



TARTU ÜLIKOOLI
RAAMATUKOOL



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TARTU ÜLIKOOLI
RAAMATUKOGU
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FOREWORD

The range of relationships of the restorers of the Tartu University Library has constantly widened in newly independent Estonia. Direct contacts have become feasible both through the projects related to practical restoration work and through international seminars. The present collection offers a variety of reports of a seminar held in 1993 at the Tartu University Library on the training of restorers at Tartu University and in Finland, and on the problems of preserving old books at the Vilnius University Library in Lithuania.

During all its period activity (from 1966 as Sector of Hygiene and Restoration affiliated to the Lending Department, from 1970 as an independent department) the Restoration Department has considered familiarizing the public with practical conservation work and the results of respective research essential (see the list of publications at the end of the collection). The restoration/conservation and preservation of the library stocks have been under discussion at scientific conferences, seminars and instruction days organized for librarians, workers of archives and museums. The Restoration Department has served as a site of practical and advanced training for students of Tartu University, Tallinn Art University, Tallinn Pedagogical University and several higher professional schools, as well as for practising restorers and for specialists from outside Estonia. Several aspects of the Department's activity are based on long-term cooperation with scientists of Tartu University institutes and centres of restoration of the other countries.

Considering the cultural value of the stocks of the Tartu University Library, the earlier preservation conditions, intensification of use, steadily rise in air pollution as well as many other factors and their interaction, the joint effect of various kind of damage on all materials has increased. The constant monitoring of such changes as well as knowledge of novel preventive measures and of the latest standpoints of practical preservation and conservation work, and putting them to practice are the requirements set by our time.

Viiu Klement

Compiler

SAATEKS

Taasiseseisvunud Eestis on Tartu Ülikooli Raamatukogu konserveerimise suhtlusring avardunud. Praktilise konserveerimistööga seotud projektide kõrval võimaldavad vahetuid kontakte rahvusvahelised seminarid. Käesolev kogumik pakub 1993. a. TÜ Raamatukogus toimunud seminari ettekandeid uurimistööst raamatukogus, konserveerimise ettevalmistamisest Tartu Ülikoolis ja Soomes ning probleeme vanaraamatu säilitamisel Vilniuse Ülikooli Raamatukogus Leedus.

Kogu oma tegevusaja vältel (hügieeni- ja restaureerimissektorina hoiuosakonna koosseisus 1966. a. alates, 1970. a-st iseseisva osakonnana) on TÜ Raamatukogu restaureerimisosakond pidanud oluliseks praktilise konserveerimistöö ning sellealase uurimistöö tulemuste tutvustamist (vt. nimestikku käesoleva kogumiku lõpus). Raamatukogu varade restaureerimise/konserveerimise ja säilitamise teemadel on korraldatud teaduskonverentse, praktilisi seminare ning nöpäevi raamatukoguhoidjatele, arhiivide ja muuseumide töötajatele. Restaureerimisosakond on kujunenud praktikabaasiks Tartu Ülikooli, Tallinna Kunstiülikooli, Tallinna Pedagoogikaülikooli ja mitme rakenduskõrgkooli üliõpilastele, samuti tegevrestauraatoritele. Siia tullakse end täiendama ka väljastpoolt Eestit. Osakonna tegevuse mitmed tahud rajanevad pikaajalisele koostööle TÜ instituutide teadlastega, samuti restaureerimiskeskustega teistes riikides.

Tartu Ülikooli Raamatukogu kogude varasemad hoiutingimused, kasutamise intensiivistumine, õhu saastatuse pidev kasv ning paljud muud tegurid oma koosmõjus võimendavad kõige erinevamate kahjustuste toimet mistahes materjalidel. Nende muutuste järjepidev seire, kahjustuste toime uued profülaktilised tõkendid, praktilise hoiu- ja konserveerimistöö uusimate seisukohtadega kursisolek ning praktikas rakendamine on aja nõue.

Viiu Klement

koostaja

ANALYSIS OF STORING CONDITIONS IN TARTU UNIVERSITY LIBRARY IN 1982-1992

Kersti Jalas

The opening of the new library building marked an entirely new period in the work of the Section of Hygiene: the storage area of the library is now more spacious, storing conditions are better, all books are kept in the same building. Our workers, together with those of the Department of Technical Maintenance spared no efforts to make preservation conditions for books as favourable as possible. The beginning was quite difficult: the temperature in stockrooms was high, sometimes even up to 23°-32°C, fluctuations of air humidity were very great, 40-75%. For example, in stockroom A-1 the temperature was 24°C and humidity 39% in 1981. In summer months conditions were the most favourable in stockrooms on C-floor: air humidity was 70-75%, temperature was still within the standard. Many problems concerned stockrooms in the Department of Manuscripts and Rare Books, the Book Museum and reading-rooms. By the autumn and winter of 1982 we were able to meet requirements for preserving conditions in underground stockrooms on A-, B- and C-floors. However, even during the following years July and August remained the riskiest months because of high air humidity, especially on the lowest, C-floor. Disinfectors' work was considerably easier in the new building, since books had been cleaned of dust and disinfected in the course of moving; many books in need of repair were protected by means of special covers. The workers of the Department of

Hygiene were constantly monitoring conditions in stockrooms. In each suspected case of infection with mould we removed the book from stacks and subjected it to treatment in the workrooms of the Department of Hygiene. After treatment the book was kept in the hood for a week before being returned to stacks. The new library building was drying very slowly and so already in 1983 the walls of the corridors in stockrooms were covered with mould, especially in underground stockrooms on C-floor. The walls were disinfected using formalin solution. During the same summer mould was scraped off the walls after which they were repainted, since no other effective method was available. Such a procedure has to be repeated after every few years. During four years conditions in stockrooms became stable while problems persisted in connection with the stockrooms of the Department of Manuscripts and Rare Books and the Book Museum where rare books, manuscripts, pamphlets (booklets), engravings etc. are displayed. In order that these materials would be preserved for future generation, several prerequisites should be fulfilled of which more important are lighting and showcases. The showcases of the Book Museum have been dusted at least four times a year together with the disinfection of underlying textiles. Pest control has also been carried out.

The preservation of books on open stacks has brought about problems. There, too, lighting plays an important role, as well as the existence of dust and soot particles carried on books.

Measurements of temperature and air humidity in stockrooms and reading-rooms are carried out by workers of the Department of Hygiene once a week (up to 1985 data were gathered two or three times a week). The measurement sites are in general stockrooms (15 sites): in the stockroom of the Department of Manuscripts and Rare Books (2), in newspaper stocks, in the Book Museum and in stockrooms (3) and in the reading-rooms (5) of the textbook collection.

The analysis of data from the reading-rooms shows that the temperature there is too high — even up to 23°–25°C in winter. Librarians try to improve the situation by opening windows and airing the rooms. When analysing preservation conditions in stockrooms, in the Book Museum and in reading-rooms we can point out that the present air-conditioning

system of the library is not able to guarantee a stable microclimate all the year round. Although temperature can be kept in the range 18°–21°C, the fluctuation of air humidity in summer and winter months is too large, 57–76% and 37–50%, respectively. The library is in great need of a local heating system; this would be the only way to ensure satisfactory preserving conditions in the case of materials of high cultural value.

Another serious problem is the quality of filters of the air conditioner. The filters should guarantee the maximum cleanness of the air entering the library rooms. However, the air of workrooms as well as of stockrooms contains dust, soot and fine sand and clay particles. These originate from the highly polluted air of the town of Tartu, the cause of which are bad out-of-date heating systems, heavy traffic and littered streets.

In order to preserve clean conditions at least in the stockroom of the Department of Manuscripts and Rare Books, we covered the ventilator opening with three-layer gauze, hoping it would gather all soot and dust. The gauze filters are changed three times a year and they have been of considerable help.

The Department of Hygiene monitors constantly the condition of all library collections, including the materials that have already been conserved and restored. It is important to make sure that the methods used for conserving valuable materials (especially in the case of chemical treatment) would not cause them any damage.

The first requirement for the good preservation of books and other materials is the maintenance of proper temperature and lighting in stockrooms. The preferable temperature would rather be lower than higher; temperature over 18°C is not considered favourable, while 25°C is the turning point above which heat already causes a harmful effect on paper. Library materials are particularly affected by sharp rises and falls of temperature. For example, a 10°C rise in temperature accelerates the processes of ageing of paper threefold. In case materials are kept during one year in a room where temperature is 20°C, it would affect paper to the same degree as if it were kept during 40 days at a temperature of 40°C.

The optimal lighting system is as important from the viewpoint of preservation conditions as is the right temperature. In this library the lighting system enables the workers to switch the lights on and off selectively, so that only the necessary area of stockrooms is lighted while the rest of the area is dark.

On the whole, we can consider preservation conditions in general stockrooms almost satisfactory; however, a lot remains to be desired concerning the stockroom of the Department of Manuscripts and Rare Books. The measurement results obtained from the stockrooms showed that the temperature interval from January 1982 to August 1985 was 15°–25°C, relative air humidity 37–72%. For the period September 1985 – May 1989 the respective data were 15°–25°C and 34–76%, and for Jan. 1990 – Dec. 1992, 19°–23°C and 40–68%, respectively.

To guarantee the preserving of our books and other valuable cultural treasures for future generations, it would be necessary to:

- 1) instal a local heating system in the stockrooms as the only means of guaranteeing stable preservation conditions corresponding to standards;

- 2) furnish a laboratory where it would be possible to analyse materials chemically and structurally, take microphotos, use x-ray and infra-light devices;

- 3) create a database including (at least at first) data on the state of books preserved in the Department of Manuscripts and Rare Books, on the nature of their damage and restoration, further also data on the books of other collections.

The storing conditions of the library are now better than they have ever been; however, all previous periods affect books even scores of years later. Any stable storing regime was lacking in the past: books were constantly rearranged, transported from one building into another, kept in unsuitable rooms (cellars, churches, etc.). All this has its consequences till the present.

HOIUREŽIIMIST TARTU ÜLIKOOLI RAAMATUKOGUS AASTATEL 1982–1992

Kersti Jalas

Resümee

Artiklis antakse ülevaade raamatukogu hügieenisektori tööst ja hoiurežiimist uues hoones.

Temperatuuri ja niiskuse probleemidega tuli hakata tegelema juba enne raamatute ülekolimist. Tehnilise eksploatatsiooni osakond püüdis teha kõik, et hoiutingimused oleksid raamatutele soodsad. Kõik see tuli suurte raskustega. Temperatuuri ja õhuniiskuse kõikumine oli hirmuäratavalt suur. Palju muret põhjustas kõige alumise — C-korruse — hoidla. Juba 1983. a. talvel kattusid hoidlate koridoride seinad hallitusega, mis tuli maha kraapida. Seinad värviti seejärel uuesti üle. Probleeme oli ka käsikirjade ja haruldaste raamatute osakonna (KHO) hoidla, raamatumuuseumi ja lugemissaalidega.

Hügieenisektor teeb mõõtmisi üks kord nädalas (kuni 1985. aastani kaks kuni kolm korda nädalas). Mõõtmispunkte on 27.

Säilitusrežiimi näitudest hoidlates, raamatumuuseumis, lugemissaalides võib järeldada, et raamatukogu praegune konditsioneeride süsteem ei taga aastaringset stabiilset mikrokliimat. Kuigi temperatuur suudetakse hoida $+18^{\circ}$ – $+21^{\circ}$ C piires, on endiselt suured erinevused niiskusrežiimis suve- ja talvekuudel — vastavalt 57%–76% ja 37%–50%. Kui üldkogu hoiutingimustega võib praegu veel kuidagi rahule jääda, siis palju jätavad soovida KHO kogu hoiutingimused.

Et tagada raamatute ja muude kultuurivarade säilimine tulevastele põlvetele, tuleks:

1. Hoidlates seada sisse stabiilne, normidele vastav säilitusrežiim — seda tagab ainult raamatukogu lokaalne küttesüsteem.

2. Sisustada laboratoorium, kus oleks võimalik teha materjalide struktuuri- ja keemilist analüüsi, mikrofotosid, röntgen- ja infraülesvõtteid.

3. Luua KHO kogu seisundi, kahjustuste iseloomu ja restaureerimistööde kohta elektrooniline andmebaas (pank), mis tagaks operatiivseks tegutsemiseks vajaliku info käepärasuse.

MICROBIOLOGICAL CONTAMINATION OF AIR IN TARTU UNIVERSITY LIBRARY

Kurmo Konsa
Urmas Kokassaar

A severe problem in libraries and archives is the biological damage of books and manuscripts, caused mostly by filamentous fungi [1]. Microorganisms, including filamentous fungi, enter book repositories with outdoor air, incoming books, equipment and people. The main source of book contamination with fungal conidia is the surrounding air [2]. The continuous presence of people increases contamination with fungal conidia nearly twice and with bacteria three to four times [3].

The possibility of spreading filamentous fungi in book repositories depends primarily on storage conditions. As the mycelium and especially the conidia of filamentous fungi maintain their virility during a long period (up to 50 years), it is also important to be acquainted with the formation of stocks, the origin of storage items, their storage conditions in the past, accidents etc. [4].

Storage conditions in Tartu University Library have been far from normal. Formerly library stocks were accommodated in several buildings where unsuitable heating conditions caused strong fluctuations in relative humidity (10–95%); ventilation was practically lacking; both uncleaned and disinfected books were kept in the same repositories. Storage conditions improved considerably in 1981 when the library was transferred to a new air-conditioned building. However, the danger of microbiological deterioration still exists. A great part of the stocks has been kept, during a shorter or a longer period, in conditions favourable for the development of filamentous fungi; in spite of disinfection, they

may be contaminated by the fungal mycelium and conidia. The present air-conditioning devices are not able to provide a stable microclimate all the year round. There occur great differences in relative humidity in summer and winter months: 57–76% and 37–50%, respectively. One of the main aspects of microbiological research in Tartu University Library is to determine the extent of microbiological contamination of the air, and the factors affecting it. The data of microbiological monitoring allow to find out the most endangered stocks and give recommendations for changing heating and ventilation. The microbiological monitoring of the air gives partly information both on conditions in the repositories and on the degree of contamination of storage items.

MATERIALS AND METHODS

The microbiological analyses of the air were carried out in the rooms of Tartu University Library in 1991–1993; 1 — May 1991; 2 — September 1991; 3 — January 1992; 4 — April 1992; 5 — June 1992, 6 — September 1992; 7 — November 1992; 8 — January 1993.

The air samples were taken from 10 stationary testing places 8 times, with each test being repeated three times. Air seedings were carried out with a Krotov impaction sampler on the surface of a sterile solid medium. The volume of filtrated air was 25–100 litres, depending on the degree of the microbiological contamination of rooms. The sampling height was 1.5 m.

The following microbiological characteristics were determined from the tests: total number of microorganisms, total number of fungal conidia and total number of conidia of filamentous fungi with cellulolytic and proteolytic activity. In finding out the number of different groups of microorganisms media with a different composition were used. To determine the amount of microorganisms a mixture of 2% fish peptone agar and 2% malt agar with the ratio 1:1 was used. To find out the amount of conidia of cellulolytic filamentous fungi the mineral Czapek-Dox solid medium was used, to which 40 g/l carboxymethylcellulose was added as a source of carbon. The Czapek-Dox mineral medium contained the following components (grams per 1 litre of distilled water): NaNO_3 — 3;

KH_2PO_4 — 1; $\text{MgSO}_4 \times 7\text{H}_2\text{O}$ — 0.5; KCl — 0.5, $\text{FeSO}_4 \times 7\text{H}_2\text{O}$ — 0.01, agar — 20. To inhibit the growth of bacteria, streptomycin (50 mg/l) was added to the medium. The number of conidia of proteolytic filamentous fungi was determined on milk agar prepared on the basis of the Czapek-Dox mineral medium. A double concentration of the Czapek-Dox mineral medium and centrifuged milk (500 g, 20 min) were autoclaved separately and poured together sterilely with the ratio 1:1. Streptomycin was used as a bactericide in the medium. All the media were autoclaved at 0.5 atm during 30 minutes.

Petri dishes with air seedings were incubated in dark conditions at $30^\circ\text{C} \pm 2^\circ\text{C}$ for 3–10 days.

The number of colonies of microorganisms was counted supposing that each colony originated from one conidium, cell or a piece of mycelium which had been precipitated onto the medium. The number of colony forming units was expressed per 1 m^3 of air. The logarithms of the numbers of microorganisms and fungal conidia were used in calculations.

Air seeding samples were taken during the morning hours of weekdays in the presence of the staff or visitors who were encouraged to continue their normal daily routine. Sampling was always carried out by two persons.

RESULTS AND DISCUSSION

The rooms tested can be divided into three groups: repositories (A; B; C_1 ; C_v and the Department of Manuscripts and Rare Books DMRB); working offices (restoration and disinfection rooms) and public rooms (hall, reading-room and Book Museum).

The initial observation of the results suggests that filamentous fungi are permanently present in the microflora of the library (Figure 1A). In only 5% of the tests no filamentous fungi could be found, whereas in 41% of the tests fungi occurred in all three types of media. A certain regularity in the occurrence of conidia of filamentous fungi can be observed in different rooms.

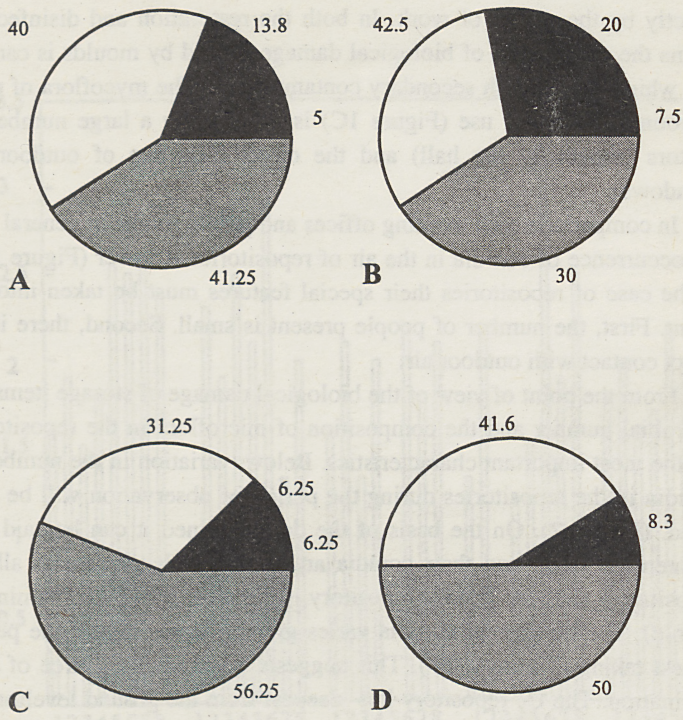






Figure 1. Occurrence of filamentous fungi in library rooms (in percentages):
 A — in general; B — repositories;
 C — working-offices; D — public rooms.

 fungi lacked in all three samples;
 fungi occurred in one sample out of three;
 fungi occurred in two samples out of three;
 fungi occurred in all three samples.

Abundant mycoflora in the working offices (Figure 1B) is caused directly by the nature of work. In both the restoration and disinfection rooms the elimination of biological damage caused by moulds is carried out, which causes high secondary contamination. The mycoflora of public rooms in general use (Figure 1C) is affected by a large number of visitors (especially the hall) and the direct influence of outdoor air (windows).

In comparison with working offices and public rooms in general use, the occurrence of conidia in the air of repositories is lower (Figure 1D). In the case of repositories their special features must be taken into account. First, the number of people present is small. Second, there is no direct contact with outdoor air.

From the point of view of the biological damage of storage items the microbial number and the composition of microflora in the repositories are the most important characteristics. Below, variation in the number of conidia in the repositories during the period of observation will be analysed. (Figure 2). On the basis of the data obtained it can be said that filamentous fungi and their conidia are permanently present in all the repositories studied. The C_V repository is the most heavily contaminated (Table). The number of conidia varies greatly depending on the period of test taking (Figure 2-IV). This suggests a permanent source of contamination. The C_V repository lies deepest from the ground level on the second basement floor. Due to badly isolated outer walls relative humidity there is 5-15% higher than in the other repositories (Table). As a result of permanent moisture on corridor walls, mycelium is growing on them which, in its turn, causes the secondary contamination of the air by conidia and mycelium fragments. The role of local contamination is clearly revealed by data on the C_I repository (Figure 2-III, Table) where microbiological characteristics are considerably small in comparison with the C_V repository. It should be mentioned that the distance between the C_I and C_V repositories is 54 m and they are separated by four tightly closed doors.

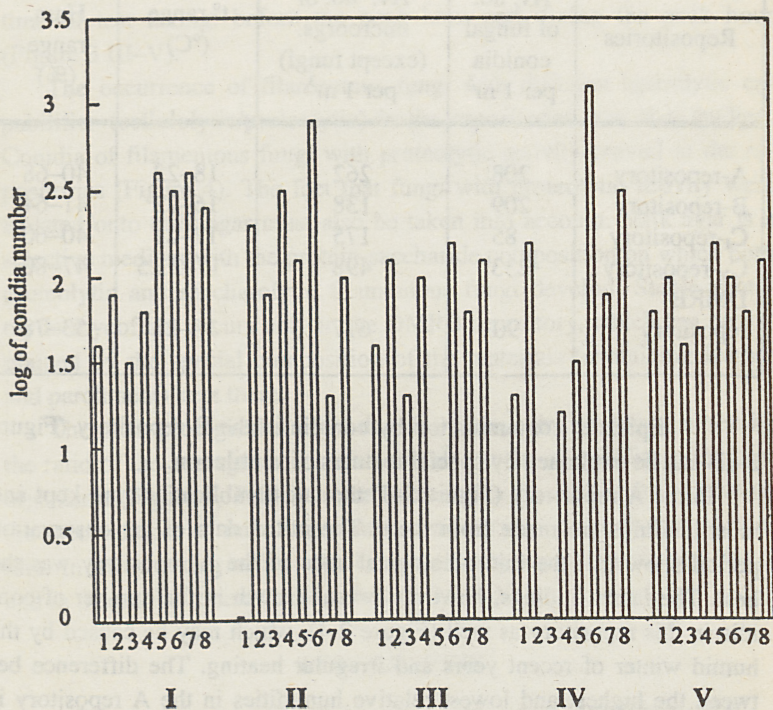


Figure 2. The average number of fungal conidia in the air of repositories during the observation period.

I – A repository; *II* – B repository; *III* – C_1 repository; *IV* – C_V repository; *V* – Department of Manuscripts and Rare Books (DMRB).

1...8 sampling periods (see section "Materials and methods").

Table. *The microbiological and physical characteristics of library repositories during the observation period*

Repositories	Av. no. of fungal conidia per 1 m ³	Av. no. of microorgs. (except fungi) per 1 m ³	t° range (°C)	Hum. range (%)
A-repository	208	262	18–22	40–68
B-repository	209	138	16–22	41–64
C _I -repository	85	175	17–21	40–60
C _V -repository	233	498	17–21.5	47–80
DMRB-repository	90	617	16–23	53–78

Episodic contamination by conidia in the B repository (Figure 2–II) can be explained by special features of ventilation.

In the A repository (Figure 2–I) the latest publications are kept and most lendings are made from there. The initial data of the observation period show that the microbiological state of the A repository was the best. The latest findings, however, reveal growth in the number of conidia in this repository as well (Figure 2–I), which may be caused by the humid winter of recent years and irregular heating. The difference between the highest and lowest relative humidities in the A repository is $\approx 30\%$ (Table).

The most stable mycoflora occurs in the DMRB repository (Figure 2–V) where older, often mould-damaged books and manuscripts are kept. However, the influence of the potential contamination sources has been stabilized by very intensive ventilation.

The contamination of working offices by conidia is caused by special features of work. The average number of conidia in 1 m³ of air is of the same order both in the restoration room and in the disinfection room (Figure 3 I–II).

In public rooms the number of conidia depends mainly on the number of visitors. Thus the number of conidia per 1 m^3 of air increases in the following succession: museum < reading-room < hall (Figure 5). The few abrupt changes in the number of conidia can be explained by the time of test taking: before the peak hour and during the peak hour (Figure 3 III–V).

The occurrence of filamentous fungi with different hydrolytic capabilities (cellulolytic/proteolytic) in the repositories was also studied. Conidia of filamentous fungi with proteolytic activity prevail in the repositories (Figure 4). The fact that fungi with proteolytic activity were isolated onto milk agar must also be taken into account. Milk agar is a selective medium with the protein-saccharide composition on which both proteolytic and saccharolytic filamentous fungi develop. Stable proteolytic mycoflora occurs only in the DMRB repository, which can be explained by the special composition of the materials (containing leather and parchment) kept there.

The microbiological state of the air in the rooms is characterized by the ratio of the average values of the total number of conidia and microorganisms (Figure 5, Table). In the repositories the ratio is 0.8–6.8 while the total number of microorganisms in most cases exceeds that of conidia. In the working offices the corresponding characteristic is 2.7–4.8 and in the public rooms (hall excluded) 0.8–1.1.

CONCLUSIONS

1. Filamentous fungi are permanently present in all library rooms.

2. In the repositories of Tartu University Library the number of conidia in 1 m^3 of air is within the allowed limits. On the average, there occur 100–200 conidia per 1 m^3 in the repositories. For comparison it can be noted that in the repositories of the Saltykov-Shchedrin Library in St. Petersburg the total number of conidia in 1 m^3 of air is 30–600. The episodic contamination of some repositories and a general tendency towards increasing contamination in the A repository are disturbing phenomena.

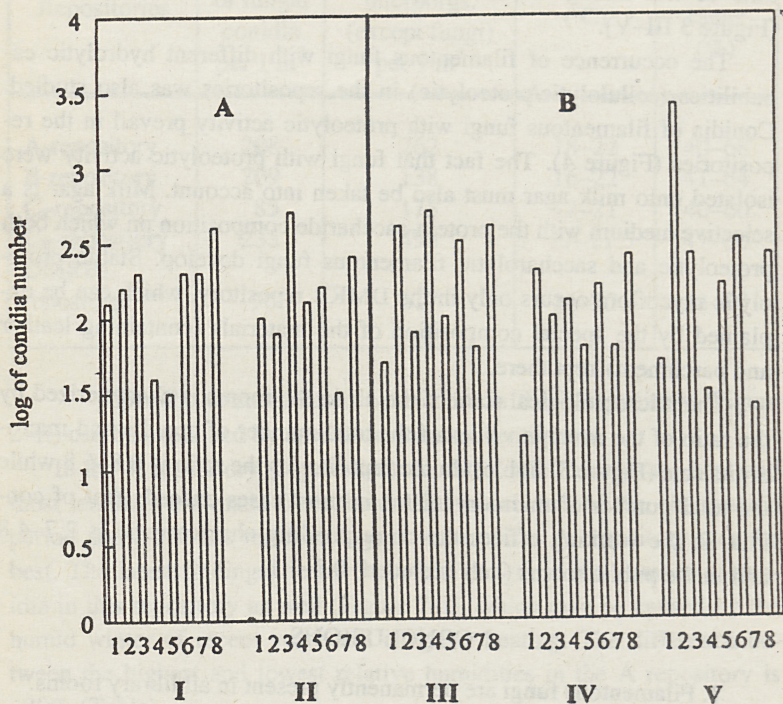


Figure 3. *The average number of fungal conidia in the air of working-offices (A) and in the air of public-rooms (B) during the observation period.*

A: I — restoration room, II — disinfection room;

B: III — reading-room; IV — Book Museum; V — hall.

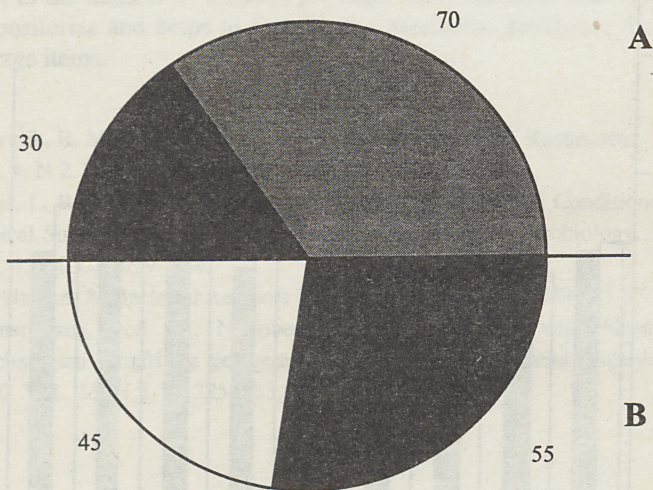





Figure 4. Occurrence of fungal conidia with cellulolytic and proteolytic activity in the air of repositories (in percentages).

-  fungal conidia with proteolytic activity A;
-  fungal conidia with cellulolytic activity B;
-  no fungal conidia.

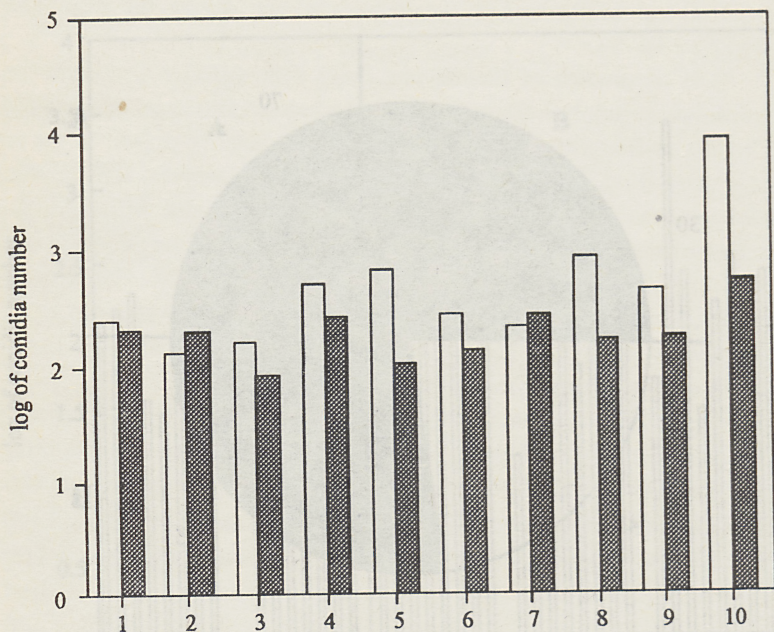


Figure 5. Comparison of the average number of microorganisms and fungal conidia in the air (per 1 m³) during the observation period.

- | | | |
|--------------------------------|-----------------------|--------------------------------|
| 1 — A repository; | 2 — B repository; | 3 — C ₁ repository; |
| 4 — C _V repository; | 5 — DMRB; | 6 — Book Museum; |
| 7 — reading room; | 8 — restoration room; | |
| 9 — disinfection room; | 10 — hall. | |

3. The number of conidia of filamentous fungi in the library air depends on the following factors: *) temperature and humidity conditions in rooms; **) direct influence of outdoor air; ***) the presence of people and the number of visitors; ****) special features of work; *****) the character of materials kept in the rooms.

4. Permanent microbiological monitoring of the air, particularly with respect to the number of conidia, provides information on conditions in the repositories and helps to forecast the potential biological damage of storage items.

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TARTU ÜLIKOOLI RAAMATUKOGU RUUMIDE ÕHU MIKROBIOLOOGILINE SAASTATUS

Kurmo Konsa
Urmas Kokassaar
Resüme

Raamatukogudes ja arhiivides on oluliseks probleemiks raamatute ja dokumentide mitmesugused biokahjustused, mida põhjustavad hallitus- ehk mikroseed. Raamatute peamiseks saasteallikaks on mikrosete spooridega küllastatud õhk.

TÜ Raamatukogu ruumide õhu mikrobioloogilised analüüsid viidi läbi 1991–1993. a. 8 korral 10 statsionaarsest proovivõtupunktist. Õhkülvid tehti

uuritavates ruumides Krotovi aparadi abil steriilse tardsöötme pinnale. Filtreeritava õhu ruumala oli vahemikus 25–100 liitrit, sõltuvalt ruumide saastatuse määra. Proovid võeti 1,5 m kõrguselt. Söötmetena kasutati 2% kalapeptoon- ja 2% õllevirdeagari segu, Czapek-Doxi mineraalsöödet karboksümetüülselluloosiga (40 g/l) ning Czapek-Doxi mineraalsöötme baasil valmistatud piimagarit.

Õhuproovidest määrati järgmised mikrobioloogilised näitajad: mikroorganismide üldarv, mikroseenite üldarv, tsellulolüütilise ja proteolüütilise aktiivsusega mikroseenite üldarv. Mikroorganismide arvukus väljendati 1 m^3 õhu kohta.

Uuritud ruumid jaotati kolme rühma: hoidlad (A, B, C_I, C_V, KHO), tööruumid (restaureerimis- ja desinfitseerimisruum) ning lugejatele mõeldud ruumid (raamatumuuseum, lugemissaal ja fuajee).

Mikroseened on raamatukogu õhu mikrofloora püasasukad (joon. 1). Mikroseenite hulk õhus on kõrgeim C_V-hoidlas, keskmiselt 233 spoori 1 m^3 õhus (joon. 2, tab.). Mikroseenite suur arv on eelkõige põhjustatud kõrgest suhtelisest õhuniiskusest C-korrusel.

Tööruumides tingib inimeste pidev kohalolek ja töö spetsiifika (käsitatakse vanu, hallituskahjustustega raamatuid) saastatuse kõrge taseme. Keskmise mikroseenite spooride hulk 1 m^3 õhus on restaureerimisruumis 445 ja desinfitseerimisruumis 359. Lugejatele mõeldud ruumidest on saastatus mikroseenite spooridega suurim lugemissaalis (1 m^3 õhus on keskmiselt 644 spoori) ja fuajees (1334).

Uuriti ka erineva ökoloogilise nõudlusega mikroseenite (tsellulolüütiliste ja proteolüütiliste) esinemissagedust hoidlates. Leiti, et hoidlates on ülekaalus proteolüütilise aktiivsusega mikroseenite spoorid (joon. 4).

Raamatukogu ruumide õhu mikrobioloogiline seire annab informatsiooni ruumide sanitaar-hügieenilistest tingimustest ning hoidlates säilivate mikroorganismidega saastatuse määra.

PILOT SURVEY OF TARTU UNIVERSITY LIBRARY COLLECTIONS

Kurmo Konsa
Tiina Tensing
Maret Konson

People have always collected information. When culture becomes literate it begins to store its information mostly in the form of books.

Information presented in a book is contained not only in its text but also in its structure and material [1]. The book is thus viewed as a unit comprising text, substance and the techniques used in its physical production [2].

A book is a complex material object; it may be composed of paper, cardboard, leather, parchment, cloth, inks, adhesives, etc. [3]. All these components are subject to processes of natural degradation, i.e. they age [4].

The main causes of the deterioration of books are:

- (1) physical and chemical characteristics of item materials;
- (2) storage conditions (temperature, humidity, light, atmospheric pollution);
- (3) intensity of use;
- (4) history of collections (origin of storage items, storage conditions in the past, previous preservation activities, accidents, etc.).

Paper was invented about 2000 years ago in China from where it spread to Europe during the Middle Ages. Until relatively recently, paper was made by hand from the pulp of cotton rags. This type of paper was strong and chemically stable.

The growing need for paper led to the development of mechanized paper production processes in the nineteenth century. Wood pulp as a promising alternative to cotton rags was introduced during the 1840s. At the same time, paper mills began to use new chemical additives, especially aluminium sulphate (commonly known as alum), to help give their products a good finish and printability. This new paper contained seeds of its own destruction. The alum sizing combines with air humidity to produce sulphuric acid. With time, increased acidity destroys cellulose fibres and weakens paper.

Alum-sized acidic paper can become unusable in as short time as fifty years.

Unfavourable storage conditions and intensive use hasten deterioration processes.

During the last two decades several international reports have published results referring to a large percentage of books with deteriorated paper.

Studies conducted at the Library of Congress, at Yale, Harvard and Stanford University Libraries have confirmed that 25 to 40 percent of their collections are already deteriorated [5, 6, 7, 8, 9].

The Tartu University Library (TUL) survey designed to address the following research problems:

(1) What is the condition of books in the general stock and in different collections of TUL?

(2) How to determine the number of volumes requiring conservation/restoration?

(3) How can this condition be compared with the results of similar surveys at other libraries?

The study had a double purpose. First, the data would serve as a basis for assessing the current condition of the collection and for making long-range preservation planning. Second, the data will be compared with the results of similar surveys to reveal similarities and differences in paper deterioration in different libraries [9, 10].

METHODOLOGY

Choice of sample

Random sampling technique was used. According to a hypothesis one should choose randomly a number of books and estimate them with respect to a set of standards. The result would show the percentage of deteriorated books in the entire collection.

Separate stocks investigated in this study were:

(1) The Collection of Estonian Literature (EL) including books and periodicals from the 17th century up to the present time;

(2) The Collection of Recent Foreign Literature (RFL) including books published after 1917;

(3) The Collection of Older Foreign Literature (OFL) including books published before 1917;

(4) The Collection of Large Format Books (LFB) including large (B, D, C) format books in foreign languages.

The Study Library, the Collection of Periodicals, the Memorial Collections, the Collection of Dissertations and the Collection of Reference Books were excluded.

Sample sizes were weighted to reflect the variety of materials in stocks and the assumed deterioration rates. The total sample amounted to 551 volumes which were distributed as shown in Table 1.

Table 1. Total number and sample sizes of volumes per collection

Collection	Number of volumes	Sample size
1 Estonian Literature	180,000	100
2. Recent Foreign Literature	667,000	150
3. Older Foreign Literature	283,000	201
4. Large Format Books		100
Total	1,130,000	551

The ordinary position of a volume in stocks served as a basis for random selection. To establish the set of racks, shelves, and eventually the books to be tested, computer-generated random numbers were used.

Gathering data

Data on each book were recorded directly onto work sheets (Figure 1).

For each book selected, the numbers of location, the call number and the place and date of publication were recorded.

The physical condition of the book was determined by the Stanford method [8].

The Stanford method helped to judge of the condition of paper, binding and cover. Each book was to be estimated on these three parts each of which had three grading alternatives, 1 = good condition, 2 = worn condition, 3 = bad condition (deteriorated).

The gradings were later to be weighted against one another so that the results would give a picture of the state of each book.

Paper brittleness was determined by the corner-fold test. The top corner of the last page (not the end paper) was folded and creased repeatedly until the fold broke or after it had been folded successively six times (three double folds). The number of folds was the measure of brittleness and was recorded on the worksheet. Paper capable of six successive folds without breaking was considered not brittle.

The acidity of paper was determined using the contact pH method [11].

Each book was then tested for the kind of cover (paper cover, hard cover and leather), mould damages and previous repairs. Finally, the last year lendings and shelving were recorded.

RESULTS

General physical condition

Figure 2 shows the weighted gradings of paper, binding and cover in different collections. There are not very many differences between OFL and LFB collections revealing the highest percentage of deteriorated books (books graded "3"), 8% and 9%, respectively. This is not surprising, since these collections contain a larger proportion of older books

than the other collections. Nearly 2% of EL collection books were deteriorated and 70% were in a good condition. The condition of the books of the RFL collection is better than that of other collections: 94% were in a good condition, 5% were in a worn condition and only 1% were deteriorated.

So the percentage of deteriorated books increases in the following order: RFL < EL < OFL < LFB.

Table 2 shows the gradings of paper, binding and cover separately in the collections studied.

Table 2. *Gradings of paper, binding and cover in different collections (in percentages)*

Collection	EL			RFL		
	1	2	3	1	2	3
Paper	80	18	2	97	2	1
Binding	75	20	5	93	5	2
Cover	56	39	5	83	16	1

Collection	OFL			LFB		
	1	2	3	1	2	3
Paper	73	21	6	68	24	8
Binding	82	14	4	90	8	2
Cover	42	53	5	44	43	13

LFB and OFL collections showed the highest percentage of books with deteriorated paper, 8% and 6%, respectively.

EL and OFL collections contained the largest proportion (5% and 4%) of books with a deteriorated binding, while RFL and LFB collections showed only 2% as being deteriorated.

TUL TEST

Stock Set of shelves Shelf Book

Call numbers:

Publication data:

1 A Paper

Stanford test

Folding test

pH

B Binding

C Cover

Paper covers Hard covers Leather covers

D Mould damages

E Repairs

WEIGHTED GRADING

2 Shelving

normal

thick

horizontal

.....

.....

3 Notes

Figure 1. Data collection sheet.

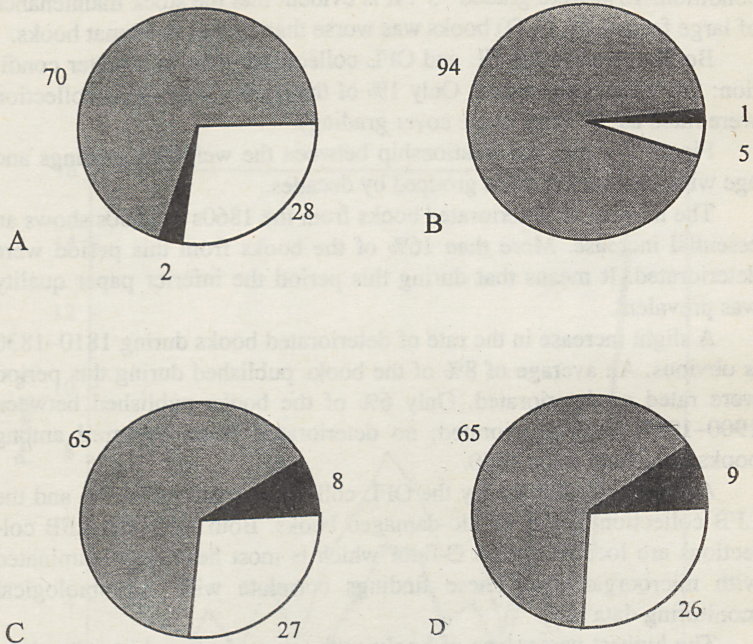


Figure 2. Weighted gradings of paper, binding and cover in different collections (in percentages).

A — Collection of Estonian Literature

B — Collection of Recent Foreign Literature

C — Collection of Older Foreign Literature

D — Collection of Large Format Books

grading 1;
 grading 2;
 grading 3.

Books in the LFB collection were characterized by the poorest cover condition: 13% were graded "3". It is evident that the stock maintenance of large format (B, C, D) books was worse than that of A format books.

Book covers in the EL and OFL collections were in a better condition: 5% were deteriorated. Only 1% of the books in the RFL collection were rated as "3" (due to the cover grading).

Figure 3 shows the relationship between the weighted gradings and age with publication dates grouped by decades.

The number of deteriorated books from the 1860s to 1880s shows an essential increase. More than 16% of the books from this period were deteriorated. It means that during this period the inferior paper quality was prevalent.

A slight increase in the rate of deteriorated books during 1810–1830 is obvious. An average of 8% of the books published during this period were rated as deteriorated. Only 6% of the books published between 1900–1950 were deteriorated; no deteriorated items occurred among books published since 1950.

According to the survey the OFL collection contained 4.5% and the LFB collection 8% of mould-damaged books. Both OFL and LFB collections are located on the C-floor which is most heavily contaminated with microorganisms. These findings correlate with microbiological monitoring data [14].

The highest percentage of books with repairs is found in collections containing older materials: LFB collection 10%, EL collection 8%, OFL collection 7%. Only 0.4% of the books in the RFL collection had some repairs.

The load of usage varies from one collection to another: 9% of the EL collection and 5% of the RFL collection had circulated at least once during 1992, but only 0.5% of the OFL and LFB collections had been used during 1992.

Acidity

Among the commonly used book papers, the principal cause of deterioration seems to be acidity. The most stable papers show pH of about 7 while the less stable ones show pH below 6 [12, 13].

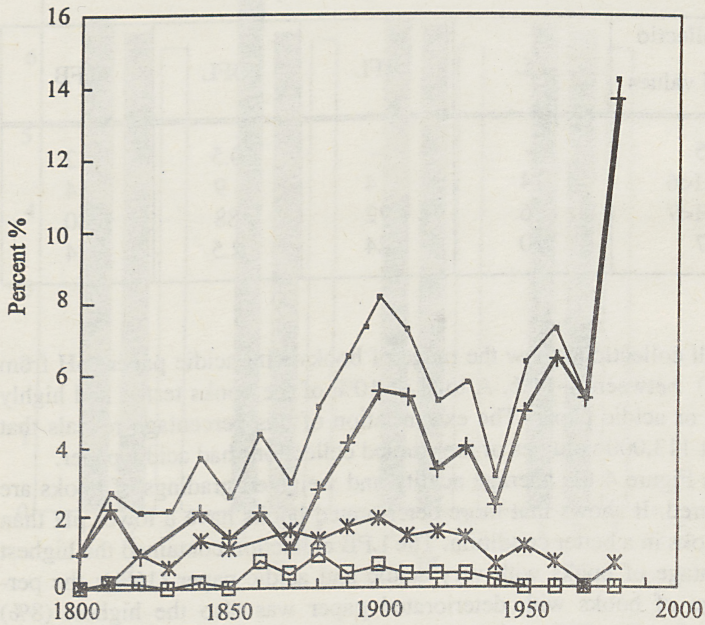


Figure 3. Distribution of weighted gradings per Decade

- total;
- +— grading 1;
- *— grading 2;
- grading 3.

The summary comparison of acidity data for the four collections is given in table 3. Only OFL and LFB collections contained books with highly acidic paper (pH below 5), 0.5% and 2%, respectively.

Table 3. Percentage distribution of acidity values

Collection pH values	EL	RFL	OFL	LFB
pH<5	—	—	0.5	2
5<pH<6	14	4	9	14
6<pH<7	76	72	88	80
pH>7	10	24	2.5	4

All collections show the range of books with acidic paper (pH from 5 to 6) between 4–14%. A total of 10% of the books tested had highly acidic or acidic paper. The extrapolation of this percentage reveals that almost 113,000 volumes of the studied collections had acidic paper.

In Figure 4 the average acidity and weighted gradings of books are compared. It shows that more deteriorated books have a lower pH than the books in a better condition. The LFB collection contained the highest percentage of books with very acidic and acidic paper (16%); the percentage of books with deteriorated paper was also the highest (8%) (Table 2). The OFL collection contained 9.5% of books with highly acidic and acidic paper and 6% of books with deteriorated paper. The EL collection is an exception with 14% of books with acidic paper, while only 2% were in a bad condition.

Figure 5 shows the average pH plotted by decades. A decrease in pH was revealed in the paper of books published in 1830–1840, 1850–1870, 1890–1900 and 1920–1930.

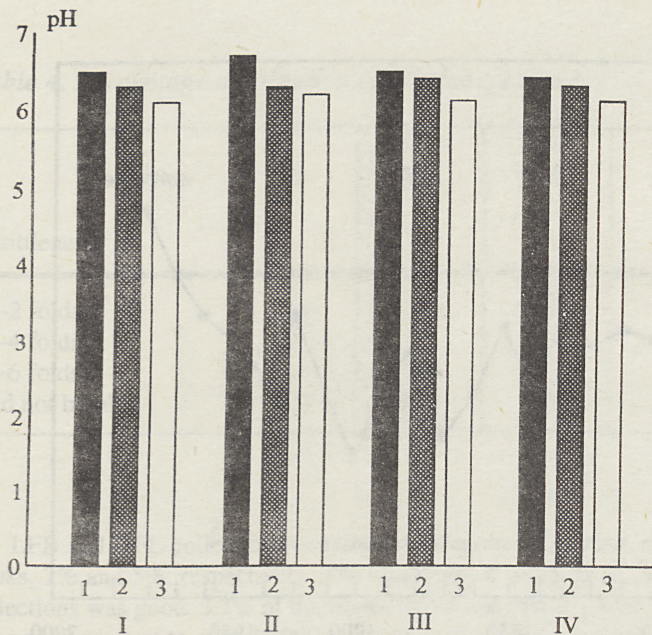


Figure 4. Average pH values at different weighted gradings in different collections

- I – Collection of Estonian Literature
- II – Collection of Recent Foreign Literature
- III – Collection of Foreign Literature
- IV – Collection of Large Format Books

1 – grading 1; 2 – grading 2; 3 – grading 3.

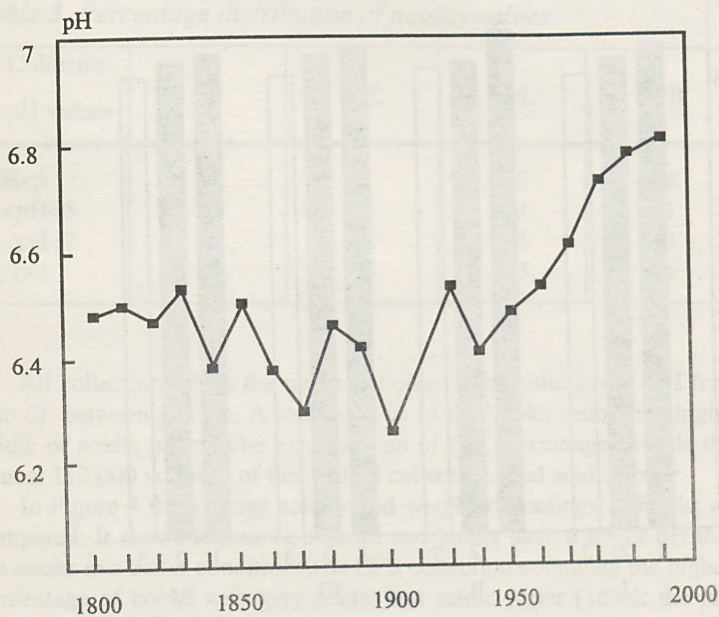


Figure 5. Average pH values by dates of publication.

Brittleness

Table 4 shows the percentage of brittle books, i.e. books whose paper broke after three double foldings.

Table 4. Percentage distribution of brittleness values

Collection	EL	RFL	OFL	LFB
Brittleness				
1-2 folds	—	—	0.5	—
3-4 folds	—	—	3	—
5-6 folds	—	0.6	1.5	7
did not break	100	99.4	95	93

LFB and OFL collections contained the largest proportion of brittle books, 7% and 5%, respectively. The condition of paper in EL and RFL collections was good. 3.2% of the books tested had brittle paper. In total, this would amount to over 36,000 volumes in the collections studied.

Figure 6 shows the proportions of brittle volumes in a collection by 10-year periods.

We found that most of the brittle paper is dated from the 1860s to the 1920s. In the case of 1810s and 1950s the quality of paper was not good either.

The relationship between brittleness and age is not smooth.

The quality of paper used in book manufacturing has not been stable through years.

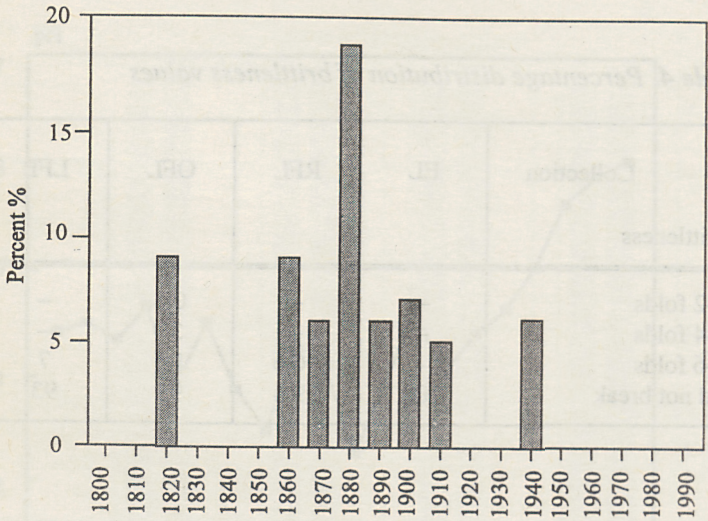


Figure 6. Percentage of brittle books by decades of publication

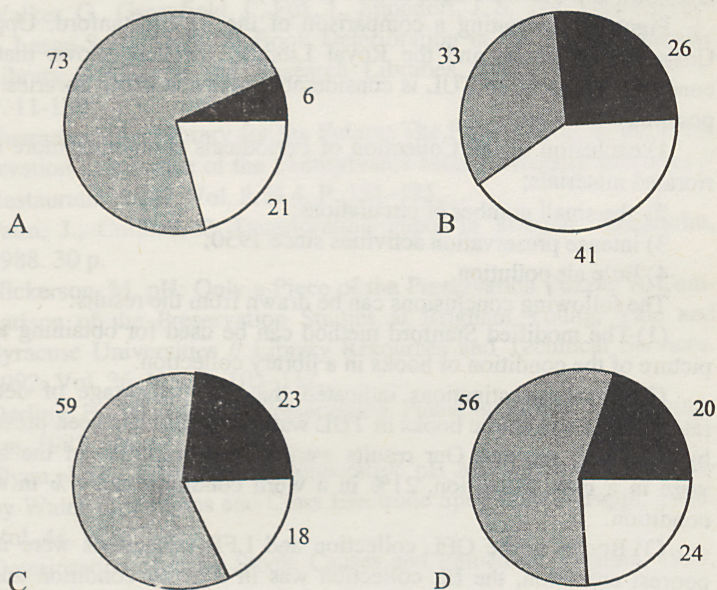





Figure 7. Weighted gradings of paper, binding and cover (in percentages) in different libraries

- A — Tartu University Library
 B — Stanford University Library
 C — Uppsala University Library
 D — Royal Library (Sweden)

 grading 1;
  grading 2;
  grading 3.

CONCLUSIONS

The studied collections which constituted 46.5% of the books were stored in TUL. 73% were in a good condition, 21% were in a worn condition and 6% were deteriorated (Fig. 7).

Figure 7 presenting a comparison of the TUL, Stanford, Uppsala University Libraries and the Royal Library, Sweden, shows that the condition of books in TUL is considerably better in other libraries. The possible causes are:

- 1) exclusion of the Collection of Periodicals containing more deteriorated materials;
- 2) the small number of circulations;
- 3) intense preservation activities since 1950;
- 4) little air pollution.

The following conclusions can be drawn from the results:

(1) The modified Stanford method can be used for obtaining a true picture of the condition of books in a library collection.

(2) Initial investigations indicated that the percentage of deteriorated, brittle and acidic books in TUL was lower than has been presented by published surveys. Our results were as follows: 73% of the books were in a good condition, 21% in a worn condition and 6% in a bad condition.

(3) Books in the OFL collection and LFB collections were in the poorest condition, the EL collection was in a better condition and the RFL collection was in an excellent condition.

(4) The period 1860–1890 shows an increase in deteriorated books in relation to the total amount of volumes. This can be accounted for by the inferior quality of paper used during this period.

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TARTU ÜLIKOOLI RAAMATUKOGU KOGUDE SEISUNDI EELUURING

Kurmo Konsa
Tiina Tensing
Maret Konson

Resüme

TÜ Raamatukogu läbi viidud kogude eeluuringu eesmärgiks oli hinnata modifitseeritud Stanfordini meetodi sobivust raamatukogu kogude seisundi analüüsiks ning selgitada välja raamatute seisund erinevates kogudes. Saadud tulemusi on võimalik kasutada konserveerimis-restaureerimistöde planeerimisel.

Uuritava valemi leidmiseks kasutati juhusliku valiku meetodit. Uuriti järgmisi kogusid:

- 1) eestikeelse kirjanduse kogu (ilm. 1917. a-st) (EKK),
- 2) võõrkeelse raamatu kogu (ilm. 1917. a-ni) (VKK),
- 3) võõrkeelse raamatu kogu (ilm. 1917. a-st) (UVK),
- 4) suureformaadiliste raamatute kogu (SFR).

Valimi suuruseks oli 551 raamatut (tab. 1). Iga uuritud raamatu kohta täideti test (joon. 1). Raamatute seisundi hindamisel kasutati Stanfordini meetodit. Eraldi hinnati paberi, sisuploki kinnituse ja köite seisukorda vastavalt kolmeastmelisele skaalale — tugevasti kahjustunud (3), mõõdukalt kahjustunud (2) ja kahjustamata (1). Testiti ka paberi mehhaanilist vastupidavust kolmele kaksikmurdele ning mõõdeti paberi pH kontaktmeetodil. Testi kanti andmed köite liigi (pehme-, kõva- või nahkköide), hallituskahjustuste, celnevate paranduste, raamatute asendi ning viimase aasta laenutuste kohta.

Kõige enam kahjustunud raamatuid leidub VVK- ja SFR-kogus (joon. 2), EKK- ja UVK-kogus on raamatute seisund tunduvalt parem. Kõige rohkem tugevasti kahjustunud raamatuid pärineb ajavahemikust 1860–1890 (joon. 3).

Testitud raamatutest oli 10% happelise paberiga (pH alla 6) ning 3,2% rabeda paberiga. Happelise ja rabeda paberiga raamatute osatähtsus oli suurem VVK- ja SFR-kogus.

Eeluuringu tulemustest võib teha järgmised järeldused:

1. Tartu Ülikooli Raamatukogu uuritud kogudes oli 73% raamatutest kahjustamata, 21% mõõdukalt kahjustunud ning 6% tugevasti kahjustunud.
2. Täiendatud Stanfordini meetodi kasutamine annab piisava ülevaate raamatukogu kogude seisukorrast.

METHODS OF EVALUATING THE EFFECT OF FUNGICIDES ON THE GROWTH OF FUNGI

Kurmo Kansa
Urmas Kokassaar

Filamentous fungi are able to grow and develop on a great variety of substrata. In book repositories, in the case of favourable environmental conditions, they can damage practically all materials kept there. Nowadays more than 300 species of filamentous fungi from 24 genera have been identified as damagers of books and manuscripts. Species of filamentous fungi with cellulolytic activity have been found among the genera *Alternaria*, *Aspergillus*, *Chaetomium*, *Trichoderma*, *Penicillium*, *Stachybotrys* etc.[1]. Filamentous fungi decompose the micro- and macrostructure of paper and other materials of books. The destruction of paper is catalyzed by exoenzymes, organic acids and water secreted by filamentous fungi [2; 3].

The simplest way to prevent fungal damage on books is by the control of environmental conditions [4]. One of the means to prevent the growth of mycoflora is to make use of fungicides [5]. Effective fungicides must meet several requirements. A fungicide should destroy both the mycelium and spores of filamentous fungi without influencing on the growth substratum, i.e. paper, leather, parchment etc. It must also be taken into account that the majority of the fungicides used are, to a greater or lesser extent, harmful to man [6].

In libraries the following fungicides (at certain concentrations) are used:

- * formaldehyde (2% water solution);
- * sodium fluoride (3% water solution);

- * thymol (2–10% ethanol solution);
- * catamine AB (0.1–2% water or ethanol solution);
- * nipagine (0.5–2% ethanol solution);
- * sodium pentachlorophenate (5–10% water solution).

In the selection and use of fungicides the following aspects should be considered:

1) Different species of fungi differ as to their sensitivity to a particular fungicide.

2) The effect of fungicides on filamentous fungi depends on environmental conditions (pH; temperature, composition of the growth substratum).

3) The effect of fungicides on fungi depends on the phase of their life cycle (spores/mycelium).

4) Fungicides exert a strong effect on fungi only at certain concentrations, over- or underdosing reduces it considerably.

MATERIALS AND METHODS

Two methods were used for evaluating the effect of fungicides on the growth of fungi.

Broth culture method.

The fungi *Alternaria humicola*, *Aspergillus niger*, *Mucor plumbeus*, *Penicillium notatum*, *Trichoderma viride* were used as test organisms. Stock cultures were maintained on Czapek-Dox agar slants at 4°C. The fungicides used in this study were catamine AB, monochloramine and sodium fluoride. Concentrations of the fungicides were: catamine 0.1–10 µl/ml; monochloramine 0.05–80 µg/ml and sodium fluoride 0.1×10^3 – 2.5×10^3 µg/ml. Dilutions of the fungicides were prepared in sterile water. Fungi were grown in a medium containing (g/l): NaNO₃ — 3; KH₂PO₄ — 1; MgSO₄ x 7H₂O — 0.5; KCl — 0.5; FeSO₄ x 7H₂O — 0.01, glucose — 1.

The medium was inoculated with fungal spores after which fungicides were added at different concentrations. Control media without fungicides were used. Cultures (100 ml) in 250 ml Erlenmeyer flasks were incubated at 28–30°C for 7 days. The sensitivity of fungi to the

fungicides was determined by the inhibition of the dry weight increase of the mycelium. Mycelia were collected with "Synpor" filters (pore diameter 1.5 μm) and dried at 105°C for 24 hours. Subsequently the dry weight of mycelia was determined.

Paper disc method.

Fungicide catamine AB was employed to study the growth of *Trichoderma viride* on different paper substrata. Concentrations of catamine AB were 1.5–25 $\mu\text{l/ml}$. Four different kinds of paper were employed as growth substrata: Filtrak FN 11, Indian paper, writing paper N1 and micalent (restoration paper).

Table. Properties of the paper used

Characteristics	Filtrak FN 11	Indian paper	Writing paper N 1	Micalent
weight (g/m^2)	90	67	70	15
moisture content (%)	5	4.6	4.5	3.7
mineral matter content (%)	0.035	6.82	20	0
α -cellulose content (%)	100	99.5	86.6	100
β -cellulose content (%)	0	0	8	0
χ -cellulose content (%)	0	0	5.3	0
folding endurance	146	89	676	3051

Sterile starvation agar, i.e. 2–3% water agar as a moisture-preserving medium was poured into Petri dishes. Of the studied papers discs with 30 mm diameter were cut. The discs were soaked in fungicide water solution (at a certain concentration) for 30 minutes. The discs were then dried in a drying box at 30°C and laid into Petri dishes onto an agar plate in sterile conditions. The paper discs which had been soaked in distilled water and then dried served as control. Subsequently, spores from the test culture of *Trichoderma viride* were inoculated into the centre of a paper disc by means of a loop.

The dishes were incubated at 30°C at a relative humidity of 100% for four weeks. Growth was evaluated by measuring the diameter of the

colony after every seven days. The average diameter (in mm) of the colony was used. An average was obtained from two measurements made at right angles to each other.

RESULTS AND DISCUSSION

The purpose of the initial series of experiments was to determine the most effective fungicide and the most resistant fungus for testing on paper discs. In this series of experiments the broth culture method was used.

All the fungicides employed, catamine AB, monochloramine, sodium fluoride, affected the growth of the test fungi. Catamine AB was the most effective fungicide in controlling the growth of all the tested fungi. At a concentration of 10 $\mu\text{l/ml}$ no fungal growth was observed. Monochloramin prevented growth at concentrations higher than 50 $\mu\text{l/ml}$. Sodium fluoride inhibited the growth of fungi by more than 50% at a concentration of $1.5 \times 10^3 \mu\text{g/ml}$.

Of the fungal species studied the filamentous fungus *Trichoderma viride* was the most resistant to the growth inhibiting effects of fungicides.

In further experiments the effect of catamine AB was studied on *Trichoderma viride* growing on different kinds of paper. *T. viride* is able to grow on all paper substrata used in the experiments (Table). No significant differences were observed in its growth in the case of all kinds of paper tested, while only on filter paper the growth rate was to some extent lower (Figure 1). Pure cotton cellulose forming filter paper Filtrak is more durable to fungal damage than the other kinds of cellulose. Filter paper contains no minerals necessary for the growth of filamentous fungi.

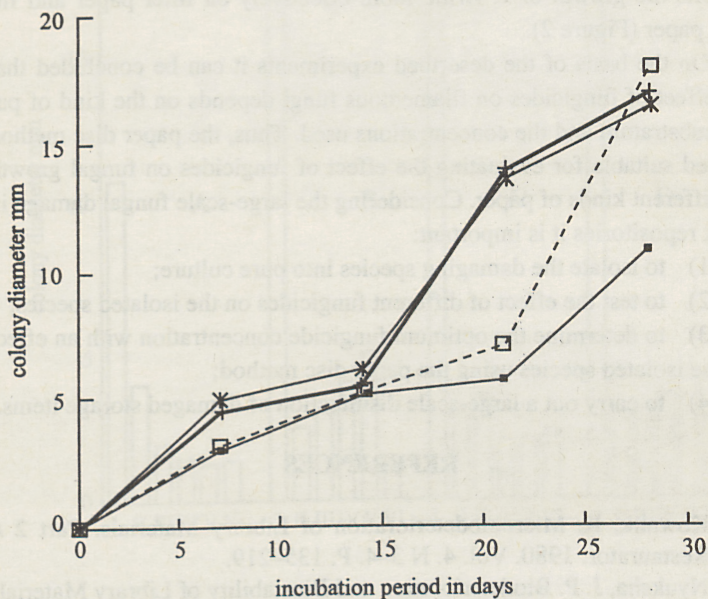


Figure 1. Growth of the filamentous fungi *Trichoderma viride* on different paper substrata.

- Filtrak
- *— writing paper
- +— Indian paper
- micalent

Catamine AB is highly effective in inhibiting the mycelial growth of *T. viride* in a liquid nutrient medium. In the case of paper substrates the fungicidal concentration of catamine AB is higher than that of the liquid media (Figure 2). The growth of *T. viride* occurred with inhibition appearing at tested concentrations. Slight differences in the degree of inhibition were observed between the concentrations used. Catamine AB inhibits the growth of *T. viride* more effectively on filter paper and Indian paper (Figure 2).

On the basis of the described experiments it can be concluded that the effect of fungicides on filamentous fungi depends on the kind of paper substratum and the concentrations used. Thus, the paper disc method proved suitable for evaluating the effect of fungicides on fungal growth on different kinds of paper. Considering the large-scale fungal damage in book repositories it is important:

- 1) to isolate the damaging species into pure culture;
- 2) to test the effect of different fungicides on the isolated species;
- 3) to determine the optimum fungicide concentration with an effect on the isolated species using the paper disc method;
- 4) to carry out a large-scale disinfection of damaged storage items.

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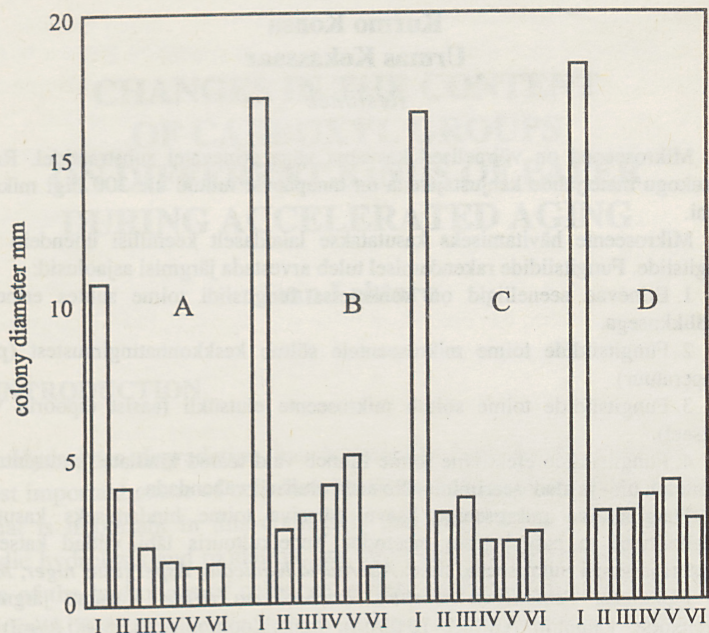


Figure 2. Effect of various concentrations of catamine on the growth of *Trichoderma viride* after an incubation period of 28 days.

A — Filtrak; B — Indian paper; C — writing paper;
D — micalent.

I — control; II–VI — catamine concentrations:
II — 1, III — 5, IV — 10, V — 15, VI — 25 ($\mu\text{l/ml}$).

MEETODID MIKROSEENTE KASVU MÕJUTAVATE FUNGITSIIDIDE TOIME HINDAMISEKS

Kurmo Konsa
Urmas Kokassaar

Resümee

Mikroseened on võimelised kasvama väga erinevatel substraatidel. Raamatukogu materjalide kahjustajatena on tänapäeval tuntud üle 300 liigi mikro-
seeni.

Mikroseente hävitamiseks kasutatakse laialdaselt keemilisi ühendeid —
fungitsiide. Fungitsiidide rakendamisel tuleb arvestada järgmisi asjaolusid:

1. Erinevad seeneliigid on konkreetse fungitsiidi toime suhtes erineva
tundlikkusega.

2. Fungitsiidide toime mikroseentele sõltub keskkonnatingimustest (pH,
temperatuur).

3. Fungitsiidide toime sõltub mikroseente elutsükli faasist (spoorid või
mütseel).

4. Fungitsiidide efektiivne toime ilmneb vaid teatud kindlatel kontsentrati-
oonidel, üle- ja aladoseerimine võib seda oluliselt vähendada.

Fungitsiidide mikroseente kasvu pärssiva toime hindamiseks kasutati
vedelkultuuri ja paberketaste meetodit. Vedelkultuuris läbi viidud katsetes
kasutati järgmisi mikroseente liike: *Alternaria humicola*, *Aspergillus niger*, *Mu-
cor plumbeus*, *Penicillium notatum*, *Trichoderma viride*. Kasutati järgmisi
fungitsiide: katamiin AB (0,1–10 µl/ml), monoklooramiin (0,05–80 µl/ml) ja
naatriumfluoriid ($0,1 \times 10^3$ – $2,5 \times 10^3$ µg/ml). Fungitsiidide toimet mikroseente
kasvule hinnati mütseeli kuivkaalu muutuste järgi. Kõige efektiivsemaks fun-
gitsiidiks osutus katamiin AB, mis kontsentratsioonis 10 µl/ml inhibeeris kõiki-
de mikroseente kasvu. Fungitsiidide toime suhtes oli kõige resistentsem mikro-
seen *T. viride*. Paberketaste meetodil uuriti katamiin AB mõju mikroseene
T. viride kasvule pabersubstraatidel. Kasutati järgmisi paberisorte: *Filtrak FN11*,
india paber, kirjutuspaber N1, restaureerimispaber (mikalent). Mikroseente
kasvu hinnati koloonia mõõtmisega paberkettal. Mikroseen *T. viride* kasvas
kõikidel kasutatud pabersubstraatidel (joon. 1). Katamiin AB toime
mikroseenele *T. viride* sõltub pabersubstraadist ning fungitsiidi kontsentrati-
oonist (joon. 2).

Kirjeldatud mikrobioloogilised testimismeetodid võimaldavad valida raa-
matukogus kasutatavatest fungitsiididest kõige efektiivsema, lähtudes mikro-
seente liigist kui kahjustatud substraadist. Samuti on võimalik leida fungitsiidi
optimaalne toimekontsentratsioon.

CHANGES IN THE CONTENT OF CARBOXYL GROUPS ON DIFFERENT KINDS OF PAPER DURING ACCELERATED AGING

Jaan Lehtaru

1. INTRODUCTION

Hydrolytic degradation has historically been looked upon as the most important cause of cellulose breakdown during the aging of paper. What is important in this context is that degradation processes, both acidic hydrolysis and oxidation, are often very strongly related [1]. The rate of the hydrolysis of cellulose is thus strongly increased when it is oxidized. Similarly, acidic hydrolysis leads to the formation of reducing end groups which can easily be oxidized to carboxyl groups inducing the autohydrolytical breakdown of cellulose. Hemicellulose is hydrolyzed more rapidly than cellulose, while the acidic degradation products formed accelerate hydrolysis. The higher content of non-cellulose material in the fibre leads to the higher content of carboxyl groups.

When starting from a fibre material with a higher content of carboxyl groups, it leads to the increased content of transition metals in the paper because of ion exchange with acidic groups; these transition metals (Fe, Mn etc.) catalyze oxidation process including the oxidation of sorbed SO_2 to H_2SO_4 (from environmental contamination).

Oxidation bleaching by e. g. Cl_2 , hypochlorite or oxygen is harmful due to the increase of the carboxyl content. The formation of chlorinated residual products (chlorinated lignin, chlorinated extractive substances) in the fibre during chlorine-based pulp bleaching makes the formation of HCl and a subsequent hydrolytic attack possible.

A photochemical attack leads mainly to the oxidation process of cellulose. An increase in the moisture content or temperature leads to a rise of the rate of both hydrolytic and oxidation degradation processes.

The breakdown and aging of paper, therefore, depends in a complex way on the chemical environment, the composition of raw material etc. and cannot, in principle, be predicted from kinetic investigations (Arrhenius extrapolation) unless the aging process is completely dominated by a single degradation process, e. g. acid hydrolysis. However, this must have been the case since there still seems to exist a correlation between accelerated and natural aging [2].

2. SAMPLES

1. White handmade paper
(Made in India)

WEIGHT: 67 G. SM.

DATE: 14.02.76.

2. Chromatography-electrophoresis paper
(Made in the USSR)

WEIGHT: 85 G. SM.

DATE: 09.02.74.

3. Micalent paper (thin transparent repair paper)
(Made in the USSR)

WEIGHT: 15-20 G. SM.

DATE: 16.06.70.

Treated with polyvinyl alcohol solution

4. Chalk paper
(Made in the USSR)

WEIGHT: 240 G. SM.

DATE: 14.11.88.

5. Newsprint paper
(Made in Russia)
WEIGHT:45-48 G. SM.
DATE: 28. 08.92.
6. Writing paper
(Made in Russia)
WEIGHT:63 G. SM.
DATE: 19.03.89.
50% unbleached sulfitcellulose
50% bleached sulfitcellulose
7. Book paper 1832
(Manufactured and printed in Russia, Moscow)
8. Book paper 1869
(Manufactured and printed in Germany, Leipzig)
9. Book paper 1917
(Manufactured and printed in Germany, Bonn)
10. Book paper 1936
(Manufactured and printed in Germany, Berlin)
11. Book paper 1948
(Manufactured and printed in the USSR, Omsk)
12. Book paper 1955
(Manufactured and printed in East Germany, Berlin)

3. METHODS OF TESTING

3.1 Determination of moisture

There are several principal methods for determining the moisture content of paper:

- 1) drying methods
- 2) distillation methods
- 3) titration methods [3]
- 4) infrared methods [4]

The drying method is the most commonly used procedure for determining the moisture content of paper because of its easiness and simplicity. In the case of these methods paper is exposed to relative humid-

ity while the decrease in weight caused by the loss of moisture is determined. A common procedure is drying in an electrically heated oven; for general use, a temperature of $105 \pm 2^\circ\text{C}$ is recommended (TAPPI T 412).

Calculation

$$M (\%) = \frac{W_1 - W_2}{W_1} \times 100$$

W_1 – weight of air-dry paper sample

W_2 – weight of dried paper sample [3]

In the present work the moisture content was determined by the drying method. The results are given in Table 2.

3.2. Determination of the amount of filler

The amount of filler in paper is found from the ash content. The percentage of ash is always lower than the percentage of filler added to the paper stock or furnish, since a complete retention during the forming of the sheet is rarely achieved.

On the other hand, the amount of ash may be greater than the amount accounting for the filler content because inorganic residues introduced in the pulp during processing (particularly alum) contribute to the ash content.

The ash content will be smaller than the amount of filler in paper if the filler loses weight during ashing. For example, calcium carbonate is converted to calcium oxide (at 925°C), and clay and satin white lose water of hydration [3].

Procedure

Paper samples placed in porcelain crucibles were ignited in an electric muffle furnace at $575 \pm 25^\circ\text{C}$, cooled in a desiccator and weighed to 0.1 mg. Heating, cooling and weighting were repeated until the weight was constant.

The ash content (F) was calculated [5] from

$$\text{Ash content (\%)} = \frac{\text{weight of ash} \times 100}{\text{weight of sample (100 - M)}} \times 100$$

The results are given in Table 2.

3. 3. Determination of lignin

Lignin is stained or coloured in the presence of HCl or H₂SO₄ with a large number of reagents (phenols, amines). Table 1 [6].

Table 1. Colour reactions indicating the presence of lignin

Reagent	Colour
phenol	greenish-gray
o-cresol	greenish-gray
m-cresol	gray
p-cresol	green
resorcinol	gray
hydroxyquinone	sorell-green
phloroglucinol	bright-red or magenta colour
pyrogallol	green
o-nitrophenol	yellowish-green
m-nitrophenol	yellowish-green
p-nitrophenol	yellowish-green
o-aminophenol	yellow
m-aminophenol	yellow
p-aminophenol	brownish-yellow
o-nitroaniline	yellow
m-nitroaniline	orange
p-nitroaniline	orange

Aniline sulfate and dimethyl p-phenylene diamine have been used for testing groundwood papers. Sulfanic acid as a solid or as a solution (20 g of sulfanilic acid, 40 g of urea, 40 g of glycerol and 900 g of water) produces an intensive yellow colour after 5 min. when applied to moist groundwood. This method has been discussed in detail by Brayns [3]. The phloroglucinol method is used primarily to indicate the presence of lignin.

In the present work lignin was determined by the Brayns method. Paper samples Nos. 5, 6, 11, 12 revealed an intensive yellow colour while Nos. 8, 9, 10 revealed a pale yellow colour.

3. 4. Determination of carboxyl groups

The number of methods for determining the content of carboxyl groups in paper is large.

1) Alkalimetric method

Cellulose is treated with 0.01 N NaHCO_3 and 0.1 N NaCl mixture while excess of alkali is titrated with 0.01 N HCl in the presence of a methyl red indicator. Although it is a simple method, it yields a higher content of COOH groups. In alkali conditions carbonyl groups are oxidized to carboxyl groups [7].

2) Calcium acetate, zinc acetate method

The method is based on an exchange reaction between carboxyl groups and calcium acetate, resulting in the formation of acetic acid. Acetic acid is titrated with 0.01 N NaOH solution in the presence of a phenolphthalein indicator. This method yields a lower content of COOH groups because carboxyl groups bound with lactate compounds are not determined. The presence of carbonyl groups is ineffective [8].

3) Determination of COOH groups by reaction with silver nitrophenolate ($\text{AgOC}_6\text{H}_4\text{NO}_2$)

COOH groups react equivalently with silver ions. Carboxyl groups are determined from the decrease of silver ions. The presence of reducing groups (carbonyl groups) gives incorrect results [9].

4) Determination of COOH groups by alkaline dyes

Reaction with methylene chloride is most widely used. A decrease in the concentration of methylene chloride indicates the content of COOH groups [10].

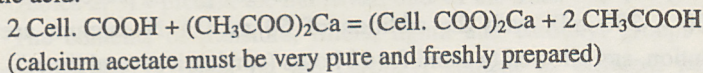
5) Determination of COOH groups by reactions with amines

The presence of carbonyl groups gives incorrect results [6].

6) Spectroscopic (IR) (UV) methods

Spectroscopic methods give approximate results [6].

In this work the content of COOH groups in cellulose was determined by exchange reaction with calcium acetate reacting quantitatively with COOH groups in cellulose. This reaction results in the formation of acetic acid.



Acetic acid is titrated with 0.01 N NaOH in the presence of a phenolphthalein indicator.

Calculation

1) How many COOH groups (g) are equal to 1 ml 0.01 N NaOH solution

$$P = \frac{45.01 \times 0.01 \text{ N} \times 1.000}{1000} = \dots (\text{g})$$

$$E_{\text{COOH}} = 45.01 \text{ (equivalent weight)}$$

2) Content of COOH groups (g) in air-dry cellulose

$$B = \frac{P (a - b) \times V_1}{V_2} = \dots (\text{g})$$

a – ml of 0.01 N NaOH required for the titration of COOH groups in cellulose

b – ml of 0.01 N NaOH required for titration in the absence of cellulose

V_1 – ml of $(\text{CH}_3\text{COO})_2\text{Ca}$ (50 ml)

V_2 – ml of titrated $(\text{CH}_3\text{COO})_2\text{Ca}$ solution (25 ml)

3) Content of COOH groups (%) in absolutely dry cellulose

$$\frac{B}{G \times (100 - M)} \times 100 = \dots (\%)$$

G – weight of air-dry cellulose sample

M – moisture content in cellulose

Procedure

1) A paper sample was treated with 0.5 % HCl solution for 40 min. to avoid formation of salts with COOH groups.

2) Cellulose was neutralized with water (congo red reaction).

3) A paper sample was dried in air and defibred.

4) A paper sample (~ 1 g weighed to ± 0.01 g) was placed in a flask (100 – 200 ml), with the addition of 50 ml 0.1 N calcium acetate solution, and allowed to stand for 12 hours (stirring it several times).

5) 25 ml of the above-mentioned solution was taken from the flask with a pipette and titrated with 0.01 N NaOH solution in the presence of a phenolphthalein indicator until the end point was reached (yellow colour of the solution turned to violet-pink)

6) Parallel titration was performed without a paper sample [11].

The results are presented in Table 2.

3. 5. Accelerated aging

The aging stability of paper is usually characterized by exposing it to the so-called accelerated aging procedure [1, 2, 12, 13].

Although the Arrhenius approach towards estimating paper permanence appears simple and straightforward, the predictions of permanence may be just as misleading as those obtained by the single temperature method. More than one reaction contribute to the degradation of paper, while the Arrhenius concept is applicable, in a simple manner, only to single reactions. It has become quite clear that much information has to be derived about the effect of moisture on the accelerated aging of paper. In order to obtain such information it would be necessary to age paper at a multitude of humidities and temperatures [14].

In this work conditions were chosen to maintain, as closely as possible, the moisture content of paper at the existing level with the paper being conditioned at 50 % RH and 19°C. Twelve different kinds of paper samples sealed into glass tubes were aged in an oven at 100°C for 72 hours and 240 hours while the content of carboxyl groups was determined. The results are given in Table 3 (Figs. 1, 2).

Finally, pH of the cold water extract was measured (TAPPI (T435) and ASTM (D778)). The results are presented in Table (Figs. 3, 4).

4. DISCUSSION OF RESULTS

Tables 2, 3, 4 present the numerical data of the tests.

The contents of moisture, fillers, lignin and carboxyl groups are given in Table 2. Data on the carboxyl content of different paper samples indicate a small tendency to increase [1] except for micalent paper (No. 3). This paper had been impregnated with polyvinyl alcohol which retained stability even during accelerated aging [15].

An the increase of the carboxyl content in chromatography-electrophoresis paper (No. 2) and chalk paper (No. 4) is insignificant. Calcium carbonate, the most widely used coating in chalk paper, has been found to increase the stability of paper under accelerated aging [12, 16].

Papers Nos. 7, 9 reveal the smallest change in the content of COOH groups among book papers. Papers Nos. 1, 12, 5 indicate the biggest rise in the carboxyl content. Table 4, Fig. (5, 6).

The results of pH (cold water extract) measurements are given in Table 3. While in papers Nos. 2, 4, 7, 9 pH values decrease only by 0.1 pH unit, the rest of the paper samples indicate a stronger tendency to decrease. pH changes of micalent paper are comparable with changes of the carboxyl content.

Table 2. Content of moisture, filler, lignin and carboxyl groups

No. of paper samples	Content of moisture	Content of filler	Lignin	Content of COOH groups (10^{-3} %) before and after accelerated aging		
	M (%)	F (%)			72 h	240 h
1	5.47	4.94	-	6.4017 ± 0.1874	11.1136 ± 0.0469	12.8626 ± 0.0932
2	5.55	0.17	-	0.8460 ± 0.1892	0.4373 ± 0.1897	1.5080 ± 0.1904
3	3.76	0.22	-	3.0981 ± 0.1829	0.3887 ± 1.9440	0.9230 ± 0.2034
4	3.05	36.39	-	4.9396 ± 0.1798	4.9810 ± 0.1816	5.7826 ± 0.1800
5	5.77	0.83	+	4.0140 ± 0.1873	6.8853 ± 0.1358	9.3257 ± 0.1807
6	3.30	15.82	+	3.7853 ± 0.1815	5.3009 ± 0.1792	6.4951 ± 0.1799
7	3.62	1.16	-	3.1491 ± 0.1820	3.1695 ± 0.1821	3.7089 ± 0.1869
8	3.46	21.04	+	6.2404 ± 0.1785	8.1058 ± 0.1762	9.0883 ± 0.0830
9	3.64	17.81	+	3.1278 ± 0.1815	3.9694 ± 0.1788	4.1796 ± 0.1829
10	3.07	25.60	+	3.0468 ± 0.1816	3.4199 ± 0.1813	8.2991 ± 0.1770
11	4.96	13.81	+	6.7086 ± 0.1743	7.6077 ± 0.1859	13.0948 ± 0.1752
12	5.27	23.76	+	6.9150 ± 0.1802	7.9771 ± 0.1934	15.1621 ± 0.1735

Figure 1. Dependence between COOH content and time of accelerated aging

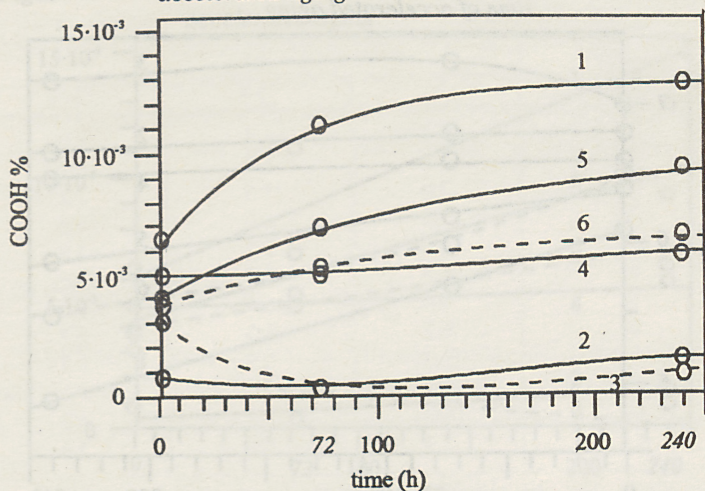


Figure 2. Dependence between COOH content and time of accelerated aging

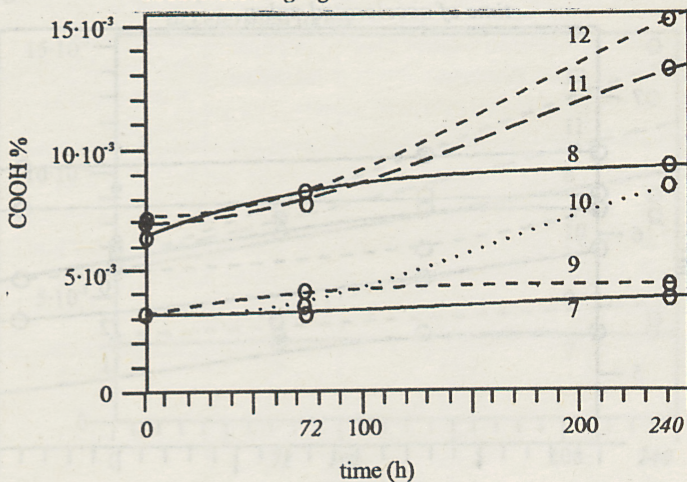


Figure 3. *Dependence between pH of cold water extract and time of accelerated aging*

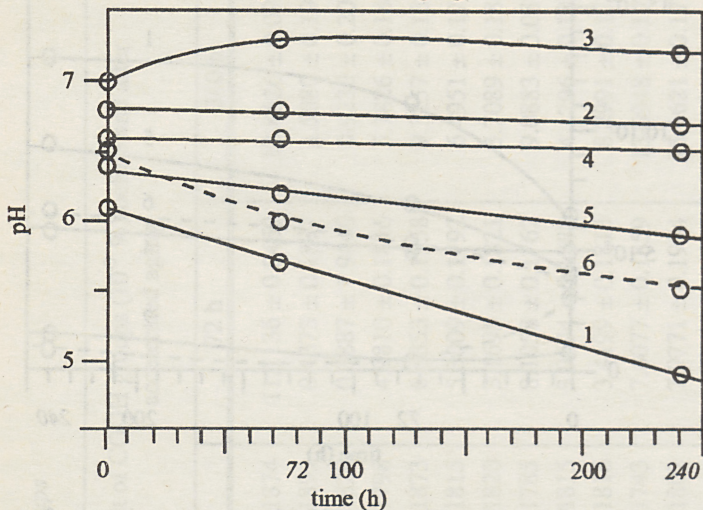


Figure 4. *Dependence between pH of cold water extract and time of accelerated aging*

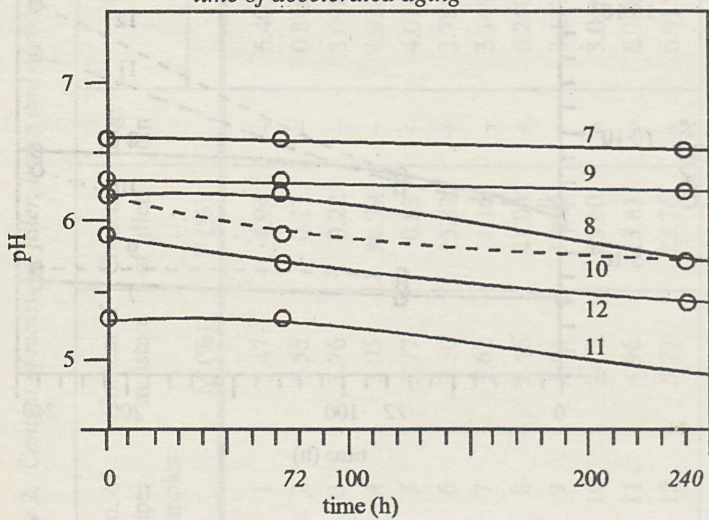


Figure 5. *Dependence between COOH content and time of accelerated aging*

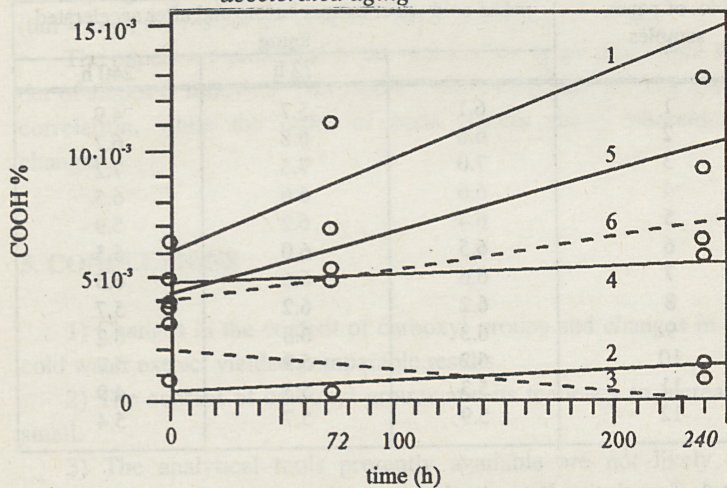


Figure 6. *Dependence between COOH content and time of accelerated aging*

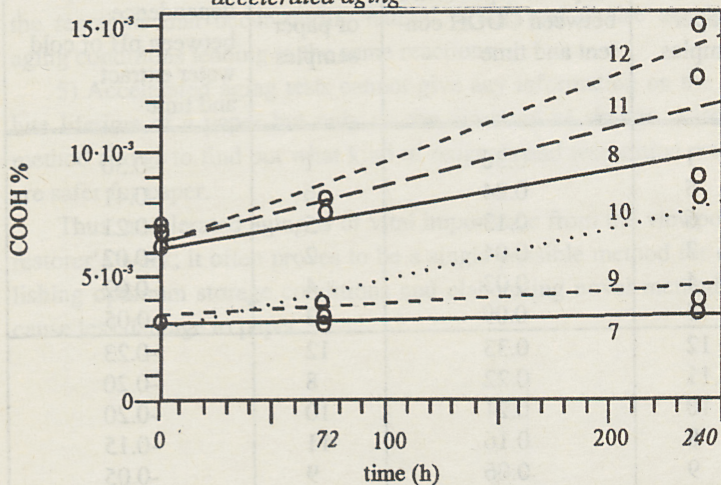


Table 3. *pH of cold water extract before and after accelerated aging*

No. of paper samples	pH of cold water extract before and after accelerated aging		
		72 h	240 h
1	6.1	5.7	4.9
2	6.8	6.8	6.7
3	7.0	7.3	7.2
4	6.6	6.6	6.5
5	6.4	6.2	5.9
6	6.5	6.0	5.5
7	6.6	6.6	6.5
8	6.2	6.2	5.7
9	6.3	6.3	6.2
10	6.2	5.9	5.7
11	5.3	5.3	4.9
12	5.9	5.7	5.4

Table 4. *Correlation between changes in the content of carboxyl groups and pH of cold water extract*

No. of paper samples	Slope of dependence between COOH content and time	No. of paper samples	Slope of dependence between pH of cold water extract and time
1	0.36	1	-0.50
5	0.24	6	-0.41
6	0.13	5	-0.21
2	0.04	2	-0.02
4	0.03	4	-0.02
3	-0.09	3	0.05
12	0.33	12	-0.23
11	0.22	8	-0.20
10	0.21	10	-0.20
8	0.16	11	-0.15
9	0.06	9	-0.05
7	0.02	7	-0.02

In order to find out the correlation between changes in the content of carboxyl groups and cold water extract, pH slopes were calculated ($\tan = x/y$); the results are given in Table 4, (Figs. 5, 6, 7, 8).

The papers are presented in the order of the slope size, while the order of slopes is followed. The papers (Nos. 1-6) gave a surprisingly good correlation, while the order of book papers shows nonremarkable changes.

5. CONCLUSIONS

1) Changes in the content of carboxyl groups and changes in pH of cold water extract yielded comparable results.

2) The content of carboxyl groups and its tendency to increase are small.

3) The analytical tools presently available are not likely to be capable of measuring or detecting changes in carboxyl due to natural or accelerated aging.

4) A far more useful approach than Arrhenius plots would be testing the reactions that occur during natural aging, and devise accelerated aging conditions leading to the same reactions.

5) Accelerated aging tests cannot give any information on the absolute lifetime of a paper but only on the direction of change. Also, this method allows to find out what kind of reagents and restoration methods are safer for paper.

Thus, accelerated aging is of vital importance from the viewpoint of restorer's work; it often proves to be a single possible method for establishing optimum storage conditions and elaborating novel methods that cause less damage to paper.

Figure 7. *Dependence between pH of cold water extract and time of accelerated aging*

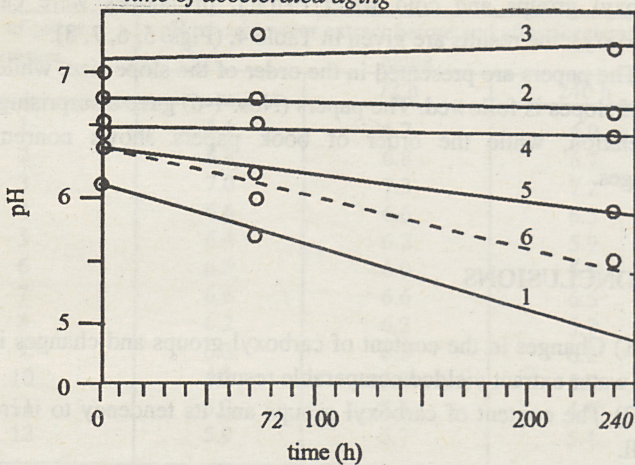
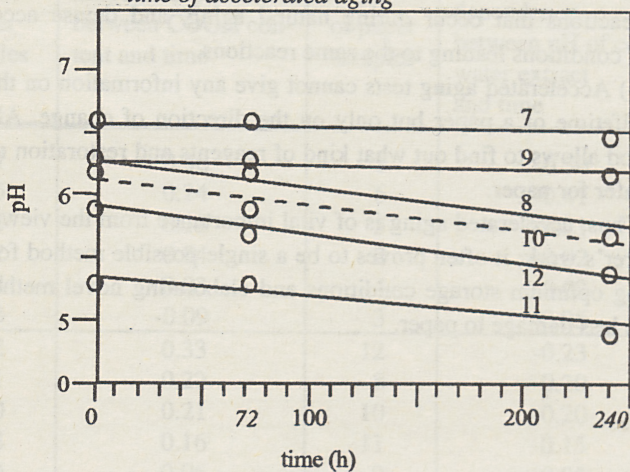


Figure 8. *Dependence between pH of cold water extract and time of accelerated aging*



6. ABSTRACT

12 different kinds of paper were tested in Tartu University Library (Estonia).

The content of moisture, fillers, lignin, carboxyl groups and cold water pH were determined.

The purpose of this investigation was to determine changes in the content of carbonyl groups on different kinds of paper under accelerated aging, to compare the results with those obtained from the study of changes in pH of cold water extract, and to find a paper suitable for restoring. All paper samples were tested before and after accelerated aging for 72 and 240 hours at 100°C and at 50% RH.

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KARBOKSÜÜLRÜHMADE SISALDUSE MUUTUMINE ERINEVATES PABERISORTIDES NENDE KUNSTLIKUL VANANDAMISEL

Jaan Lehtaru

Resüme

Pabermaterjalide säilivuse ning seisundi hindamise probleem on iga aastaga üha enam päevakorda kerkinud.

Paberi säilivus sõltub väga paljudest üksteisega seoses olevatest faktoritest:

- 1) toormaterjalist, millest paber on valmistatud,
- 2) tootmisprotsessi iseärasustest,
- 3) paberi koostisest,
- 4) paberi hoitingimustest,
- 5) konserveerimis- ja restaureerimismeetoditest jne.

Kuigi pabermaterjalide lagunemise põhjused võivad olla äärmiselt erinevad, viivad need kokkuvõttes kõik samadele tagajärgedele. Peamisteks paberit lagundavateks protsessideks on tselluloosi happeline hüdrolüüs ning oksüdeerimine, mille tagajärjel toimub tselluloosi ahela lõhkumine ning tselluloosi lagunemisproduktide karbonüül- (CHO) ja karboksüülrühmade (COOH) tekkimine. Määrates eri sorti paberite COOH-rühmade sisalduse ning nende rühmade sisalduse muutumise paberi kunstlikul vanandamisel, saame informatsiooni nende paberite happesuse kohta ning ka teavet nende paberite lagunemisprotsesside kiiruse kohta.

Uurimiseks valiti järgmised paberisordid:

- 1) käsitsi valmistatud india paber,
- 2) kromatograafia-elektroforeespaber,
- 3) õhuke mikalentpaber,
- 4) kriitpaber,
- 5) ajalehepaber,
- 6) kirjpaber,

7–12) raamatu trükipaberid ajavahemikust 1832–1955.

Määrati nende paberite niiskuse-, mineraalainete- ja ligniinisaldus. Karboksüülrühmade sisaldus ning pH määrati enne ja pärast kunstlikku vanandamist. Saadud tulemused on toodud tabelites ning graafikutes.

Antud töö eesmärgiks oligi uurida, kuidas muutub eri sorti paberites COOH-rühmade sisaldus nende kunstlikul vanandamisel ning kuidas need tulemused korreleeruvad tulemustega, mida saadi pH mõõtmisel külma vee ekstrakti meetodil. Samuti, kasutades saadud tulemusi, jõuda selgusele, kas paberite (1–6) kasutamine pabermaterjalide konserveerimisel ja restaureerimisel on otstarbekas.

Uuringutest selgus, et COOH-rühmade sisaldus näitas kõikide paberite puhul, v.a. õhuke mikalentpaber, väikest kasvutendentsi (tab. 2, joon. 1, 2). Mikalentpaberi selline käitumine on seletatav sellega, et paberit on töödeldud polüvinüülalkoholiga, mis pidurdab selle paberi happelisemaks muutumist. Suhteliselt vähe suurenes COOH-rühmade sisaldus kromatograafia-elektroforeespaberis ja kriitpaberis. On leitud, et CaCO_3 , mida kasutatakse laialdaselt täidisainena kriitpaberites, pikendab tunduvalt nende paberite eluiga happelise hüdrolüüsi toime vastu.

Kõige suurem COOH-rühmade kasvutendents ilmnis paberite 1, 5, 12 puhul, mida kinnitasid ka nende paberite pH mõõtmised külma vee ekstrakti meetodil (tab. 3, joon. 3, 4). Uuringu tulemustest lähtub, et käsitsi valmistatud india paberi antud sordi kasutamine restaureerimisel ei ole otstarbekas.

Uuringute põhjal võib järeldada:

1. COOH-rühmade sisaldus ja pH enne ja pärast kunstlikku vanandamist andsid kokkulangevaid tulemusi.

2. COOH-rühmade sisalduse suurenemine paberite kunstlikul vanandamisel oli suhteliselt väike.

3. Praegu teada olevate meetoditega ei ole võimalik määrata täiesti täpselt COOH-rühmade sisaldust.

4. Kunstliku vanandamise meetod ei võimalda ennustada täpselt ette paberi eluiga, küll aga paberis toimuvate muutuste suunda. Samuti aitab see meetod välja selgitada, millised reaktiivid ning restaureerimismeetodid on paberile ohutumad. Seega on paberi kunstliku vanandamise meetod olulise tähtsusega restauraatori töö seisukohalt ning sageli ainuvõimalik, leidmaks optimaalseid hoiutingimusi ja töötamaks välja uusi, paberit vähem kahjustavaid meetodeid

ON LITHOGRAPHY, ITS PRESERVATION AND RESTORATION IN TARTU UNIVERSITY LIBRARY

Maie Austa

Lithography (lithographic printing) as planographic printing is one of the most widespread techniques of graphic arts offering varied possibilities. It is easily performed and enables to produce numerous prints.

Lithography was invented in the late 1790s by a German A. Senefelder (1771–1834) who at first copied sheets of music by this technique. He published the first handbook of lithography “Vollständiges Lehrbuch der Steindruckerey” in 1818.

In lithography special fine-crystal limestone (lithostone) that occurs in different kinds, of different density and hardness, is used as a printing form.

The image to be printed is transferred on a previously prepared lithostone. In the case of a pen or brush drawing the stone is well ground, in the case of a black lead or lithochalk drawing the surface is left rough, grainy. The original is drawn on the stone as a mirror image.

After the image is transferred on the stone, its surface is soaked with weak nitric acid, the image is fixed on the stone while the non-printing area becomes water-absorbing. In order to get a print, the stone is moistened and the ink is transferred on it by means of a roll; the ink is deposited only in places of the image. In this way one gets a printing form on which the drawing and the image are on the same plane, i. e. flat-bed

print. Further, paper is placed on the lithostone and the ink is pressed from the stone onto the paper.

Since the lithographic stone is usually large and heavy, the work can be accomplished only in the studio. Therefore, in lithography the so-called reprinting is employed. In this case the drawing paper is covered with a special paste and the drawing is done in lithographic ink, chalk or black lead pencil on the dried paste surface. The drawing is placed on a prepared stone and run through the lithographic press. Under pressure the drawing is transferred onto paper from the stone from which prints are taken after etching.

Besides the techniques related purely to drawing, lithography offers still more varied methods.

The lithographic plate can be covered with lithographic ink; after drying the drawing can be scraped out of the black surface with a scraper and a needle. In this way a smooth transition from light to dark shades is attained. Since the engraving on stone permits to render very fine sharp lines, this method was used in the last century for printing music, vignettes, embroidery patterns, geographic maps etc.

Lithography opens wide possibilities for colour printing, i. e. chromolithography. Each shade (up to ten) is carried on a separate printing form, drawings are of an equal size.

Lithography is divided into autolithography and reproducing lithography. In the first case the artist completes a drawing on stone. When a lithographer makes a copy of the original drawing on stone, one has to do with reproducing lithography. Reproducing lithography can be widely applied in book illustrations. The invention of photography diminished sharply the role of lithography, and towards the end of the 19th century the latter became a purely artistic technique of reproduction; at present typographic lithography has been replaced by offset printing.

The first lithographic printing office was opened in Germany in Munich, later in Paris and in Russia. In Estonia lithography was taken into use as early as the beginning of the 19th century. One of the first artists who started experimenting with lithography was Carl Walther (1783–1867) from Tallinn. The first lithographic printing office was founded in Tartu in 1832 by Georg Friedrich Schlater (1804–1879). The

second printing office, the owner of which was W. F. Krüger, was opened in Tartu in 1835. However, this was not justified and in 1839 it was joined to Schlater's printing-office. The best known artists-lithographers in Estonia were the Baltic Germans G. F. Schlater, A. Pezold, K. Kügelgen, F. S. Stern. Of the artists of the 20th century E. Viiralt, A. Hoidre, E. Okas, O. Soans, E. Tihemets, M. Vint, Tõnis Vint have used lithographic technique.

The Collection of Engravings of the Tartu University Library comprises over 2000 lithographic sheets.

An outstanding part of the collection of lithographs-incunabula is formed by German lithography from the period 1797–1821. (The compiler of the first catalogue of lithographs F. M. Ferchel regarded lithographs as lithographic incunabula in case they were produced 25 years after the invention of the lithographic technique in the late 1790s.) The collection of lithographs-incunabula consists of 412 single sheets made after the drawings of West European artists, and 229 reproductions in various books. The most valuable part is represented by lithographs accomplished after Albrecht Dürer's pen drawings that are collected into the volume "Christlich-mythologischen Handzeichnungen" (1808). These are the first German artistic lithographs drawn on stone by J. N. Strixner (1782–1855). Especially valuable are the few colour prints one of which belongs to the University Library.

J. N. Strixner, F. Piloty (1786–1844) and some other lithographers were able to render drawings as true facsimiles the natural look of which was stressed by the colour background. The lithographic reproductions of the drawings of West European masters produced by J. N. Strixner and F. Piloty were published in 72 instalments of which 60 are stored in the Tartu University Library. (Due to financial difficulties the whole series was not procured.) The overwhelming majority are the reproductions of drawings of Italian, Netherlandish and German artists, a smaller number those of French artists. The represented artists are Raffael, L. da Vinci, L. Granach, A. Dürer, H. Holbein, P. Rubens, A. van Dyck, N. Poussin and others.

The above lithographic series was subscribed for by the University Art Museum shortly after its appearance. Unfortunately, the founder and

first director of the Tartu University Library and Art Museum Karl Morgenstern (1770–1852) did not preserve the series as a whole but arranged the lithographs according to the authors and countries, while the corners of the lithographs were glued on yellowish brown cardboard. Evidently, by such rearrangements K. Morgenstern wished to attain a better overview of the drawings of the artists of various countries.

The Baltic German lithographic works preserved in the library stocks are about ten years younger than the lithographs-incunabula and mostly printed in the 1830s by G. F. Schlater, W. F. Krüger, K. Kügelgen, A. Pezold, and in the middle of the century by F. S. Stern and L. Höflinger. In Tartu Schlater published numerous lithographic series depicting views of Tartu and its vicinity (5 instalments in 1832–1835). In 1832 Schlater published another series, views of the Vaiatu manor and rural scenery near lake Peipsi. The album bore the French title “Vues pittoresques de Somel et des alentours en Livonie”. The instalment comprises eight sheets. A part of the edition was printed on cheap paper, another part on Chinese paper. In 1838 a new instalment of the views of the Vaiatu manor appeared in which several pictures have, however, been changed. The Tartu University Library possesses an instalment of seven sheets of this last edition (“Views of the Vaiatu manor”, “Ruins of the Laiuse castle”, “The grave of a favourite dog in Vaiatu”, “View from the park of the Vaiatu manor”, “View of the building of the Vaiatu manor from the park”, “Vaiatu mill”, “Village graveyard of Vaiatu near Peipsi”).

Artists of Tartu produced also lithographs of illustrations for a number of scientific editions, e.g. for astronomer Mädler’s “Observation Maps of the Moon”, for Pirogov’s “Atlas of Anatomy”. Portraits of university professors were done after E. Hau’s drawings.

The University Library possesses 18 books containing lithographs-incunabula. The most valuable among these are sheets of illustrations of A. Senefelder’s textbook “Vollständiges Lehrbuch der Steindruckerey”; the lithographs of drawings were done by several lithographers who used all techniques of printing from stone.

The sheets accompanying C. F. Mylius’ 4-volume travel book “Malerische Fussreise durch des Südliche Frankreich und einem Theil

von ober Italien" (1818–1819) were also performed by several lithographers.

The third work is "Praktische Anleitung zur Perspektiv mit Anwendung auf die Baukunst" (1811) the high-quality illustrations of which were done by J. M. Quaglio (1772–1813).

Over 5000 maps and atlases from the 15th–20th centuries are preserved in the library. More than a hundred of these originate from the 15th–17th centuries. The older maps are completed by woodcut or engraving technique. A few of the more recent maps from the 19th century are done by lithographic technique, e. g. "General Karte der Russischen Ost-See Provinzen, Liv- Ehist- und Kurland" (1854) and "General Charte von Livland" (1836).

The storing conditions of the library have been far from favourable during its long history. In spite of that the lithographs are in a quite satisfactory condition, while only few of them are seriously damaged. Major damage has been inflicted by brown cardboard or paper on which the originals had been glued at corners. Traces of glue have caused visible stains as well as rips on original sheets. Also, the lithographs are covered with wrinkles, stains of rust, mould and grease, fly excrements. The fact that the underlying paper is acidic has proved highly unfavourable. Analogous damages are found also in the above-mentioned books containing lithographs-incunabula. Maps produced by lithographic technique have several splits, stains, smeared areas. It is very unfortunate that the stock numbers on maps are written in ink.

A part of the lithographs belonging to the library are still in such a condition that they need restoration. The restoration of lithography was started in 1968 after the Collection of Engravings had been inspected by a state commission.

The restoration technique of lithography at Tartu University Library will be described on the basis of two examples.

(1) The new edition of Schlater's views of the Vaiatu manor (1838) was taken to restoration in a quite poor condition. As most of Schlater's lithographs, this one, too, was printed on Chinese paper that had been pressed onto the underlying paper. The binding was smeared, containing grease stains and fly excrements, the corners were lacking. All sheets

were smeared; there occurred mould stains; the edges were decayed, with splits; several particles were lacking at the corners.

In the course of restoration the sheets were first cleaned mechanically with a scalpel, eraser and India rubber powder. The stains were removed mechanically after which the sheets were carefully washed. Since there existed also mould stains, these were treated alternately with 0.5% water solution of trilon B and 2% water solution of chloramine. Rinsing was done with running water until the removal of chlorine residues, which was checked with the iodine starch indicator. Finally, the sheets were washed with distilled water and exposed to air for drying during 24 hours. Then the lacking particles were replaced, splits were fixed with micalent paper by means of flour paste, glued with gelatin water solution and pressed. The lithographs were arranged so that calendered micalent paper was inserted between all graphic sheets. In the case of favourable storing conditions the lithographs restored by this technique can be preserved for hundreds of years.

(2) K. F. Schinkel's lithograph "A Monument in the vicinity of Berlin" (1818) is monumental (85.9 × 58.8). The sheet had to be restored since it had been displayed during a long period of time in the past, which had brought about especially serious damage. In the 19th century it was not considered necessary to protect graphic works with a glass cover when displayed. Glass was used only in the case of drawings and gouache works, while graphic arts as a reproduction technique was left at the mercy of environmental factors. "A Monument in the vicinity of Berlin" was heavily smeared, yellowed, wrinkled, there occurred fly excrements. The edges of the work had slits, the corners of the right-hand side were lacking. The sheet was covered with moisture and mould stains, brownish stains of unknown origin (especially at the lower edge). At first photos were taken of the lithograph (this being a usual practice) after which restoration was carried out in the way described above.

By now the majority of graphic sheets done by lithographic technique have been restored and placed separately in mountboards. However, it should be mentioned that restoration is to be continued. The results of this work are valuable only in the presence of appropriate storing conditions and display possibilities.

LITOGRAAFIAST, SELLE SÄILIVUSEST JA RESTAUREERIMISEST TARTU ÜLIKOOLI RAAMATUKOGUS

Maie Austa

Resümee

Litograafia on enim levinud graafikatehnika 19. sajandil, eriti Sakamaal, Prantsusmaal, Inglismaal. Selle leiutas 1790-ndate aastate lõpus sakslane A. Senefelder. Esimene litograafiatöökoda Eestis asutati Tartus 1832. a. G. F. Schlateri poolt. Eestis olid tuntumad litograafiaharrastajad eeskätt baltisakslased G. F. Schlater, A. Pezold, K. Kügelgen, F. S. Stern. 20. saj. kunstnikest võiks nimetada E. Viiraltit, A. Hoidret, E. Okast jt.

Raamatukogu graafikakogus on üle 2000 lehe litograafiat. Lito-inkunaablikogus (412 üksiklehte ja 229 reproduktsiooni erinevates raamatutes) on silmapaistev osa saksa litograafial ajavahemikust 1797–1821. Nendest väärtuslikemad on J. N. Strixneri (1782–1855) poolt A. Düreri sullejoonistuste järgi tehtud litod, mis on koondatud värvitrukis köitesse “Christlich - mythologischen Handzeichnungen” (1808). J. N. Strixneri ja F. Piloty poolt litografeeritud Lääne-Euroopa meistrite joonistuste 72 vihikust on raamatukogus 60. Baltisaksa litograafide töödest on raamatukogus Tartu ja selle ümbruse vaateid, õppejõudude portreesid. Litograafia-inkunaablitega raamatuid on 18, nagu A. Senefelderi õpik “Vollständiges Lehrbuch der Steindruckerey” ja C. F. Myliuse “Malerische Fussreise durch des Südliche Frankreich und einem Theil von ober Italien” (1818–1819). Litograafiatehnikas kaartidest on olulisemad “General-Karte der Russischen Ost-See-Provinzen, Liv-Ehst- und Kurland” (1854) ja “General Charte von Livland” (1836).

Vaatamata varasemate aastate halbadele hoiutingimustele, on litod praegu küllaltki rahuldavas olukorras. Vähestel on suuremaid kahjustusi. Peamised kahjustused on tekkinud pruunist papist või paberist, millele originaalid on nurkipidi kleebitud. Liimijäljendid on originaallehtedele jätnud tugevad plekid ja rebendid. Samuti on litodel kortse, rooste-, hallitus- ja rasvaplekke. Alus- paberid on happelised.

Raamatukogus alustati litograafia restaureerimist 1968. a. pärast graafikakogu ülevaastust riikliku kontrollkomisjoni poolt. Litosid restaureeritakse järgmise metoodika alusel. Esmalt puhastatakse lehed mehaaniliselt skalpelli, kummi ja kummipuruga. Plekid eemaldatakse keemiliselt, seejärel pestakse lehti hoolikalt. Hallitusplekke töödeldakse vaheldumisi triloon B 0,5% vesilahuse ja klooramiin B 2% vesilahusega. Seejärel pestakse voolava vee all, kuni vabanetakse kloori jääkidest. Viimast kontrollitakse joodtärkilisepaberiga. Lõpuks pestakse destilleeritud vees, mille järel lastakse lehtedel õhu käes ööpäev läbi kuivada. Puuduvad osad täidetakse ja rebendid kinnitatakse jahukliistri abil mikaltpaberiga, liimitatakse ja pressitakse.

Praeguseks on suurem osa litograafiatehnikas lehti restaureeritud ja ükskhaaval partaiteeritud.

TRAINING OF CHEMISTS-RESTORERS AT TARTU UNIVERSITY

Tullio Ilomets

There are a large number of historical and cultural monuments and immovable antiquities in Estonia. Here are situated numerous museums, large libraries and several capacious archives; the cultural monuments kept in them are not only of local importance but belong to the cultural heritage of the whole Europe. The preservation and careful maintenance of the cultural monuments existing in Estonia is our contribution to the continuation and development of the culture of the West.

Nowadays the problems related to the preservation of the historical and cultural heritage have become highly topical in the whole world, especially in Estonia against the background of great changes taking place in the society here. In many European countries valuable cultural objects that have survived the destruction of World War II are being endangered. The ever-growing pollution of the environment, the menacing propagation of the ideas of economic profiteering, the lack of education, vandalism, deterioration of the cultural situation and ethics or their low level can be considered the main causes of this. In Estonia these factors are, to a greater or smaller extent, especially discernible, not to speak about economic difficulties in the sphere of culture.

Several international organisations have been set up on the initiative of UNESCO for the protection of the cultural heritage; a number of respective resolutions and recommendations have been made; pertinent large-scale projects have been launched; various states have adopted

laws for the protection of the cultural heritage. The Parliament of the Republic of Estonia passed on Feb. 9, 1994 a law on the preservation of antiquities that was proclaimed by the president in his resolution No. 289 of March 28, 1994. This law establishes fixed regulations for the ownership, preservation and maintenance of cultural heritage.

The preservation, maintenance, conservation and restoration of cultural heritage requires a close cooperation of a large number of specialists, among whom chemists-restorers occupy an important position.

In many developed countries of Europe great attention is paid to the training of restorers of both higher and secondary specialized education. While a restorer with a secondary education is a trained artisan in a certain field, a restorer with a higher education is expected to solve scientific problems facing him.

A large part of problems arising in the conservation and restoration of cultural heritage are directly related to chemistry. Therefore the participation of a chemist-restorer in this activity is nowadays indispensable. Since the 1960s chemists of Tartu University have been consulted for assistance in problems pertaining to the conservation and restoration of historical and cultural monuments. The Department of Chemistry, particularly the present Institute of Organic Chemistry (former Chair of Organic Chemistry) have on their own part shown obligingness and offered their aid in the solution of practical problems as well as in the training of chemists or chemists-restorers with a required speciality.

A large number of graduates of the Department of Chemistry of Tartu University have set to work as restorers at museums, archives and libraries since the 1960s. Having received solid education in the field of chemistry at the Department of Chemistry, they have been able to act successfully as restorers after a necessary self-improvement. Up to 1990 special education was not delivered at the Department of Chemistry of Tartu University. Since in most cases future institutions of employment were known to a student, the topic of the graduation thesis was decided upon considering the needs of the institution. The graduation thesis dealt with the chemical study of some particular problem. Usually, it was preceded by a course paper written on the same topic, and a pregraduation practice. That enabled the student to get familiarized with the selected

range of problems when working at literature, to study profoundly the theoretical aspect of work as well as to achieve the necessary standard of experimental research in good time. The course of study lasted five years while students started work at their selected topic in the third year. Using individual study programmes the training of chemists with the qualification of the chemist-restorer began in the late 1980s and has proceeded in the present Institute of Organic Chemistry up to the present time. The individual or special study programme means that besides compulsory subjects included in the syllabus for all students of the department, exams and preliminaries for specialization, fixed by the department, had to be passed during the scheduled number of lessons, and a graduation thesis on a respective topic be defended. Each student had an individual syllabus; the subjects of research in a narrower field (wood, paper, leather) were different. Also, in addition to compulsory special subjects foreseen for chemists-restorers, an exam related to the topic of the graduation thesis had to be taken. The programmes were drawn up depending on the profile of institutions wishing to employ chemists-restorers. Archives and libraries were provided with restorers of paper, wood or leather. The specialists trained at our university have received the necessary education in general chemistry and are able to work elsewhere in the field of chemistry. It is natural that the graduates of the university who start their work as chemists-restorers are expected, depending on their employment, to improve their skills considerably, especially as regards practical restoration. Conservation and restoration is an interdisciplinary activity based on the cooperation of a number of various specialists who are to solve theoretical and practical problems. For this reason, the chemist-restorer should have some information of borderline sciences as well. The schooling of chemists-restorers has proceeded from the principle that the fundamentals of conservation and restoration are the thorough knowledge of the **material and technology of manufacturing** a certain object, as well as knowledge of chemical processes underlying the production of a particular material. A chemist-restorer should know which was the level and nature of technology in a certain period and what materials were used at some time. Therefore, all chemists-restorers have taken an exam in the **history of chemistry** which

provides a historical background for the knowledge of materials and technologies. Special subjects compulsory for all chemists-restorers are presented as lecture courses. In the case of a narrower speciality students peruse literature on their own. Knowledge is tested before an exam by means of mid-term quizzes or written tests.

Another large group of subjects studied by chemists-restorers is the methods of analysis (chemical, physical-chemical and physical). A survey of the methods of analysis employed in modern restoration practice is necessary for students of this speciality. The fundamentals of analysis presented in the form of lectures and practical lessons are obligatory for all students of chemistry. Chemists-restorers are to take a course of special methods of analysis and undergo the corresponding practice. The methods of analysing the object dealt with in the graduation thesis are studied more profoundly within the framework of the exam programme of the corresponding special subject.

Below we shall briefly dwell upon subjects foreseen for the specialization of chemists-restorers. An essential subject of general education is **a course of restoration methods** that gives a survey of the causes of damage inflicted to objects of cultural value on various materials such as wood, paper, leather, textile, metal, stone, glass, ceramics etc. The most widespread principles and techniques are introduced together with the devices used. This course involves several practical lessons in the restoration laboratories of Tartu and Tallinn.

A **course of methods of special analysis** with its modest proportion of lectures and an overwhelming practical part deals more thoroughly with the use of chromatographic methods in the analysis of materials presenting interest from the viewpoint of restoration. Several spectral techniques are introduced, especially the use of infrared spectrography for the identification of various substances, e. g. polymers.

An important subject without the basic knowledge of which no chemist-restorer can manage is **the chemistry of dyes and pigments**. This course includes both natural and synthetic inorganic and organic pigments and dyes, their production, characteristics and fields of application. The course is complemented by the respective practice.

A more detailed study of certain topics of **the chemistry of polymers** is also compulsory. The fundamentals of the chemistry of polymers are introduced within a lecture course meant for chemists. Chemists-restorers are delivered an extensive course of natural high-molecular compounds. The characteristics and fields of use of synthetic polymers employed in restoration are discussed more in detail.

Selected topics of chemical technology involves various special disciplines pertaining to chemical technology. Here belong chemistry of leather, chemistry of textiles, chemistry of materials, the last covering quite a large field such as sizings, surface active substances, building materials, glass, ceramics etc. Lectures on this subject are available for all chemists concerned, being optional for students of other branches of chemistry and compulsory for chemists-restorers.

Various subjects related to the range of topics of graduation theses have been assigned as independent work, e. g. (1) chemistry and technology of paper, (2) chemistry of wood and analysis of wood, (3) methods of analysis of leather, (4) chemical fundamentals of photographic process, (5) natural resins and balms, (6) chromatographic identification of cations etc.

Every student who intends to become a chemist-restorer has to write a course paper and a graduation thesis depending on his narrow speciality. The course paper usually serves as a preparatory stage of the graduation thesis, in which proper techniques are selected and the necessary technical level of analysis is achieved. The graduation paper represents already a research of a problem connected with or arising from the restoration of some object. The university provides the future chemist-restorer with indispensable knowledge and skill in the field of chemistry, as well as the chemist's way of thinking on the basis of which he can develop further. Several of the chemists-restorers educated at our university have undergone advanced training abroad (in England, Germany, Austria, Sweden, Finland).

The period of study has been of various duration. In the case of the earlier 5-year study a more thorough training was possible than in the case of the present 4-year study. The minimum time needed for specializing would be at least two years while numerous basic subjects of

chemistry should be studied previously. Subjects related to the humanities such as the history of art, the lore of culture and others have so far been lacking in the programmes of chemists-restorers. However, considering general education, these subjects would be useful. The mentioned lecture courses should be delivered already during the first years of study. After the defending of the graduation thesis it is possible to take up a 2-year master's course. When estimating the present situation the demand for chemists-restorers in Estonia has not decreased in comparison with earlier years but, on the contrary, increased. On the other hand, the employment of these specialists may be difficult due to purely economic reasons. Considering future perspectives, the education of chemists-restorers at Tartu University should by no means be stopped but intensified, updated and diversified. Being a *universitas*, our university is the most suitable place for it in Estonia.

By way of illustrating the training of chemists-restorers the following list of graduation theses completed in the field of restoration at the Institute of Organic Chemistry of Tartu University through years is presented:

1. Maie Bender. Tintide elektroforeetilise ja kromatograafilise iseloomustamine. = Electrophoretic and chromatographic characterization of inks (1967).
2. Sigrid Kaseoru. Tintide ja värvainete kromatograafilise uurimine. = Chromatographic study of inks and pigments (1970).
3. Jaan Lehtaru. Erinevate paberisortide võrdlev keemiline analüüs. = Comparative chemical analysis of different kinds of paper (1990).
4. Peeter Maksing. Must-valgete fotonegatiivide ja fotode restaureerimine. = Restoration of black-and-white photographic photonegatives and photographs (1991).
5. Kriste Sibul. Paberil ja teistel materjalidel kasutatavate looduslike palsamite ja vaikude analüüs. = Analysis of natural resins and balms used on paper and other materials (1991).
6. Ülle Vahar. Kaasaegse kroomnaha ja arheoloogilise naha mõningate koostisosade määramine. = Identification of modern chrome leather and some constituents of archaeological leather (1991).

7. Lindy Piiri. Tartu ajaloolise keraamika uurimine. = Study of historical ceramics of Tartu (1992).
8. Eve Kull. Pärnu XIV sajandist pärineva arheoloogilise naha uurimine. = Study of the 14th century archaeological leather from Pärnu (1992).
9. Maris Madisson. Arheoloogilise puidu koostise uurimine. = Study of the composition of archaeological wood (1992).
10. Ruth Tiidor. 19. sajandi esimese poole paberi omaduste uurimine. = Study of the characteristics of paper from the 1st half of the 19th century (1992).
11. Katrin Vaino. Mõnede lakkide ja kile moodustajate analüüs. = Analysis of some lacquers and films (1992).
12. Herki Helves. Arheoloogilise puitmaterjali keemiline iseloomustamine. = Chemical characterization of archaeological wood material (1993).
13. Lilian Kippasto. Vesinikperoksiidi toime paberile uurimine. = Study of the effect of hydrogen peroxide on paper (1994).
14. Ingrid Nurmeots. Looduslike liimainete kromatograafiline identifitseerimine. = Chromatographic identification of natural sizings (1994).

Starting from the 1970s restorers have been educated, besides the Department of Chemistry, also in the Department of History within the framework of individual projects, the restoration laboratories of Tartu and Tallinn serving as institutions of practice (Compiler's note).

KEEMIK-RESTAURAATORITE ETTEVALMISTAMISEST TARTU ÜLIKOOLIS

Tullio Ilomets

Resiimee

Ajaloo- ja kultuuripärandi säilitamine ja sellega seonduvad probleemid on muutunud käesoleval ajal kogu maailmas väga aktuaalseteks. Elukeskkonna üha suurenev saastumine, majandusliku kasusaamise mentaliteedi ähvardav laienemine, harimatus, vandalism, kultuuritaseme ja eetika langus või nende madalseis on siin olulisemateks põhjusteks.

Kultuuripärandi säilitamine ja hooldamine, konserveerimine ja restaureerimine nõuab väga paljude erialainimeste tihedat koostööd. Nende hulgas on kindel koht ka keemik-restauraatoritel.

Alates 1960. aastaist on paljud Tartu Ülikooli keemiaosakonna lõpetajatest läinud restauraatorina tööle muuseumidesse, arhiividesse, raamatukogudesse. Saanud keemiaosakonnas korraliku keemia-alase ettevalmistuse, on nad pärast vajalikku eneseharimist suutnud edukalt restauraatoritena tegutseda.

Kuni 1990. aastateni keemiaosakonnas spetsiaalset eriõpetust keemik-restauraatoritele ei antud. Restaureerimisalaste probleemidega sai üliõpilane tegelda kursuse- ja diplomitöö koostamise ning praktika ajal.

1980. aastate lõpust hakati keemik-restaureerijate ette valmistama individuaalprogrammide alusel, mis erinesid omavahel kitsama uurimisobjekti (puit, paber, nahk) poolest. Igale üliõpilasele on kinnitatud individuaalne õppeplaan, kus lisaks kõigile keemiaosakonna üliõpilastele kohustuslike ainete kõrval tuleb keemik-restaureerijal teha rida spetsiaalseid eksameid-arvestusi ja kaitsta diplomitöö. Eriained, mis on kohustuslikud kõikidele keemik-restaureerijatele, on õppeplaanis loengukursustena. Kitsama eriala kohta käiva õppematerjali omandab üliõpilane vastava kirjanduse iseseisva läbitöötamise teel.

Keemik-restauraatorite koolitamisel on lähtunud põhimõttest, et konserveerimise ja restaureerimise põhialuseks on antud objekti materjalide ja valmistamise tehnoloogia korralik tundmine. Õppeained, mida loetakse keemik-restauraatoritele, on järgmised: keemia ajalugu, analüüsimetodid (keemilised, füüsikalised-keemilised, füüsikalised), restaureerimismetodid, erianalüüsi (kromatograafiline, spektraal) meetodid, värvide ja pigmentide keemia, polümeeride keemia, valitud peatükke keemilisest tehnoloogiast (naha-, tekstiili- jm. materjalide keemia).

Keemik-restauraatori diplomitöö, millele eelneb kursusetöö, kujutab endast mingi objekti või sellega seoses esilekerkinud probleemide uurimist. (Vt. artiklis esitatud kaitstud diplomitööde nimestikku.)

Minimaalne aeg keemik-restauraatori eriala omandamiseks peaks olema vähemalt kaks aastat.

Vajadus keemik-restauraatorite järele pole Eestis — käesolevat olukorda reaalselt arvestades — varasema ajaga võrreldes mitte vähenenud, vaid hoopiski suurenenud. Tulevikukavasid silmas pidades ei saa nende ettevalmistust Tartu Ülikoolis mitte mingil juhul lõpetada.

EDUCATION AND TRAINING OF CONSERVATORS IN FINLAND

Solveig Mickels

My approach to the subject is the “education and training” of conservators. This is in consistency with an international trend towards regarding conservation as an independent discipline. The former emphasis on the term “training” seems to be a consequence of a situation where conservation was seen as a post-graduate training within an adequate academic discipline, for example arts, archaeology or chemistry.

By emphasizing the concept of education and training it is made clear that the objective is to educate graduates with a special attitude towards conservation and with a sufficient manual skill. This does not mean that the knowledge of cultural history and aesthetics are of no importance. What is emphasized is that by shifting the focus from the perspective of art historians or librarians to that of conservators, we can broaden the understanding of the objects we work with in the multidisciplinary teams which are of crucial importance in saving our cultural heritage.

Thus, while the art historian is concentrating on the history of the art object and its aesthetic understanding, the conservator focuses on how these are manifested in the materials present, and how this material evidence can be transferred safely to future generations.

A short history of the Finnish education in conservation

The education and training of conservators in Finland began in 1984. The education was established as a college level education, on the proposition of the former National Board of Vocational Education (now integrated in the National Board of Education). Because of the limited opportunities for graduates to find employment it was decided to establish this education in only one institution. The institution chosen was the Vantaa Institute of Arts and Crafts in the Greater Helsinki Region. The location in the Vantaa Institute was supported by the need of the education to be geographically close to central authorities and the museums that are mainly responsible for preserving the Finnish cultural heritage. However, the location was favored not only by its vicinity to versatile collections but also by the fact that the Institute as visiting specialist teachers uses the services of many of the conservators employed by these museums.

The Institute has, since 1989, had a Delegation for the Field of Conservation, in which the most important institutions and employers are represented. The aim of the Delegation is to further co-operation between the Vantaa Institute and the conservation industry.

At the time when this education was introduced, ten years had passed since the need of the education and the training of conservators was investigated by a committee set up by the Ministry of Education. The committee estimated the number of new conservators needed in the field of paper conservation for 1985 at 36. In all, the committee estimated the number of educated conservators for that same year, distributed between the suggested fields of specialization, at 139. The eight fields realized later were art, cultural objects, furniture, paper, textiles and three in the field of building conservation: wooden building structures, building surfaces and stone buildings. Of these, all but the conservation of stone buildings have been represented at least once in a three-year-course since 1984. A new investigation of the situation in the education of conservators, conducted by the Ministry of Education, shows a need of increasing the admission of students at the average of

one student per year to keep up with the estimated need, but only by the year 2010!

At the time when the education was introduced it was also decided that a formal education in a school was better than decentralized internship training. The principle of concentrating the education in all conservation fields to one institution was, and still is, strongly supported by conservators. It is thought that this will make it possible to lay the foundations for a common professional knowledge, facilitate for graduate conservators to work together when needed, and use effectively the material and personal resources invested in the education. There are, though, two validated educations located elsewhere in Finland. One of these is the conservation of specimens of natural history, which is successfully carried out as college level internship education at the Finnish Museum of Natural History. The other is internship-based school level training in the conservation of moving pictures, films and photographs. Only one person has, until now, completed this latter program.

The practical solution of carrying out the education at the Vantaa Institute of Arts and Crafts, in accordance with the main regulations and administration of education in Finland, has been to admit 24 students at a time, distributed between four and later between three specialities. This is repeated in a three-year cycle and so far there have been three groups with 24 students each.

The Vantaa Institute has until now decided separately which specialities are to be represented in the next three-year course. The decisions have been based on inquiries carried out among employing institutions. A system with this kind of short-sighted planning has the advantage of making it possible to educate the kind of professionals needed by employers at the time. The disadvantage is that it is almost impossible for interested students to plan their studies; they just have to take the occasion as it comes along. As there exist special requirements for applicants, many will never get a real chance to apply for entry into the conservation education.

Inquiries among employers, concerning specialized fields for the period 1994–1997 showed that libraries and archives were not satisfied with the number of graduate paper conservators (totalling 12). As a

result, the Vantaa Institute decided to renew the paper conservation course in 1994, along with courses in art conservation (mainly easel paintings) and conservation of cultural objects (metal, glass, ceramics and archaeological material).

Starting with the new course in January 1994, there will be a major change in the education, as the Department of Conservation will be incorporated in an experiment of vocational higher education in Finland. The new professional degree is equivalent to the university degree but with a more professional orientation. The polytechnic program will be dealt with below in this paper.

In the field of archives and libraries the need of persons trained at a lower level has also been discussed. During recent discussions within the National Board of Education with the participation of representatives of the most important libraries and archives and the Finnish Section of the IIC Nordic Group, it was decided not to propose a new level of training at present.

College Level Curriculum

The course curriculum compiled in 1984 and revised in 1987, was drawn up by a working group of conservators under the guidance of and in close collaboration with the National Board of Vocational Education. The basis for the curriculum was the concept of the ICOM Conservation Committee, which was finally approved in Copenhagen in 1984. These principles are published in the document "The Conservator-Restorer; A Definition of the Profession".

The education is a three-year course consisting of three main blocks: A — theoretical and practical studies (76 %); B — internship in conservation studios (16 %) and C — final diploma work (8 %). Though the main part of the theoretical and practical courses are conducted at the Institute, some of them have been carried out in cooperation with other institutions. Among the courses in paper conservation, for example, fibre identification and analysis was arranged at the Central Laboratory of the

Finnish Paper and Pulp Industry. Numerous study visits have been organized to other institutions in the region and abroad.

The components of Block A are general studies, general conservation studies and studies in the field of specialization. General studies account for 11 % of the whole course of Block A, including mainly studies in domestic and foreign languages.

General conservation studies, 29 % of Block A, include courses in conservation methodology, technology, documentation, natural sciences, material science, cultural history, history and theory of conservation, and museology. Most of these courses are taught during the first study year. They have partly a general content that can be taught to all students jointly. Partly, the students are divided into smaller groups. This is the case, for example, with photography and some of the courses in natural sciences.

Studies in the specialized field make up 60% of the total Block A. They include the same subjects as general conservation studies but are related to the respective field. These courses are mostly taught in conservation studios, with students working on real museum objects.

The internship period, Block B, is planned for each student in co-operation with the host institutions. The student collaborates with the museum personnel and should be given a variety of tasks in conservation. There have been some difficulties in arranging internship in accordance with the wishes of all parties concerned, which are due to a variety of practical aspects for the student and the possibilities for the institution to arrange the required supervision. Some students have, according to their personal interests, taken their internship period abroad. There exists a governmental system for paying internship students small salaries for their work or, alternatively, to compensate the institutions for their additional costs. These systems are available only for domestic internship.

The object for the final diploma work, Block C, is chosen by the student in cooperation with teaching and supervising conservators. The work consists mostly of a conservation project and its documentation. The extent of the written part has been from 30 to about 100 pages. Some purely theoretical diploma works have also been completed.

Numerous efforts have been made to combine theory and practice during the whole study time, for which there are conservation studios and a laboratory at the Vantaa Institute of Arts and Crafts. The aim is to procure, as far as possible, all modern equipment needed to give students knowledge of the broad range of modern conservation methods and treatments. Nevertheless, a three-year course is certainly not sufficient for students to acquire manual skill comparable to that of an experienced conservator.

Polytechnic Curriculum

While the college level curriculum was compiled and approved of by the central authorities, the planning of the polytechnic curriculum has been delegated to the local administration. It is worth noting that the suggested curriculum has not yet been approved of by the Vantaa Temporary Polytechnic.

The main differences between the college curriculum and the suggested polytechnic syllabus are the length and use of the study time, the intergration of subjects, and optional courses.

The polytechnic study program consists of seven terms, i.e. 140 study weeks. Courses comparable to Block A now make up 71% of the curriculum. The internship (Block B) forms 16% and the final diploma work (Block C) 13%.

The integration of separate subjects into conservation courses is widely carried out. In the suggested curriculum there are, for example, no separate language courses but they are integrated with the writing of term papers.¹

The Finnish polytechnic concept involves optional courses: in the conservation curriculum these make up 10 study weeks. The student can choose the courses according to his or her personal interests and the courses are widely sought from outside the institution.

¹ According to plans in 1993. Changes are introduced in the approved curriculum from 1994.

The polytechnic curriculum is based on suggested changes in the personnel structure, with an increase of the full-time teaching staff. Without this, the polytechnic degree would run the risk of just becoming a new name for an old fact. When accurately realized, the polytechnic curriculum can promote the development of overall professional competence.

The students

A vocational diploma or its equivalent has been required of persons applying for entry into the conservation department. This means that most of the applicants are adults who have studied from three to six years and are trained professionals in a suitable field, mostly artisans. Therefore, the students have a good knowledge of materials and technology. Special problems have arisen in the field of paper conservation due to the scarcity of training possibilities at a suitable level that would provide the needed basic knowledge. Thus, more time should be spent on teaching material science, which can be only realized at the expense of teaching conservation methodology.

The long study time, six years of basic training at most, followed by three years of conservation, education has been regarded as too long and, consequently, too expensive by the authorities. Many conservators have still pointed out that the three-year education and training in conservation is too short for the development of adequate understanding of the objects, and the manual skill. In the polytechnic program the requirements for applicants will be the matriculation examination or its equivalent, plus a sufficient knowledge of the corresponding speciality. This will perhaps shorten the total education period, providing slightly longer time for conservation studies.

The students apply for entry by submitting their curriculum vitae and the needed school certificates. The applicants are ranked on the basis of their school achievement and work experience, and the best are invited to attend the entrance examinations.

Until now, the two-day examination has consisted of the following five tests: a foreign language, drawing, colour differentiation, manual

skill and accuracy and, finally, a test estimating the applicant's knowledge of his or her field of specialization, faculty of observation and attitude towards conservation. The entrance examinations have been altered each time and will probably be adapted to the polytechnic entrance examination.

The Staff

The full-time staff of the Department of Conservation consists of three persons: head of the Department, a lecturing teacher, and an assistant, all conservators. In addition, the Department employs some other teachers of the Institute (e.g. in foreign languages, computer science). The secretarial office, too, provides some service for the Department.

Until recently, visiting teachers have been responsible for the main part of teaching. This has led to some advantages but probably to more problems. The main advantage is a close contact with the conservation industry in the museums, libraries and archives where conservators are employed. It has been possible for the students to get to know the personnel of the institutions and the organisations concerned. Another significant advantage is the highly specialized knowledge that these conservators have brought with them into the teaching process. Through the visiting teachers a flow of information from the latest international courses and seminars has reached the students in a way that would not have been possible otherwise.

The disadvantages are, of course, the discontinuity of the courses, which has been impossible to overcome. No matter how hard the personnel of the Department of Conservation has tried to inform the teachers about what has to be taught during their sessions, there have been overlappings and gaps. In the case of different teachers for separate courses it is hard for the student to comprehend the connection between the courses and between conservation theory and method, and to fully grasp the integrity of the knowledge offered.

Another problem arises from the use of specialist teachers from outside the conservation field. These teachers might be the best specialists in their own branch but they still lack means to associate their

knowledge with conservation. This is, of course, a well-known problem in the world and can be attacked only through a well planned system of cooperation among teachers, through research programs inside the institution and broad tutorial activities.

The teaching situation has also affected the evaluation of students' achievements. The assessment has often been possible only within the framework of separate courses, while the grading of overall competence has been hard to carry out.

The experience of the education so far shows that the Finnish school has to secure the engagement of full-time teachers for each of the represented specializations. This has, fortunately, been the situation during some period of time. The school also needs a full-time scientist. However, it is equally important to guarantee the employment of visiting teachers because of their close connection with "real life" outside school and the high standard of their knowledge with respect to special problems.

Evaluation of the education

Until now, a small-scale evaluation of the education has been performed in the light of employment requirements. This was carried out by a graduate conservator in her postgraduate education for vocational teachers, and it deals with the field of building conservation. The seminar paper discusses how well the curriculum fits in with the needed competence in employment, on the basis of an inquiry made among graduate building conservators. Without considering certain criticism, the general opinion is that the curriculum serves surprisingly well the need of competence. One would hope that in the nearest future evaluations of the other fields of conservation education and training will be under way.

The introduction of the new polytechnic program will be a challenge to the conservation education which has not yet developed a reliable network and solid educational traditions in Finland. At its best, the new program can promote professional knowledge and research activities far outside the Vantaa Temporary Polytechnic.

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RESTAURAATORITE VÄLJAÕPE SOOMES

Solveig Mickels

Resüme

Tänapäeval loetakse restauratorite väljaõpet iseseisvaks erialaks, kus võrdselt tähtsad on nii restaureerimise teooria kui ka käelised oskused. Pidades restaureerimist iseseisvaks valdkonnaks, mitte mingi traditsioonilise teadusala lisakursuseks, pööratakse senisest enam tähelepanu selle tegevuse materiaalsele küljele. Nii jõutakse ka nendes, läbinisti teaduslikes töögruppides, kus otsustatakse kultuuriajalooliselt väärtusliku materjali säilitamise üle, uuele efektiivsusastmele.

Soomes on restauraatoreid koolitatud alates 1984. a-st. See oli kolm aastat kestev kursus Vantaa Käsitöö- ja Tarbekunstikoolis. Kool asub praktiliselt pealinnas ja valiku langetamisel kujunes määravaks, et kõik tähtsad kogud, restaureerimiskeskused ja ametnikud asuvad kooli vahetus läheduses. Spetsialiseeruda on võimalik kaheksale erialale: ese, mööbel, paber, kunst, tekstiil ja kolm ehitusalast eriala. Haridus loeti tehnikumihariduseks ja vastava õppeplaani koostas kutsehariduskomitee poolt määratud töörühm, mis koosnes peaaesjalikult restauraatoritest. Plaan põhines *ICOM Committee for Conservation*'i formuleeringutele.

Esimest korda arutati restauraatorite koolituse vajadust haridusministeeriumi komitees 1974. a. Tollal arvestati, et 1985. aastaks vajatakse 36 paberirestaatorit. Kuid kuus esimest paberirestaatorit lõpetasid alles 1987. a. ning järgmised kaheksa 1990. aastal. 1994. a. alustas õpinguid uus rühm ja eelnevalt läbiviidud küsitlusest selgus, et nii raamatukogudes kui arhiivides napib paberirestaatoreid.

Tehnikumi õppeplaani koosneb kolmest osast: üld- ja erialaõpingud (76%), praktika (16%) ja lõputöö (8%). Erialained on järgmised: restaureerimismeetodid, tehnoloogia, dokumentatsioon, loodusteaduslikud ained, kultuuriajalugu, restaureerimise ajalugu ja -teooria ning museoloogia. Üldained õpetatakse kõikidele koos, kuid õppetöö põhiosa moodustavad erialatunnid vastavalt õpilase spetsialiseerumisalale. Koolituses on püütud teooriat ja praktikat võimalikult palju kokku viia. Nii on koolis olemas restaureerimisstudiod ja keemialabor, kus õpilased töötavad muuseumieksponaatide kallal.

Alates 1994. a. on restauraatorite koolitus viidud Soome rakendusliku kõrgharidussüsteemi osaks. See vastab kõrgharidusele, kuid tavalise ülikooliga võrreldes on ta suurema kutsesuunitlusega. Õppeplaani koostatakse õppeasutuses endas. Suurim muutus on õpingute pikkuses, mis on 140 nädalat (u. 3,5 aastat), ja pikendatud on praktika- ja lõputöö aega.

Vastuvõtt toimub iga kolme aasta järel. Kolmele spetsialiseerumisalale võetakse korraga vastu 24 üliõpilast. Üliõpilaskandidaadil peab eelnevalt olema erialane keskastme koolitus ja enamik neist on ka vastaval erialal tööd teinud. Uude rakenduskõrgkooli astujatelt nõutakse küpsustunnistust ja eelnevat erialast töökogemust. Kavas on ka lühendada koolitusaega. Üliõpilased valitakse välja küpsus- ja töötunnistuse ning sisseastumiseksamite põhjal.

Restaureerimisosakonnas töötab kolm põhikohaga inimest: osakonnajuhataja, lektor ja assistent. Kõik nad on elukutselised restauraatorid. Suurema osa

õppetööst viivad läbi külalisõppejõud. Nendeks on tavaliselt Helsingi ja selle lähema ümbruse restaureerimisasutustes töötavad restauraatorid. Õppejõudude pidev vaheldumine on tekitanud küll mõningaid probleeme, kuid positiivset on rohkem. Selleks on õppejõudude pidev seotus erialase tööga ja kuna nad tunnevad hästi kõiki erialaseid probleeme ja uuendusi, rakendavad nad neid ka õppetöös. Kui põhipersonali arvu suurendatakse, peab külalisõppejõudude traditsiooni sellegipoolest säilitama.

Kõikidest nendest probleemidest pole senini just palju kirjutatud. On olemas vaid üks lühiuurimus, kus on vaadeldud lähemalt koolituse struktuuri ja sisu ning selle vastavust erialanõuetele. Selles seminaritöös nenditakse, et tehnikumi õppeplaan vastab isegi üllatavalt hästi tulevase eriala nõuetele.

COLLECTIONS OF OLD BOOKS IN THE LIBRARY OF VILNIUS UNIVERSITY. PRESENT SITUATION AND PROBLEMS OF BOOK DEPOSITING

Alma Braziūnienė

The Library of Vilnius University has gathered a large number of valuable books, manuscripts and maps during its respectable existence of more than 400 years. At present approximately 180 thousand printings are kept in the Department of Rare Books. These are printings from the 15th–18th centuries as well as rare and especially valuable issues from the 19th–20th centuries. The library is the largest book depository of such issues in Lithuania.

The aim of this article is to describe old collections in the library of our university and to elucidate problems of their keeping.

Founded in 1570, the Library of Vilnius University was already mentioned in the 17th century among the most famous European libraries. The basis of the library consisted of donated collections. In 1570 the Lithuanian Grand Duke and King of Poland Sigismundus Augustus donated his wonderful collection of 4000 books to the Library of the Jesuit College (unfortunately, only 15 of these have been preserved). The Bishop of Vilnius G. Albinus, College Rector S. Varszewicki and the noblemen Sapiegos whose books formed a separate collection "Bibliotheca Sapiehana", at that time, as well as many professors of the university presented the library with their personal collections. Until the end of the 18th century when obligatory copies were first introduced, the library grew only through donated collections. Many books of the library perished in Vilnius fires (in 1610, 1737, 1748), while a large number of books got lost during wars with Sweden (1656–1660). The latter are now

kept in various Scandinavian libraries, many of them are in Poland and Russia [1]; a part of these books were returned to Lithuania. In 1956 the director of the library L. Vladimirovas initiated the returning of 106 16th – 17th century issues from Moscow, 4572 books from Leningrad, 1000 volumes from Kharkov, 7542 from Kiev [2]. All these oldest books that were kept in the library until the reorganization of the university in 1842, are now deposited as a separate collection "Bibliotheca Academiae Vilnensis". The size of the collection is 18 thousand issues and it is one of the largest and most valuable collections in the Department of Rare Books. Besides this, separate historical collections are: the Library of the Medical Society (1805–1914, 1920–1939, 21 thousand items), the private collection of Vilnius University professor J. Lelevel (1786-1861) (4800 items), the Vilnius-Versal Library collected by Polish emigrants in Versal after the rebellion of 1831 against the tsarist regime.

All other books preserved in the department are divided into separate stocks. According to the chronological principle generally used in libraries, the stocks consist of incunabula (322 items), books of the 16th century (5000 items), books of the 17th century (18 thousand items), books of the 18th century (55 thousand items). The Collection of the Lithuanian Books is arranged on the language principle. It consists of Lithuanian books from 1547, when the first Lithuanian book appeared, to 1918 — the date of the proclamation of the Republic of Lithuania. The size of this collection is 12 thousand items. The Collection of Old Latvian Books (105 items) and the Collection of Estonian Books (12 items) are formed according to the same principle. The latter is not a historically formed collection. It was separated from the main bulk of books in 1962–1963 when selecting books in the Estonian language. These are books from the 17th – 19th centuries. Their sources are very different. Among them are books from personal libraries (G. Plater, L. Zavisza), monastery libraries (Vilnius and Dotnuva Bernardin Monasteries), state libraries (Collegium Nobilium S. J., Vilnius Public Library, Kaunas Vytautas the Great University Library). With regard to the content, these are religious books, grammars of the Estonian language, dictionaries (mainly with parallel texts in German). The collection has been arranged and provided with a separate catalogue.

The Collections of Aldines, Elzevirs, Plantins (40 items, 411 items, 300 items) are formed on the principle of publishing, the Collections of

the Old Slavish Books in the Cyrillic alphabet and in "grazdanka" are formed on the alphabetic principle (388 items and 1812 items). The Collection of Old Cartography (atlases and maps) is one of the richest in Europe (2863 items). Its basis is constituted by Prof. Lelevel's collection of old atlases, which was later supplemented with new ones. There exist a few smaller collections: the Collection of Minimalia (290 items), the Collection of Small Issues (1415 items), the Collection of Old Notes (4227 items), the Collection of Copies (477 items), the auxiliary stock (4122 items), the Collection of Albums (11 thousand items). The items not corresponding to the profile will be handed over to the Department of Graphic Art. The dividing of publications between numerous collections in the book depository is of little use, since it only makes work more difficult. Instead, it would be sufficient to classify publications according to the chronological principle. Numerous collections cause additional complications in searching for information: there is no summary alphabetic catalogue in the department. It would be more expedient to prepare appropriate card-indexes instead of having separate collections. However, so far we have to adapt ourselves to the circumstances since it is practically impossible to change the existing system.

At present, 5 librarians work in the department. They have a higher philological education (3 of them are specialists of classical philology, 1 of Germanic philology, 1 of Romanic philology). For a long time our department has been oriented mostly to the research activity. Publications reflecting the stocks of the department were prepared and printed (the catalogue of Lithuanian books [3], the catalogue of incunabula [4], the catalogue of Elzevirs [5]). The catalogue of paleotypes and the publication of the manuscript "Laureae Academiae Vilnensis" are also being prepared. Due to the lack of staff and bad conditions the maintenance of these collections has been inadequate. For a long time the books of the department were kept in old rooms scattered in the main buildings of the 16th century university. The collections were repeatedly moved from one place to another. As late as in 1973 the department occupied two storeys in a new depository. It should be mentioned that now there is enough space for the books but, at the same time, we are not satisfied with the conditions of book depositing. By now it is clear that the depository does not meet the modern requirements of book depositing. Also, errors have been made in planning: the library is situated in a valley in the old town where the concentration of dust and

soot is high. That is why it is so difficult to fight against dust in our depository. Dust covers especially the books that are less frequently read and the collections that have not yet been described (e.g. the Collection of the 18th Century Books on which the personnel of our department are working now, the Collection of the Medical Society, the Collection of the Vilnius Public Library).

We lack modern equipment and measurement devices to maintain proper air temperature and humidity in the depository. Ventilation and other equipment is not automatic and is regulated in the whole 8-storey building. Last winter was especially severe in Lithuania, air temperature in the depositories reached only 13° C; in summer temperature rises up to 19° C. Relative humidity was 55% in winter, and is 60% at present.

Hopes were entertained in connection with the establishment of the Sector of Hygiene at the Restoration Department in 1989. It was the staff of this sector that began cleaning the books thoroughly. First, books of the duplicate-defective stock were cleaned followed by books of the Collection of the Medical Society. The latter collection was considered less important since it contains mainly books of the 18th – 19th centuries. The Sector of Hygiene has also cleaned non-described books of the 18th century. Still, the speed of cleaning does not satisfy us: only 2% of all the books have so far been cleaned.

Severely damaged books requiring urgent care are given to be restored. The Restoration Department, established in 1968, is at present capable of performing complicated work that requires high qualification. Altogether, 879 books of the Department of Rare Books have already been restored, while 300 of them can only be called as relatively restored. These books were restored during the period of the establishment of the department in 1968–1971, when only partial restoration was performed, such as gluing, fastening, stain removal etc.

The department is arranging card indexes for the already restored books and for books that need restoration. The card index of books designated for restoration includes data on the state of the book, order of emergency, pressmark etc. The card index is arranged on the basis of collections. One person is in charge of it, while each member of the staff of the department can give information on books that need restoration. The director of the library usually checks the books to be subjected to restoration.

Having at our disposal such rich stocks of old books, we are certainly not satisfied with the speed of restoration. Thus, when selecting books for restoration we take into account priority collections, e.g. the Collection of the Lithuanian Books requiring exceptional care, the Collection of the Old University (*Bibliotheca Academiae Vilnensis*), the Collection of Cartography etc. The amount of restoration according to the present status of stocks is the following:

Cartography: atlases	17 items	- 8.1 %
maps	234 items	
16th century books	120 items	- 2.2 %
15th century books (incunabulas)	5 items	- 1.5 % [6]
Collection of the Lithuanian Books	157 items	- 1.5 %
<i>Bibliotheca Academiae Vilnensis</i>	30 items	- 0.16 %
17th century books	152 items	- 0.8 %
18th century books	37 items	- 0.06 % [7]

Among the already restored books the following valuable publications are worth mentioning: Aristoteles. *Copulata novae logicae*. — Köln, 1489. — 235 ff; *Ruralia commoda*. — Speyer, 1490. — 73 ff.; Erasmus Roterdamus. *Paraphrasis*. — Argentinae, 1535. — /200/ p.; Lauxmin, Sigismund. *Praxis oratoria*. — Brunsbergae, 1648. — 257 p. (the first textbook of rhetoric by a Lithuanian author); *Hippika albo auka o koniach*. — Kraków, 1647. — 136 p. (the first monograph on horses in the Polish language); Radziwillus, Christophorus. *Hierosolymitana peregrinatio*. — Brunsbergae, 1601. — /316/ p. (description of a trip to Jerusalem by a Lithuanian author, with engravings); Sarbievius, Mathias. *Lyricorum libri tres*. — Kalisz, 1681. — 404 p. (a book of verses by a prominent Lithuanian poet who used to write in Latin); Ortelius A. *Theatrum orbis terrarum*. — Antverpiae, 1579, — 93 ff; Bruin G. *Civitates orbis terrarum*. — Köln, 1572. — /66/ ff; Mercator G. *Atlas sive geographiae meditationes*. — Amsterdam, 1616. — 145 ff. (the last three publications are atlases by famous cartographers). One Estonian book restored in 1976–1981 is certainly worth mentioning too: *Tarto Ma Kele Laulu Ramat*. — Riga, 1690. — /260/ p. This is a convolutus composed of 3 books.

After restoration all books are skilfully bound. Efforts have been made, as far as possible, to preserve the original cover. Unfortunately,

the idea of unbound book restoration is not very popular in our Restoration Department.

Suggestions for complex restoration of separate collections have also been made. In this case the whole attention of restorers, hygienists and books-binders is concentrated on one certain collection: books are looked through, cleaned, minor repairs performed and books for full restoration are selected. The general approach should be to do now as much as necessary to preserve the book, expecting that future technologies will be more advanced. In order to realize this attitude, unanimity between all book restorers and curators is desirable. Meanwhile, our highly qualified restorers prefer to deal with books that require accurate and time-consuming work. When comparing the speed of restoration with the speed of book deterioration, one can notice that a well organized intermediate link is missing in our library: people who could work in partial restoration, i.e. a quicker way of working. We hope that future has in store better material conditions. Today our depositories need badly modern air and humidity measuring devices, automatic air conditioners, etc. The economic and cultural situation in Lithuania is now quite hard, and all librarians' complaints are still left up in the air. Nevertheless, there remains hope that our books, having survived for centuries, will be properly protected and evaluated in future. At present, we paraphrase a well known saying: *Facimus quod possumus, faciant meliora potentes.*

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7. The percentage presented here is not absolutely exact since the calculation unit of the collection is a printed item and the calculation unit of restoration is in this case a book.

VANARAAMATU KOLLEKTSIOONID VILNIUSE ÜLIKOOLI RAAMATUKOGUS. PRAEGUNE SITUATSIOON JA RAAMATUTE SÄILITAMISE PROBLEEMID

Alma Braziūnienė

Resümee

Artikkel annab ülevaate Vilniuse Ülikooli Raamatukogu vana- raamatu kollektsoonidest, nende kujunemisest ning vanade väljaannete konserveerimisest ja säilitamisest.

Vilniuse Ülikooli Raamatukogu, mis asutati 1570. a., mainitakse juba 17. sajandil Euroopa tuntumate raamatukogude seas. Raamatukogu kogudele lisasid olulist täiendust raamatud Leedu suurvürsti ja Poola kuninga Sigismundas Augustuse ja teiste ülikute erakogudest. Kahjuks hävis suur hulk raamatuid sõdades ja tuleõnnetustes, paljud raamatud viidi naabermaadesse. 1956. a. õnnestus Vilniuse Ülikoolil tagasi saada ligikaudu 13 000 vana raamatut Moskvast, Leningradist (Peterburist), Harkovist, Kiievist.

Kõik praegu haruldaste raamatute osakonnas hoitavad väljaanded on jaotatud eri kollektsoonidesse mitmete printsiipide (kronoloogiline, alfaabetaalne, keeleline jt.) alusel. Osakonnas säilitatavate raamatute üldarv on u. 18 000.

Restaureerimisosakonna (asutatud 1968. a.) ja hügieenisektori (asutatud 1989. a.) töö kiirus ei vasta tänapäeva nõuetele. Samuti on jäänud paljud restaureerimisega seotud probleemid lahendamata puuduliku tehnoloogia ja seadmete tõttu. Artikkel analüüsib ka restaureeritud raamatuid liikide ja kollektsoonide järgi.

Vaatamata kõikidele probleemidele ja raskustele vanaraamatu säilitamisel ja restaureerimisel väljendab autor lootusrikast suhtumist tulevikku.

ABBREVIATIONS

DMRB	—	Department of Manuscripts and Rare Books
EL	—	Collection of Estonian Literature
LFB	—	Collection of Large Format Books
OFL	—	Collection of Older Foreign Literature
RFL	—	Collection of Recent Foreign Literature
TUL	—	Tartu University Library

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Tartu Ülikooli Kirjastuse trükikoda
Tüügi 78, EE2400 Tartu
Tellimus nr. 148.

Vabandus

Trükitehnilistel põhjustel on joonisel 1 lk. 17 erinevad halltoonid kokku sulanud. Toome siinkohal ära õige joonise.

Tartu Ülikooli Kirjastuse trükikoda

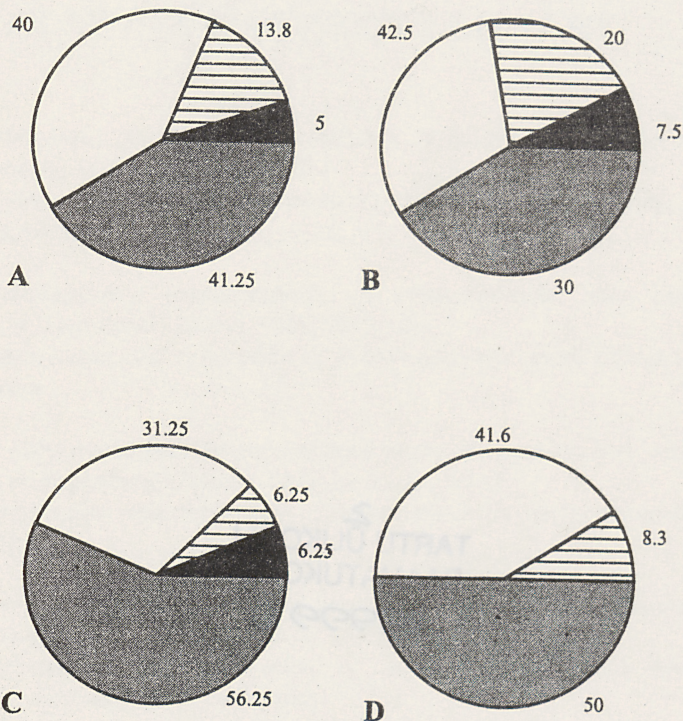






Figure 1. Occurrence of filamentous fungi in library rooms (in percentages):

A — in general; B — repositories;
C — working-offices; D — public rooms.

-  fungi lacked in all three samples;
-  fungi occurred in one sample out of three;
-  fungi occurred in two samples out of three;
-  fungi occurred in all three samples.

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