made out of a mineral pigment, for example white cerrusite, or in the form of a gold leaf. Gold powder is prepared with a binder as gold drops for trade. When used as paint, it is ground together with mercury to clean it by amalgamation before mixing it with glue.

However, the historical formulas do not only describe the extraction and production of pigments. Since Antiquity, dyes which were produced from plants and animals were used not only for manufacturing textiles, but also as lakes for the decoration of manuscripts. Historical dyes are less resistant to ageing than pigments are; this is surely the main reason that less is known about their use in Antiquity or in the Middle Ages.

Indigo is surely the most important organic deep blue pigment. The colourless pre-product is present in different plants, particularly in the East Indian *Indigofera tinctoria* L. The extraction of the blue pigment is done by fermentation.

A red dye is obtained from brazilwood and similar types of wood. During the manufacturing process, the deep red colour is extracted from the wood and the bark by using lye, vinegar, alcohol or urine. By extraction with alum, one gets a red violet lake. Depending on the extraction time and medium, one obtains colours between pink, crimson and reddish brown. Brazilwood was imported mainly from Ceylon

and India in the Middle Ages. Several red or violet dyes can be produced by fermentation from different lichens (for example, *Rocella*). For the production, crushed lichens were treated with a thinned ammonia or urine and then fermented for some days or months. Other dyes were produced from scaled insects, for example, *Kermes vermilio* PLANCHON, *Porphyrophora hameli* BRANDT or *Kerria lacca* by extraction (Hofenk de Graaff et al. 2004).

1.1.6. Writing instruments (MMa)

Information about writing instruments comes from various kinds of sources: surviving examples (quite rare and mostly antique); texts, both literary and technical; pictures, mainly those appearing in manuscripts themselves; and also—particularly from Ethiopia and sub-Saharan Africa—ethnographic observations (including interviews with local craftsmen). But the available information is very uneven. Written sources (for example, Arabic treatises on penmanship) may contain very detailed instructions, but they do not resolve all doubts concerning the relationship between the use of specific instruments and scripts of different thickness and contrast. As for pictures, miniatures of the evangelists sitting in front of a lectern full of instruments (such as pens, ink pots, knives, scissors) and occasionally copying from a roll to a codex (or vice versa) occur frequently in manuscripts belonging to different Christian book cultures (Greek, Syriac, Georgian, Armenian, Ethiopic, Slavonic), but these conventional portraits, perpetuating ancient traditions and therefore abounding in inconsistencies and anachronisms, seem to be of only limited value; common models and relationships across cultures await specific study. Late Islamic miniatures are more realistic in the depiction of scribes and calligraphers.

Waxed tablets (where attested) were written with a pointed metal or ivory stylus (known from archaeological and literary sources), with one end in the shape of a spatula used to erase previously engraved letters, by smoothing them out of the wax. Flexible supports (mainly papyrus, parchment and paper) required different tools: most often mentioned (and most often described, particularly by Islamic authors) is the ‘reed’ pen or ‘calamus’ (Greek *kalamos*, Arabic *qalam*), a hollow plant stem (or also—less frequently—a hollow metal tube?), through which the ink could flow to a tapered point. The cut of the point had a strong influence on the execution and aspect of the written script. ‘Quill’ pens, made from the moulted flight feather of some large bird, were employed in Ashkenaz according to western practice, but their use is also known in the Orient (an earlier Syriac instance, from 509 CE, is particularly noteworthy (see Ch. 1 § 11.1.7), although its diffusion could perhaps be verified by the analysis of the oriental scripts).

Mentions and representations of other tools connected with writing, or with the preparation of the page (ink pots, knives, scissors, rulers, compasses, burnishers, pieces of furniture, as well as painters’ and illuminators’ tools) also occur in various sources from the different manuscript traditions.

1.2. Book forms (MMa)

1.2.1. Miscellaneous forms

Writing on a variety of surfaces quite unlike any book of the usual sort—clay tablets and *ostraca* (pottery sherds, limestone chips), bones, seashells, sticks, cloth—was a common practice in most (if not all) oriental book cultures. For books, the ‘roll’, or ‘scroll’ (terminology is inconsistent in the different scholarly traditions), both in the horizontal ‘multi-column’ and in the vertical ‘single-column’ (‘rotulus’) arrangement, and especially the ‘codex’ are the norm in all book cultures, although with salient differences from one to another.

1.2.2. The roll and the rotulus

As already described above (Ch. 1 § 1.1.1), Greek and Coptic rolls were made of a series of papyrus sheets (*kollēmata*) which were glued together (at joins called *kollēseis*) and rolled/unrolled, usually with the help of a wooden or bone stick attached to one or both ends of the roll. Rolls were sometimes made of parchment—or leather—in which case the sheets could be sewn together. The text was arranged, normally only on the inner side (in papyrus rolls, usually along the horizontal fibres), in a series of columns, usually rather narrow, but sometimes broad, whose lines run parallel to the long side of the roll. Height and length of rolls, as well as the number of sheets and the width of the columns, varied according to local conventions (which have been partially investigated only with regard to Greek rolls), with the limits to our knowledge being determined by the fragmentary state of the evidence and its uneven geographical distribution. Although more rarely preserved, parchment rolls might have been more widely used than is