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INTRODUCTION

The manuscript collection of the Marburg University includes approximately 100 mediaeval codices, 570 fragments, 110 estates in writings and 1600 samples of own handwriting. The estates of professors from Marburg are of special significance within this collection. Among them the documents of the jurist Friedrich Carl Savigny (1779–1861) ranks highest. Since 1949 it has been acquired from several sources, either directly from the family, or through the art market. The collection includes numerous extensive volumes with manuscripts, working material, business documents and various other types of documents as well as some hardcover works. The correspondence of Savigny available at Marburg is also of a scientific nature. However, it is very far ranging, exceeding far beyond the legal sphere, which can be seen particularly in his correspondence with the brothers Jacob and Wilhelm Grimm. It is an important piece of Germany’s intellectual history from the first half of the nineteenth century. Savigny’s estate is one of the most widely used inventories of handwritten scripts at Marburg University.

In 1998 the estate was included into the program “Retrospective Digitalisation of Library Collections” of the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG). In addition to digitalisation, preservation treatments were performed to decrease the mechanical stress of the documents during the individual phases of digitalisation as well as improve their storage.

The preservation included the rearrangement of letters and single sheets some of which had been folded several times and were kept in envelopes or folders, which were too small and acidic. In the course of this work special attention was paid to ink corrosion: a damage quite characteristic for the collection.

Hitherto ink corrosion on handwritten documents at Marburg University had rather accidental attention as the documents were used. Often, damage was only noticed when the documents were already unstable and single handwritten sheets...
were about to or had actually come off the paper. In those cases the individual documents were stored in barrier papers, protective boxes and partially microfilmed. The digitalisation of the Savigny estate provided the first opportunity for conservation measures to be taken including a detailed condition survey of an entire collection.

**THE COLLECTION**

**Letters**

The collection of letters includes circa 4,500 letters written by approximately 700 different people between 1787 and 1867. The inventory consists of many different qualities of often rather thin letter paper. It is also consists of different compositions of ink and of varying individual and different technical writing styles. Among those documents are also copies of letters on extremely thin repigraphic paper with copying ink transferred by pressing from a handwritten original. Additionally, there are the traces of regular handling which were caused by mailing, by folding and unfolding before and after reading and by breaking the seals. Further damage such as creases, cracks or traces of migration of dissolvable ingredients of ink and sealing wax have been caused by temporarily storing them in twentieth-century standard envelopes, which are too small and acidic.

**Manuscripts**

The inventory of manuscripts includes 46 hardcover items and numerous large volumes. Apart from documents written by Savigny’s own hand the collection contains documents from family members, friends, colleagues and students. The hardcover items are printer’s copies, handwritten enclosures containing books with numerous additional notes and corrections, transcripts of his lectures made by students, etc. The large volumes comprise manuscripts of his publications and his lectures as well as working material, business documents and other various documents. Because the condition of the books was so variable they had to be numbered for the report. They amount to approximately 20,000 pages.

Unlike the letters, the manuscripts are often written on heavier white, yellow-brownish, grey or blue-greyish handmade paper. Before the documents were purchased by the University Library they had been stored improperly at many different places, which has again left its mark on the documents. Apart from mechanical loss and traces of ink migration some volumes are damaged by mould.
Prior to any further handling of the documents some practical conservation was undertaken. Barrier papers and envelopes were inserted in order to stop the migration of certain components from the inks and seals. All unbound and unprotected handwritten documents were placed in ageing resistant folders and protective boxes. This was done not only to provide proper storage in the future, but also to protect the items during the digitalisation procedure: transport, inspection before microfilming, comparison of the scans with the microfilm, etc.

The main aim of the condition report was to give a gradual spectrum of damage caused by ink corrosion. On this basis it is possible to estimate the amount of necessary treatment and its cost. Moreover, the condition report should give basic data concerning the completeness of the collection, the number of pages with damage such as creases, cracks, missing parts, stains, mould infection, binding damages, etc. Furthermore, special characteristics of the written documents were noted such as the number of letters with different kinds of seals and their condition.

The collection has no uniform appearance. It includes, for example, oversize formats, enclosures in letters and special qualities of paper which has consequences for restoration and conservation. In parallel to recording the damage and peculiarities future conservation and/or restoration treatments were noted.

The approximately 4,500 letters and circa 20,000 pages of manuscript were described according to a specially developed system describing their qualities using keywords such as: date of origin, number and size of sheets, quality and structure of the paper, kind of damage, etc. In the case of bound volumes the quality of the covers and necessary conservation treatment were recorded. As the project progressed it was clear that, because of the huge volume of material, we would have to reduce the information collected and so only basic information was noted.

The recording work took ca. 1,500 work hours, i.e. 90,000 minutes, which corresponds to 3–4 minutes for one sheet. Along with it some very dirty and mould-contaminated documents were cleaned. About 2,200 pages of manuscripts had to be treated for mould infection.
Condition Report of the Ink Corrosion Damage

Recording of ink corrosion

Ink corrosion is the technical term for the specific kind of damage that is caused by iron gall ink. Since those inks were commonly used until the beginning of the twentieth century, archives, libraries and museums preserving handwritten documents and drawings in ink are confronted with huge amounts of relevant damage.

Ink corrosion consists in embrittlement of the paper where the ink is applied and, in the final state, in loss of the substrate. The causes are to be found in the mixture proportions of the ink components, i.e. iron(II) sulphate and gallic acid. They should be mixed in the stoichiometric relation to each other. But, because the sulphate was cheap and gallic acid was expensive, quite often more of the first was used. The symptoms of ink corrosion differ depending on the quality of ink and paper. Even the character of the writing instrument and the individual way of writing can influence the intensity of the damage. Furthermore, the conditions of storage and the climatic circumstances influence the progress of corrosion.

The ink corrosion damage in the handwritten scripts of Savigny’s estate was estimated according to the condition rating developed by B. Reißland and J. Ho-fenk de Graaff. The authors classified four conditions of ink corrosion ranging from good to bad:

- **Condition rating 1 (good):** no or slight discolouration at inked areas visible on the verso of the page.
- **Condition rating 2 (fair):** partly dark brown discolouration at inked areas on the verso of the page – mechanical damage (fair).
- **Condition rating 3 (poor):** intensive brown discolouration and mechanical damage (cracks) at the inked areas.
- **Condition rating 4 (bad):** Severe losses in the inked areas.

Describing the Savigny estate it seemed appropriate to combine stages 2 and 3 because in some cases it was very hard to distinguish between them. Moreover, it was assumed that both stages of degradation could be treated according to the same method and that mechanical stabilisation could be performed afterwards.

The goal of the inquiry was to eventually determine the need for restoration. Possible treatment was taken into consideration as follows:

- **Condition rating 1 (Fig. 1):** Documents with first indications of ink corrosion are physically stable; they do not need any intervention, but they should be inspected in regular intervals.
- **Condition ratings 2 & 3 (Figs. 2 and 3):** These documents need restoration treatment of a kind that can be done in the restoration workshop of the university library.
Fig. 1: Ink corrosion stage 1: slight light discolouration of the writing on the back of the page, writings are fluorescent.

Fig. 2: Ink corrosion stage 2: partly dark discolouration of the writing.
Condition Report of the Ink Corrosion Damage

Fig. 3: Ink corrosion stage 3: strong discolouration of the writing on the back of the page, formation of cracks.

Fig. 4: Ink corrosion stage 4: parts of the writing burst off.
• Condition rating 4 (Fig. 4): Most of these documents usually require chemical treatment against ink corrosion as well as stabilisation of the paper by whatever method.

Fig. 5: Spectra of damage: left: the entire letters; below left: 205 letters of the Grimm brothers; below right: 94 letters of Barthold Georg Niebuhr
FREQUENCY OF INK CORROSION

**Letters**

4,462 letters, consisting of 5,478 single or double sheets, were recorded. 5,304 sheets are written with iron gall ink, most of the others with pencils and coloured inks. Damage caused by these other writing materials could not be detected. The spectrum of damage with regard to the sheets written with iron gall ink is given in Fig. 5. The recording of the state also allowed for the depiction of stages of degradation by means of arbitrarily chosen partial inventories; e.g. the 205 letters of the Grimm brothers or the 94 letters of the diplomat and historian Barthold Georg Niebuhr. Those detailed results will help to set priorities for future necessary conservation treatments.

**Manuscripts**

19,588 sheets of the inventory of manuscripts were recorded. 17,802 of them are written with iron gall ink. The rest consists of mainly printed material; a few manuscripts handwritten with pencil or coloured inks are to be found as well. The spectrum of damage of sheets written in iron gall ink is given in Fig. 6.
Possible sources of error

In the beginning of the Savigny project in 1998 there was little experience of undertaking a condition survey of an entire collection. To the knowledge of the author no other comparable work concerning the damage symptoms of ink corrosion has been published. The recording extended over a long period, and there were some periods of suspension.

Nevertheless, it can be assumed that the categorisation of the handwritten scripts is consistent, since they were carried out by one person. If doubts arose whether a certain item should be categorised in a higher or a lower stage, a new check was done in order to avoid possible inconsistencies. Additionally, selected representative parts of the collection were randomly re-assessed and compared with the initially recorded data. This was done in order to be as certain as possible about the estimation of the damage symptoms and the final analysis of the results. No serious differences were found in those cases which confirms the data to be reliable.

Combining stages 2 and 3, which allowed for quicker recording, resulted in a less differentiated picture in the middle range of damage. However, this seems to be acceptable. If necessary, further differentiating will be done during the later practical conservation and restoration work.

Concluding remarks

The results of the analysis provide the basis for a concept of practical conservation of the inventory. They also allow for conclusions regarding the means and the relevant expense. Most attention has been paid to ink corrosion, because this is the dominant problem for both its degree and quality. Furthermore, palaeographical particularities such as the type of paper, writing habits, seals, form of appearance or typical traces of usage, as well as often repeatedly occurring specific damage were detected and recorded. It is important that they, too, are taken into account within the concept of treatment.

The analysis provides the theoretical requirements for the practical conservation and restoration work. In the case of the Savigny estate 6,574 sheets of stages 2 and 3 as well as 196 sheets of stage 4 needed some intensive treatment due to damage from ink corrosion. Moreover, the recording of the state of the Savigny estate also revealed that, apart from a few exceptions classified in stage 4, these handwritten documents are in a rather stable condition. An initial and random inspection had given the impression that there was much more stage 4 ink corrosion. Thus the result of this survey also exemplifies that, when dealing with a
large collection, random sampling does not suffice for a reliable estimation of the
damage.

Another result of the analysis is that improving the storage conditions of the
Savigny estate can prevent further damage. It is now microfilmed and digitalised;
nearly all documents are accessible from the internet. The main advantage of this
is that access for users is made considerably easier, but it also has consequences
for conservation: the originals will be less exposed to use, which will prevent
damage caused by poor handling.

Generally, the condition report on this specific estate also provides an insight
into the difficulties of maintaining larger eminent estates of handwritten docu-
ments. They are unique collections of remarkably great value. It would not be
sufficient to simply convert the text to microfilm, which is enough in the case of
homogenous items such as newspapers. In the case of handwritten documents,
palaeographic and other intrinsic peculiarities such as colour and thickness of the
paper, watermarks, flow of the writing etc. form the specific character of each in-
dividual work. On a secondary format such as microfilm or digital images they
are only visible to a limited extent. In order to conserve these notable and cultural-
ly, as well as historically important characteristics, which provide information
beyond the mere text, it is essential to conserve, restore and preserve the origi-
nals.

Since 2004 the restoration of the handwritten documents of the Savigny estate
is carried out funded by a generous grant provided by the Deutsche Forschungs-
gemeinschaft (DFG). It was decided to apply an optimized phytate treatment, as
suggested by J. Neveel in 1995. Suitable application techniques are in develop-
ment in co-operation with partner institutes, among them the State Academy of
Art and Design in Stuttgart. This research in “applied conservation science”
might become an example of how science, technology and practical restoration
should and must co-operate in order to achieve an acceptable and reproducible
results in chemically based conservation interventions.

ACKNOWLEDGEMENTS

The Author would like to express thanks to Hannah Kessler for the English trans-
lation of the manuscript, and to Heike Heuser (University of Marburg) for per-
formig the photo documentaton of the Savigny estate.
SUMMARIES

**Condition Report of the Ink Corrosion Damage in the handwritten Estate of the Jurist Friedrich Carl von Savigny within the Scope of a Digitalisation Project**

In the context of a project to digitalise a collection of mainly handwritten documents, i.e. the estate of the jurist Carl Friedrich von Savigny preserved at the Marburg university library, the condition of the collection was recorded. The main purpose was to display a spectrum of ink corrosion damage symptoms. Altogether, ca. 4,500 letters and about 20,000 manuscripts sheets were surveyed. The evaluation showed that the majority of the estate is in a good or stable condition; only 1% showed severe ink corrosion. A previous random sampling had showed much higher percentage results, which is an argument against such a simplified procedure.

The results of the analysis provide the basis for a plan to conserve the estate and perform the treatments appropriate for the different stages of ink corrosion.

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**Rapport sur l'état des détériorations de l'encre gallique des manuscrits légués par le juriste Friedrich Karl von Savigny, établi dans le contexte de sa numérisation**

Dans le contexte de la numérisation de l'oeuvre majoritairement manuscrite léguée par Carl Friedrich von Savigny à la Bibliothèque de l’Université de Marburg un rapport a été établi pour consigner l'état de ses détériorations. L'objectif principal était d'exposer le spectre des dommages causés par la rouille. Au total environ 4.500 lettres et environ 20.000 feuilles manuscrites ont été analysées. Il a été constaté que la plus grande partie des manuscrits était en bon état ou en tout cas encore stable ; seulement 1% est attaqué gravement par la rouille. Une enquête réalisée au préalable sur des échantillons avait conclu à un pourcentage plus élevé. Ceci se pose comme argument contre une telle procédure simplifiée.

Le résultat de l'analyse offre un fondement pour un concept de conservation et indique des possibilités de traitement pour les différents degrés de détérioration à l'encre gallique.

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**Zustandsbericht über die Tintenfraßschäden im handschriftlichen Nachlaß des Juristen Friedrich Carl von Savigny, angelegt im Zusammenhang mit dessen Digitalisierung**

Im Zusammenhang mit der Digitalisierung eines überwiegend handschriftlichen Bestandes, d.h. des Nachlasses von Carl Friedrich von Savigny in der Universitätsbibliothek Marburg, wurde dessen Schadenszustand protokolliert. Das Hauptideal war die Darstellung eines Spektrums von Tintenfraßschäden. Insgesamt wurden ca. 4.500 Briefe und ca. 20.000 handschriftliche Blätter untersucht. Es zeigte sich, daß der größte Teil des Bestandes in einen guten Zustand oder jedenfalls noch stabil ist; lediglich 1% weisen schweren Tintenfraß auf. Eine vorher durchgeführte Erhebung in Stichproben hatte einen weitaus höheren Anteil erbracht. Dies wird als Argument gegen ein solchen vereinfachtes Vorgehen gewertet.

Das Ergebnis der Analyse bietet die Grundlage für ein Konservierungskonzept und zeigt die Behandlungsmöglichkeiten für die verschiedenen Stadien des Tintenfrasses auf.
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