

**CHALLENGES OF PRESERVING WRITTEN  
HERITAGE : THE EXPERIENCES FROM THE  
NATIONAL AND UNIVERSITY LIBRARY**

**IZAZOVI ZAŠTITE PISANE BAŠTINE : ISKUSTVA  
NACIONALNE I SVEUČILIŠNE KNJIŽNICE**

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UDK / UDC 025.85  
UDK / UDC 027.54(497.4 Ljubljana)  
Stručni rad / Professional paper  
Primljeno / Received: 21. 1. 2015.

*Sažetak*

Zaštita pisane baštine ozbiljna je zadaća u 21. stoljeću s obzirom na količinu građe koja propada, što nije moguće kontrolirati. Tijekom prošloga desetljeća, većina naših aktivnosti bila je usmjerena na zaštitu i konzervaciju tiskane građe budući da ona čini oko 90 posto naših knjižničnih zbirki. Stupanj i žestina propadanja papira rezultat je unutarnjih i vanjskih čimbenika: najvažniji su sastav dokumenata i uvjeti u kojima je papir pohranjen. Stoga su u radu predstavljeni uvjeti pohrane u knjižnicama i aktivnosti za usporavanje dvaju najčešćih procesa koji vode propadanju papira: korozija i acidna hidroliza.

*Ključne riječi:* pisana baština, knjižnica, konzervacija, zaštita, tiskana građa, dokumenti na papiru

### *Summary*

Preservation of written heritage is a serious task in the 21st century because the amount of the decaying library material is impossible to control. During the past decade most of our activities were focused on preservation and conservation of paper-based items as they make up approximately 90% of our library collections. The rate and severity of paper deterioration are the result of the internal and external factors: most importantly, the composition of the documents and the conditions under which the paper material is stored. Therefore, this paper presents the storage conditions in the library and the activities which retard two of the most damaging processes leading to deterioration of paper, iron gall ink corrosion and acid hydrolysis.

*Keywords:* written heritage, library, conservation, preservation, paper-based documents

### **Introduction**

The National and University Library<sup>1</sup> collects, documents, preserves and archives the written cultural and scientific heritage of the Slovenian nation. It provides ready access to knowledge and culture of the past and present Slovenian generations, making it available to the citizens of Slovenia and other countries.

The activities in the field of preservation and conservation in the Library are coordinated by the Conservation and Preservation Centre. The primary task of the Centre is to provide preservation of the nation's literary heritage held at the Library. The Centre consists of Restoration Department for paper and parchment items, General Bindery, Research Group and the competent official for the preservation of library material.

The durability of library materials depends on the materials which compose the items and external causes of degradation. Traditional library collections contain natural materials which degrade during natural ageing process. These processes can be retarded by preventive methods and conservation/restoration of library materials. Conservation of collections that have suffered damage or deterioration can be performed only on a limited number of items due to expensive and long-term procedures and limited number of skilled professionals employed. Therefore, preventive care is essential for preservation

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<sup>1</sup> National and university library [Accessed: 2014-11-24]. Available at: <http://www.nuk.uni-lj.si/nukeng.asp>

of library collections. By preventive care security of the building and library materials, good quality storage and appropriate handling is meant.<sup>2</sup>

The main activities for preservation of library materials in the Library are the following:

- 1) Improvement and constant control of storage conditions in the library collections;
- 2) Digitisation of frequently used or endangered library materials, like Slovenian newspapers;
- 3) Conservation of the most damaged artefacts;
- 4) Mass deacidification of archival copies of monographic prints endangered by acid hydrolysis;
- 5) Research and development in the field of conservation science.

Paper is the most widely used support of documents stored in archives and libraries.<sup>3</sup> During the past decade most of our activities were focused on preservation and conservation of paper based items as they present approximately 90% of our library collections. Condition assessment and planning of preservation activities for modern media, such as microforms, optical and magnetic disks, digital formats, photographs, and audio and visual media, will be our priority in the next decade, due to their limited durability.

The rate and severity of paper deterioration result from internal and external factors: most importantly, the composition of the documents and the conditions under which the paper is stored.<sup>4,5</sup> Therefore, storage conditions in the library and our efforts to retard two of the most damaging processes leading to deterioration of paper, iron gall ink corrosion and acid hydrolysis, will be presented.

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<sup>2</sup> Adcock, E.P. Ifla principles for the care and handling of library material [Accessed: 2014-11-25]. Available at: <http://www.ifla.org/files/assets/pac/ipi/ipi1-en.pdf>

<sup>3</sup> Walne, P. Selected guidelines for the management of records and archives: a RAMP reader [Accessed: 2014-11-25]. Available at: <http://www.unesco.org/webworld/ramp/html/r9006e/r9006e0e.htm>

<sup>4</sup> Safeguarding our documentary heritage [Accessed: 2014-11-25]. Available at: <http://webworld.unesco.org/safeguarding/en/>

<sup>5</sup> The Deterioration and Preservation of Paper: Some Essential Facts [Accessed: 2014-11-25]. Available at: <http://www.loc.gov/preservation/care/deterioratebrochure.html>

## **Storage conditions in the Library**

The environmental factors of temperature, humidity, light, and atmospheric and particulate pollutants can all cause degradation reactions.<sup>6</sup> Therefore, one of the major tasks in our library is to provide good quality storage for our collections. During the last twenty years, large parts of our collections were moved from completely inappropriate dislocated storages to the storage areas with environmentally controlled conditions at Leskoškova 12. The relative humidity (RH) and temperature are maintained at the constant condition of up to 20 °C and  $50 \pm 5\%$  RH. The most valuable items, stored in the main building (Turjaška 1) have been moved to the modern equipped treasury of the Library with climatic control, archival copies of library materials from all collections have been moved to the Leskoškova 12 separate storage areas.

In all repositories, temperature and relative humidity is monitored by sensors. Although all storage areas in the main building of the Library (Turjaška 1) are not equipped with climatic control, the conditions are relatively good, because there are no problems with excessively high relative humidity (over 65% RH). The levels and fluctuations of relative humidity have a much greater impact on the preservation of collections than the levels and fluctuations of temperature (95% against 5%). Excessive humidity leads to proliferation of mould, rapid corrosion of metals and higher rate of degradation of materials which compose library collections.<sup>7</sup>

## **Preservation and conservation of the paper based collections**

### *Older printed material and manuscripts*

In order to plan preservation activities, it is important to assess the condition of the collections. During the past years, the condition of medieval manuscripts and incunabula has been assessed.

These items have been produced from high quality natural materials. The book blocks were produced either from parchment or high quality handmade paper. Before the mid-19th century, western paper was made from cotton, linen and hemp clothing rags by a process that largely preserved the long fibres of the raw material. While fibres may shorten with age, rag papers tend

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<sup>6</sup> Adcock, E.P., Cited on page 2.

<sup>7</sup> Safeguarding...Cited on page 3.

to remain strong and durable, especially if they have been stored properly in conditions not overly warm or humid.<sup>8</sup>

The condition assessment has shown that the items stored in the Library are mostly endangered due to mechanical damages caused by improper handling and storage over the centuries and iron gall ink corrosion. Storage has been improved by moving the books to the treasury with controlled relative humidity and temperature. Larger bound items are stored horizontally on the shelves. Custom made boxes from durable materials have been produced for all medieval manuscripts, incunabula and some rare books.



Figure 1 (Photo: Milan Štupar): Treasury of the Library with boxes from high quality materials containing rare books, incunabula, medieval manuscripts and some important unbound manuscripts

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<sup>8</sup> The Deterioration... Cited on page 3.

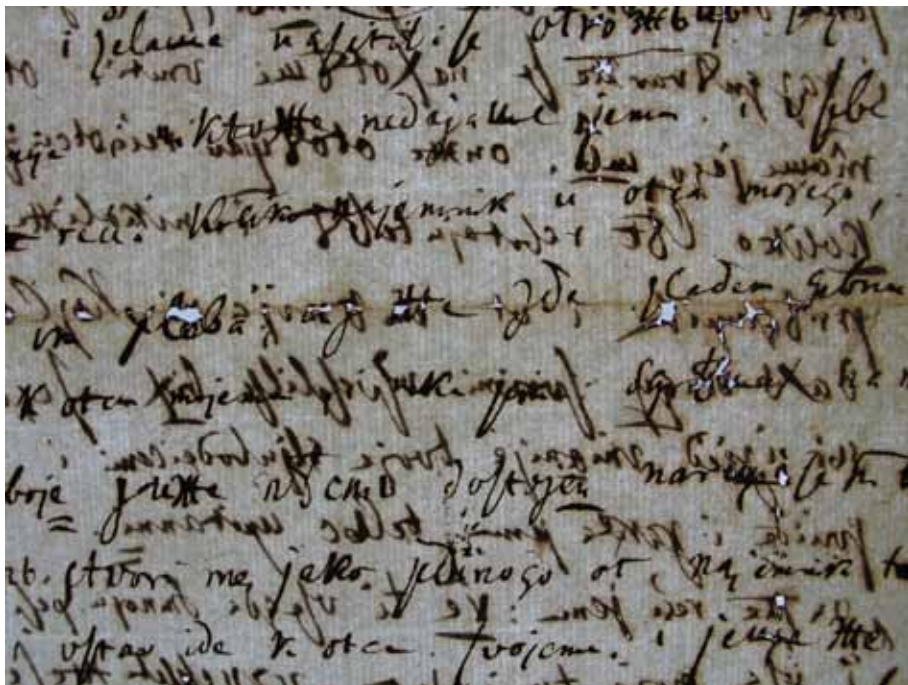


Figure 2 (Photo: Andreja Kozjek): Document, degraded due to iron gall ink corrosion. From the legacy of Jernej Kopitar, stored in the Manuscript and Rare Book Collection

The second, chemical factor of deterioration of manuscripts is iron gall ink. Iron gall ink was the standard writing and drawing ink in Europe, from about 5<sup>th</sup> century to the 19<sup>th</sup> century, and remained in use well into the 20<sup>th</sup> century.<sup>9</sup> In comparison to carbon ink, which preceded the use of iron gall ink, it was easier to manufacture and hard to remove from the surface on which it was applied, a valued characteristic for official record keeping. It was also used by many artists - painters, writers, composers, among them Leonardo Da Vinci, J. S. Bach and Victor Hugo to name only a few.<sup>10</sup>

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<sup>9</sup> Iron gall ink [Accessed: 2014-11-25]. Available at: [http://en.wikipedia.org/wiki/Iron\\_gall\\_ink](http://en.wikipedia.org/wiki/Iron_gall_ink)

<sup>10</sup> The iron gall ink website [Accessed: 2014-11-25]. Available at: <http://www.ironlink.org/>

Unfortunately, the components of the ink, containing corrosive transition metal ions and acids might cause severe damage to the paper support.<sup>11</sup> Nowadays, the world's libraries, archives and museums are faced with the immense problem of preserving countless documents, manuscripts, drawings, etc., endangered by the corrosive properties of iron gall ink.

The only generally accepted paper conservation method for prevention of iron gall ink corrosion, is the so called "calcium-phytate treatment method"<sup>12</sup> that involves immersion of paper artefacts in aqueous suspension of an antioxidant phytate and solution of calcium hydrogencarbonate.

Stabilization procedures that involve immersion in either polar or non-polar solvents pose certain risks to paper based documents; possible migration of ink compounds, changes of ink color, etc. Immersion in polar solutions is not appropriate for treatment of bound paper volumes, and single item treatments of archival documents in several solutions are time consuming considering the huge amounts of endangered materials. Due to several side effects, the procedure can be applicable only to the limited amount of artefacts. Therefore, the researchers from the Library have been actively involved in development of new techniques for stabilisation of iron gall ink corrosion for the last ten years.<sup>13, 14, 15</sup>

Environmental factors accelerating the development of ink corrosion are: the exposure to high humidity levels above 70% and exposure to mechanical stress, typically due to handling.<sup>16</sup> Therefore, preservation of the items due to iron gall ink corrosion has also been improved with moving the artefacts to

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<sup>11</sup> Scholten, Steph. Position paper.// Proceedings European Workshop on Iron Gall Ink Corrosion /ed. by Hans van der Windt. Rotterdam: Museum Boijmans van Beuningen. Amsterdam: Institute for Cultural Heritage. pp 9–12.

<sup>12</sup> Reissland, Birgit; Scheper, Karin; Fleischer, Sabine. Phytate-treatment. The Iron Gall Ink Website. [Accessed: 2014-11-25]. Available at [http://irongallink.org/igi\\_index43e7.html](http://irongallink.org/igi_index43e7.html)

<sup>13</sup> Reissland, Birgit; Scheper, Karin; Fleischer, Sabine. Phytate-treatment. The Iron Gall Ink Website. [Accessed: 2014-11-25]. Available at [http://irongallink.org/igi\\_index43e7.html](http://irongallink.org/igi_index43e7.html)

<sup>14</sup> Kolar, Jana. InkCor project – stabilisation of iron gall ink containing paper.// Proceedings of the International Conference Durability of Paper and Writing / ed. by Jana Kolar, Matija Strlic and John B. G. A. Havermans. Ljubljana: National and University Library, 2004. pp 9-10.

<sup>15</sup> Malešič, Jasna; Kočar, Drago; Balažič, Aneta. Stabilization of copper- and iron-containing papers in mildly alkaline environment. //Polymer degradation and stability 97, 1 (2012), 118-123.

<sup>16</sup> Malešič, Jasna; Šala, Martin; Šelih, Vid Simon; Kočar, Drago. Evaluation of a method for treatment of iron gall ink corrosion on paper. // Cellulose 21, 4(2014), 2925-2936.

the relative humidity conditions of  $50 \pm 5$  °C. Severely damaged manuscripts are prohibited to be used in the reading rooms and are listed as priorities for digitisation in order to provide access to the information content of the items.



Figure 3 (Photo: Andreja Kozjek): Applying magnesium phytate treatment to the Kopitar's manuscripts at the Conservation and Preservation Centre.

### *Modern paper based collections*

In the 19th century, the traditional method of the paper manufacturing has been replaced by industrial process. Wood pulp as the raw material instead of old rags made from linen, hemp or cotton and alum rosin as sizing agent instead of traditional gelatine sizing were introduced. The changes resulted in the reduction of the pH of the paper, leading to chemical breakdown of cellulose fibres, which resulted in a massive decay of library and archival holdings. Research has shown that adding alkaline compounds to the acidic paper when



it is still in usable condition, known as deacidification of paper, can extend the life expectancy of the paper.<sup>17</sup>



Figure 4 (Photo: From the documentation of Conservation and Preservation Centre): Paper document, degraded due to acid hydrolysis

The survey of monographs in the National and University Library, performed in 2006 during 6th Framework Programme EU project PaperTreat,<sup>18</sup> has revealed dramatic condition of the collection. In the collection of approximately 125.000 books, produced between 1850 and 1990, approximately one

<sup>17</sup> *Baty, John W.; Maitland, Crystal L.; Minter, William; Hubbe, Martin A.; Jordan-Mowery Sonja K.* Deacidification for the conservation and preservation of paper-based works: A review. // *Bio resources* 5, 3(2010), 1955-2023.

<sup>18</sup> *Kolar, Jana; Strlič, Matija; Lojewski, Tomasz; Havermans, John; Steemers, Ted; de Bruin, Gerrit; Knight, Barry; Palm, Jonas; Hanus, Jozef; Perminova, Olga; Nguyen, Thi-Phuong; Porck, Henk.* Papertreat project – preserving our paper-based collections. // *Durability of paper and writing 2 : book of abstracts : 2nd International Symposium and Workshops / ed. by Jana Kolar and Matija Strlič.* Ljubljana : Faculty of Chemistry and Chemical Technology, 2008. pp 11-12.

third of the books were already in severe state of degradation with degree of polymerization (DP) less than 400.

In 2013, a mass deacidification programme was introduced. The primary focus was on selection of archival copies of monographic print collection of "Slovenika", with the date of publication from the middle of the 19th century onwards. Until now, approximately 13.500 book items (2500 kg of books) were sent for mass deacidification to Preservation technologies B.V.<sup>19</sup> in the Netherlands.

The selection criteria for the books to be treated by mass deacidification were: physical condition of the items, pH value of the paper and mechanical strength. Non-destructive analysis using Karakta portable Near Infra-Red Spectrometer (Karakta d.o.o., Ljubljana)<sup>20</sup> was performed in order to determine pH before and after deacidification and DP of paper. The books already in severe state of degradation with DP less than 400 will be preserved in the digitised form.

After the books are deacidified, soft bound and unbound items have been equipped with protective enclosures made of chemically stable materials.

The positive side-effect of the selection of the books for mass deacidification is cataloguing of the old stock, arranging the books according to call number, cleaning the dust from the books in the monograph collection, replacement of the old envelopes and folders with protective enclosures made of chemically stable materials and conservation treatments of mechanical damages of the books.

The manuscripts<sup>21, 22, 23</sup> or other precious items, endangered by acid hydrolysis and/or iron gall ink corrosion are conserved in the conservation

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<sup>19</sup> Preservation technologies BV [Accessed: 2014-11-24]. Available at: <http://ptbv.nl/overview-en.html>

<sup>20</sup> Karakta d.o.o. [Accessed: 2014-11-24]. Available at: <http://www.karakta.eu/>

<sup>21</sup> Malešič, Jasna. Konserviranje-restavriranje rokopisov Valentina Vodnika. *Konservator-restavrador* /ed. by Zoran Milić. Ljubljana : Skupnost muzejev Slovenije, 2006, pp. 34.

<sup>22</sup> Malešič, Jasna; Kozjek, Andreja. Stabilizacija železo-taninske korozije na zapuščini Jerneja Kopitarja. // *Konservator-restavrador* /ed. by Zoran Milić. Ljubljana: Skupnost muzejev Slovenije, 2010, pp. 35.

<sup>23</sup> Malešič, Jasna; Štolfa, Andrej; Kojc, Meta; Perko, Simon. Konserviranje-restavriranje rokopisov Ivana Cankarja. // *Konservator-restavrador* /ed. by Zoran Milić. Ljubljana: Skupnost muzejev Slovenije, 2007. pp 41.

workshop using calcium bicarbonate and/or calcium<sup>24</sup> or magnesium phytate<sup>25</sup> treatment where applicable. After conservation procedures all documents are stored in protective enclosures made of high quality materials and under controlled environmental conditions.



Figure 5 (Photo: Meta Kojc): Part of the manuscript legacy of Ivan Cankar, the greatest writer in the Slovenian language, before conservation procedures

<sup>24</sup> Reissland, Birgit; Scheper, Karin; Fleischer, Sabine. Cited on page 6.

<sup>25</sup> Kolar, Jana; Možir, Alenka; Strlič, Matija; de Bruin, Gerrit; Pihlar, Boris; Steemers, Ted. Stabilisation of iron gall ink : aqueous treatment with magnesium phytate. // E-preservation science 4, (2007), 19-24.

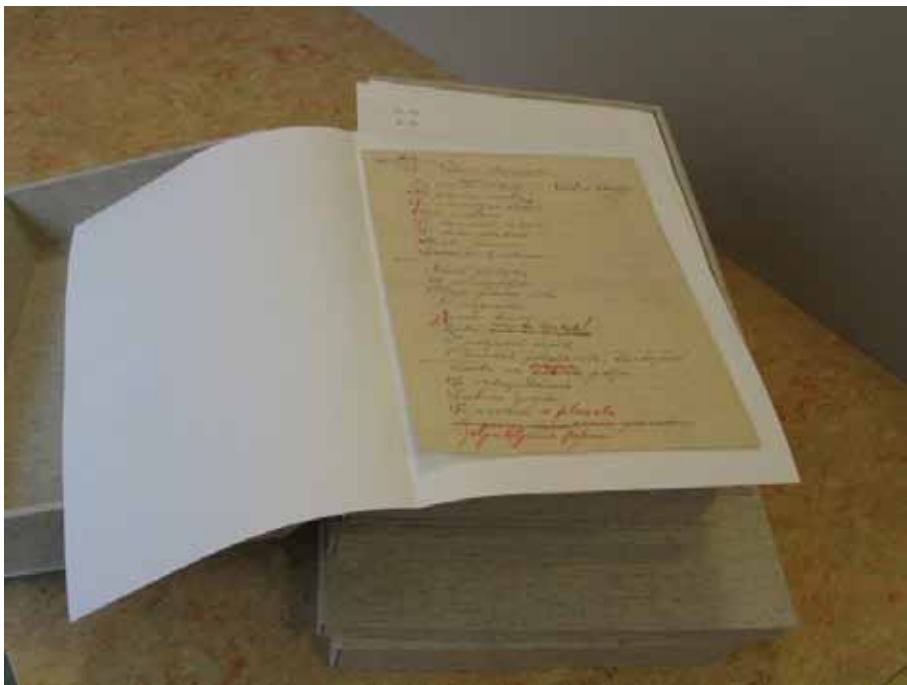


Figure 6: Part of the legacy of Ivan Cankar, stored in the Manuscript and Rare Books Collections of the Library, after conservation and stored in high quality protective enclosures

## Conclusion

Preservation of written heritage is a serious task in the 21st century due to uncontrollable amount of decaying materials. Although during the past centuries the writing medium underwent only very few changes, from parchment to paper, the last two centuries have seen the recurrent emergence of the new media.

The collections deteriorate due to a combination of elements, such as: inadequate and careless use and handling of the documents; badly controlled environmental conditions, inappropriate storage and internal causes of degradation. Older documents suffer from iron gall ink corrosion, which has been in use from the 12<sup>th</sup> century until the beginning of the 20<sup>th</sup> century, papers produced from the 19<sup>th</sup> century onwards are less durable because of the changes

in the production and even less durable is the documentary heritage on modern media, such as audio and moving image documents.

During the past decade the preservation activities in the National and University Library have been focused on the preservation of paper based documents, the activities for preservation of modern media will be our important task in the following years. Newspapers, produced on low quality paper have been preserved by digitisation and microfilming; archival copies of monographic print collection are treated with mass deacidification procedures in order to slow down degradation caused by acid hydrolysis. Older documents have been stored in appropriate environmental conditions in the enclosures of high quality materials. In order to slow down iron gall ink corrosion, single item treatments have been carried out on some of the most important and endangered documents.

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