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**IFLA SEMINAR  
PRESERVATION OF MAPS AND OTHER SPATIAL  
INFORMATION  
MOSCOW - RUSSIAN STATE LIBRARY  
27 SEPTEMBER - 1 OCTOBER 1993**

**History**

On Wednesday 21 August 1991, in the middle of the 57th IFLA Conference in Moscow, during the Kremlin reception, Mr Volik, then Head of the Lenin State Library in Moscow and Mrs Natalja Kotelnikova, Head of the Cartographic Department in the Lenin State Library and Member of the Standing Committee of the Section of Geography and Map Libraries asked the Officers of this Section to design a workshop about the conservation and restoration of cartographic documents in Moscow.

The Section already held such « training workshops » in Netherlands, Jamaica and Malaysia. Within the framework of the *Manual for practical mapcuratorship*, designed and written by several members of the Section of Geography and Map Libraries for developing countries, these meetings were mainly conferences, discussions and practice about all the operations to be done in an institution dealing with maps and cartographic documents, from acquisition to conservation, through cataloguing, indexing and communication.

The official request dated 20 November 1991 asked for a kind of meeting slightly different from the Malaysia and Jamaica Workshops : preservation, conservation, storage, restoration of cartographic documents and other spatial information were stressed. The meeting was intended to be organised for Russian map librarians and people from « Eastern Europe » and Officers from the IFLA « Geography and Map Libraries » and « Conservation » Sections were needed.

During the last three months of 1991, the political situation changed very quickly in Russia and the Seminar was not easy to prepare ; many people with whom we were in contact changed but, from both sides, the will and a lot of hard work shew at evidence that the need for this meeting still really existed.

As the initiator of the project and the official partner with the Russian colleagues, the IFLA Section of Geography and Map Libraries invited the Section of Conservation to participate, but the answer came from the IFLA Preservation and

Conservation Core programme. Thanks to Mr Jean-Marie Arnoult, then manager of the IFLA PAC program, it was possible to establish contacts with the Regional PAC centre for Eastern Europe in Leipzig. Mr Wolfgang Waechter, Manager of this Regional centre in the Deutsche Bücherei, kindly accepted to participate to the Seminar and send some papers.

We have also to thank especially Winston Roberts, IFLA Professional Coordinator, who never spared his time and was a strong supporter of the project as well as Derek Law, Chair of the Special Libraries Division, David Clements and Sally Mc Callum who, as IFLA Officers from the Professional Board or the Executive Board, helped to make the meeting to be held.

In July 1992, the Seminar was scheduled to be held from 18 to 23 April 1993 and a pre-programme was published. In Moscow, Mrs Natalja Kotelnikova was very busy : in February 1993, the abstracts of 18 papers were available, translated in Russian and English. She was able to announce nearly 50 registrations to the Seminar. But, unlike the previous workshops, UNESCO could not help us for the organisation of the Seminar. Although the efforts of Winston Roberts who was very willing this meeting to be organised, we had to postpone it in order to close the budget. Several dates were proposed to Natalja Kotelnikova who chose the week between 27 September and 1 October 1993, called the « Women's Summer » because the weather is usually sweet and sunny in Moscow...

This 6 month period was used to put an end to the financial aspects of the meeting organisation. A lot of hard work from Moscow, The Hague and Paris, and a long meeting during the Barcelona Conference between all the people involved threw the remaining problems out. At last, thanks to the efforts of Ludmila Kozlova, in charge with foreign relations in the Russian State Library, Natalja Nikolaeva, Head of the Research Centre of Conservation and restoration of Documents in the Russian State Library and Natalja Kotelnikova, the Seminar on « Preservation of maps and other spatial information » was on its way. Housing problems were also solved in Barcelona : as the budget was obviously very close, the Russian colleagues made the proposal to rent a flat in a building situated near the Russian State Library.

The « official » IFLA team was built: from the PAC side, Mr Waechter designated his deputy Henrik Otto ; the Section of Geography and Map Libraries was represented by its Chairman. At last, as an expert for large size cartographic documents and globes, Alain Roger, chief restorator for large size documents in the Département des Cartes et Plans in the Bibliothèque nationale de France in Paris was invited.

Natalja Kotelnikova was now able to announce 61 registrations. These people came from Russia - mainly from Moscow and Saint-Petersburg - and from other Republics - (Latvia, Ukraine, Kazhakstan, Czechoslovakia, etc.). The problem of simultaneous translation was solved thanks to the good will of several staff members from the Russian State Library and several Russian students engaged for this purpose. The final announcement of the program was especially heavy...

The changing political situation in Moscow in this period made our Russian colleagues to bring a last minute change in the organisation of the meeting : as the building where we were intended to stay was considered too near from the town centre, we were informed on 24 September by Mrs Ludmila Kozlova that three rooms were registered in the Sputnik Hotel, on Lenin Prospekt, 40 minutes by metro far from the Red Square.

The plane left Paris on Sunday 26 September... we reached Moscow at 15.30. We met Natalja Kotelnikova and Henrik Otto, arrived from Leipzig 30 minutes earlier and we were shuttled to the hotel.

### **The Seminar**

On Monday 27 September, the « Women's Summer » was absent : the Seminar began with a dark grey sky and a thin rain... two days later, it was 2°C under zero and the snow was falling!

Hosted in the Russian State Library - the former Lenin Library, still called « Lenin » by everybody, even in the street - the meeting was welcome by Mr Igor Filipov, Head of the Russian State Library and Mrs Natalja Igumnova, Deputy in the Russian State Library and vice-president of IFLA. Memories of the 57th IFLA Conference in Moscow are still very alive : Mr Filipov stresses the point that this Seminar is a good way for going on cooperation. Many colleagues met two years ago attend the meeting and it is satisfactory to consider that the theme of the meeting gathers so many high level professionals.

The Seminar gathered 61 people from Russia (Moscow and Saint-Petersburg), CIS Republics and Czechoslovakia, Germany and France. These people were mainly maplibrarians, archivists, chemists, engineers, cartographers and restorators. The agenda was very busy : 26 speakers and 6 visits were scheduled ; as a whole, the Seminar was of a very high professional interest. Unlike the previous meetings organised by the Section, this Seminar was less a training workshop than a meeting place to exchange experiences where questions were numberless and discussions endless about mass deacidification processes, encapsulation, « splitting » technique, use of polymers, proper restoration

techniques, materials to be used, digitalisation, storing places, conditions for conservation, etc. A simultaneous translation assumed by students was available in order to make communication easier and to allow discussions between Russian and non-Russian speaking people. During all the week, the sessions were very busy and shew a great interest from all the participants.

During the week spent in Moscow, we had the opportunity to visit the Russian State Library from the top to the bottom, the Cartographic Department in this Library, the State Library of Foreign Literature, the Russian Archives of Ancient Acts, the laboratory for microfilming and digitalizing in this institution, the Research Centre of Conservation and Restoration of Documents situated outside the Russian State Library and the cartographic agency « Cartografia », the ex-GUGK we were not allowed to visit during the 1991 IFLA Moscow Conference. These visits shew a real ability and wit from people in charge with the conservation and restoration of cartographic documents, but also a tragic lack of technical means and materials.

During these visits and discussions, it was possible to see the real link existing between chemists and restorators, although the latter profession has no real and legal status or existence in this country, which led the Russian colleagues to write a professional resolution about the lack of official training for map restorators in their country. We could see a high level craft in the restoration of books (atlases are also books...) but, due to an important lack of technical means and materials, this craft can hardly be transposed and used for large-size documents. In this situation, Alain Roger's paper about the restoration of globes, illustrated with 80 slides, and his answers to many questions about large-size cartographic documents may be considered as very important.

## **Conclusion**

As a conclusion, the Seminar was of a remarkable professional level ; it gave a meeting place for people involved in problems of the same kind and allowed a very rich discussion and information ; it gathered people from different countries and created professional contacts between them. The professional resolution discussed in Moscow and brought back to the IFLA Headquarters could be the beginning of a following action through the PAC Core program. The Seminar was held in a hard political situation, although it has to be said that the events never held up the meeting... except on one point : as it is unthinkable to stay a week in Moscow without attending a ballet, our colleagues had scheduled a performance of « Nutcracker » on the evening of the day we visited the cartographic agency ; when we reached the gate of the Kremlin, we were welcome by soldiers equipped

with brand new Kalashnikov machine guns ! Times are changing : two years ago, we could not visit the GUGK - cartography is still a sensible matter...- but we had a performance of « Romeo and Juliet » ; in 1993, it was possible to visit the cartographic agency but the ballet was not allowed... Our colleagues proved their optimism : in fact, two days later, we attended a performance of « Gisele » in another theatre!

On Saturday 2 October, the Seminar was over and our colleagues scheduled a visit of Moscow out of the « official » tours ; at the same time, tyres were burning on Arbat Street and stones were thrown on Smolenskaja Square, as we saw on TV at evening... On Sunday 3 October, on our way to the airport, the temperature was very sweet, the weather was very fine, the sky was blue, the Russian country shew marvellous autumn colours, it was the real beginning of the « Women's summer », military trucks and light tanks were going to Moscow on the other side of the road...

### **Proceedings**

The « IFLA » papers by Henrik Otto, Alain Roger and Pierre-Yves Duchemin have been published in the *Journal of the Russian State Library*. As all the papers have been translated into Russian and English, and as they are, as a whole, of a good quality level, it was obviously interesting to issue the proceedings of the Seminar. It is why this special issue of INSPEL is devoted to this meeting.

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## CARING FOR MAP COLLECTIONS

By Pierre-Yves Duchemin

The answer to the question « how can I best preserve paper-based maps? » is not quite simple. In fact, there is not one « correct » answer to the problems of preservation of maps and other spatial documents. The final acceptable solution often has to be a kind of compromise between what is considered to be the « ideal », and what is really achievable, given the restraints of time, money, human resources, skills and storage space.

The environment also has to be considered. In fact, what might be suitable in temperate climatic conditions might not be possible in hot humid conditions in the tropics or in cold humid conditions around the polar circles. Even within one country such large as Russia, the solution of preservation needs in Crimea might be quite different from the solution adopted in Siberia.

The types of documents that are candidates for preservation are many and varied. Apart from books and newspapers which are the major part of the material being preserved in libraries, one has often to deal with engravings, printed music, coins, medals, manuscript sheets, photographs, recorded music, videos, audio-visual media and any other documents of sentimental value such as birth, marriage and death certificates or small imagery, postcards etc. Even if most of this report may also concern non-cartographic documents, we shall insist on maps, whatever manuscript, engraved or printed, atlases, globes, aerial photographs and non paper-based cartographic materials such as remote sensing imagery, magnetic tapes, CD-Roms or any other optical media, various objects and any document related to spatial information. Very often, we have to admit that these documents are unique and irreplaceable.

This idea entails to another one ; there is one factor that needs consideration when planning a preservation programme : the significance or importance of the items involved in this programme. Even if they all should be taken in account - (we cannot say today which document will be considered as important in two or three centuries) -, not all records can be preserved for ever. The restraints in time, money, storage are so important that we have to choose. The very first question to be answered is often « how important is this document? ». The main aim of any

preservation programme should be to maintain and preserve consistent collections with their identified values, whether they are financial, historic, informational or sentimental.

### **How can records be preserved**

Unfortunately, all materials are subject to change and decay. Nevertheless, some simple steps can be taken that will, with a minimum of trouble and expense, maintain paper based documents in good condition and prolong their life as long as possible.

There are three important factors to be considered about the preservation of paper materials:

- their composition
- their storage environment
- their handling

Good paper will last for centuries if given good storage and good handling. However, the poorest quality of paper can survive for quite a long time if it is stored appropriately and infrequently handled. But even good quality paper will not last long in a poor environment or when subjected to physical abuse.

### **What is good quality paper?**

Paper can be made from many different fibrous materials. Traditionally, most of the paper in the « Old World » civilisations was made from cotton or linen rags, which are composed of a chemical called cellulose. With the important social and economic changes in the nineteenth century, the demand for paper outstripped the supply of rag paper. By the mid-nineteenth century, more and more paper was being made out of wood pulp. Whereas cotton and linen fibres are almost pure cellulose, wood has a lower proportion of cellulose, and in addition contains around 20 to 30 % of a material called lignin. The cellulose fibres provide most of the strength in wood, while lignin is the cementing material that binds the fibres together.

The main consequence for libraries and archives is that the paper manufactured since the mid-nineteenth century contains chemicals which are largely responsible for the premature disintegration and self-destruction of the paper, as revealed in its discoloration and brittleness.

Before wood can be made into paper, it has to be converted into pulp. There are two main methods for generating pulp : mechanical and chemical.

- Mechanical (or ground wood) pulp is made by grinding up raw wood. Both lignin and cellulose are present in ground wood pulp.
- Chemical wood pulp is made by separating the cellulose and lignin by chemical action. Most of the lignin is removed by a cooking process, usually under pressure. Bleaching can be carried out on both mechanical and chemical pulps. It is used both to help remove the lignin, and to provide the white paper which is usually favoured by today's consumer.

Lignin is relatively unstable. It yellows when exposed to light, and readily breaks down into acidic decomposition products. Ground wood paper, which contains lignin, is not very long lasting. Modern newsprint contains a high proportion of ground wood pulp, and it is very unstable. Chemical wood pulps, with the lignin removed, can make rather good quality papers, as do rag papers which have no lignin in them. Many ancient documents and printed materials, including most of the newspapers produced before the mid-nineteenth century, were made from good quality paper, and, as a result, are usually quite stable and have survived in good condition until now. Cartographic documents, as a whole, belong to this category.

The presence of acid or acid forming substances in paper causes, in time, the partial decomposition of the cellulose fibres, with the concurrent weakening of the paper structure. Besides lignin from the wood pulp, additives used in paper making also shorten the life of paper. In most cases, these also increase the acidity of paper. Many papers contain a sizing material such as resin, starch, glue or synthetic resin to improve their writing or printing qualities. This is the case of the modern nautical charts, intended to stand water and moisture. Some traditional sizes are acidic or are applied using acidic materials such as alum. It is much inconvenient to consider that, when exposed to moisture in the air, the alum produces sulphuric acid, and so causes the paper to deteriorate. Impurities in the atmosphere contribute to the acidity as well.

The ultimate life expectancy of paper can be increased by excluding acidic substances in manufacture. To counteract the effects of acidity from the environment, it is possible to buffer paper with various alkaline additives. Modern « permanent » paper is made from good quality pulp with the addition of alkaline fillers such as magnesium or calcium carbonate.

### **How does the environment affect paper?**

Some of the most important environmental enemies of paper are heat, humidity, light, air pollutants, animals, insects and natural disasters.

- Heat : high temperatures or wide fluctuations have an influence on the stability of paper : excessive heat causes a chemical decomposition that leads to hydrolysis and oxidation, then desiccation and embrittlement occur rapidly. Lower temperatures extend the life of paper. It is generally recommended that the temperature for library materials range between 18°C to 20°C. For this reason, it is often recommended that important documents be placed in « cold » storage.

If there is an air-conditioning system, the most effective method is to operate the equipment 24 hours a day during the entire year. In some institutions, it may be impossible to run the system for this length of time. Even 8 hours a day will be of value. If air-conditioning is unavailable, the desirable range can be maintained more readily by locating the storage place in the centre of the building or in its basement.

- Humidity : a significant factor to consider when preserving a map collection is humidity. In fact, humidity refers to the « dampness » of the air. Very high humidity encourages mould growth, and the control of mould is a particular problem in hot wet environments. Very low humidity causes paper to dry out and become brittle. Humidity is normally expressed as « relative humidity ». The best relative humidity for paper should be stable at around 40 to 50 % according to the temperature expressed in the previous paragraph. One has to keep in mind that heat and humidity are correlative and have to be considered as a couple : a temperature of 18°C deals with a dampness of 50 %, when a temperature of 21°C deals with a dampness of 55 %, and 24°C has to deal with a dampness of 65 %. However, in hot wet climates, it is very difficult to achieve this ideal, and compromise is often necessary.

Wide fluctuations in humidity are also bad for paper. As the humidity changes, the moisture content of the paper also changes, and the individual fibres within the paper expand and contract. A paper so much stressed deteriorates at a faster rate than paper kept at a constant humidity. When air-conditioning is available, the suggested relative humidity range is 45 to 55 %. If necessary, a dehumidifier will reduce high humidity to an acceptable level as long as windows are kept closed and doors opened infrequently.

In some areas in the world, one has to face the opposite situation : a lack of moisture which leads to desiccation, and ultimately, the ageing of cartographic materials. In such a situation, it may become necessary to use a humidifier to increase the rate of relative humidity for added moisture.

Both temperature and humidity need to be monitored daily. Various types of measuring these devices can be purchased. The ideal tool would be a hygrothermograph which records daily readings on chart paper.

- Light : exposure to light, particularly in the invisible ultraviolet regions of the spectrum can be highly damaging to paper, causing a reduction in strength, changes in paper colour, and fading of the text or image. Water-colours are particularly susceptible to fading. Although unfiltered sunlight is the most damaging process, prolonged exposure to artificial light can also be harmful. Therefore, methods can be implemented to reduce the exposure to light : if possible, lights in stock areas should be turned off when not in use ; it is recommended to use incandescent lighting because it gives out less ultraviolet rays than fluorescent lighting. However, in an existing fluorescent light environment, filter or, at least, plastic sleeves can be placed over the tubes to significantly reduce the damage caused by the ultraviolet rays. Window shades and curtains will help shield cartographic materials from the sun. Eventually, if possible, map cases and storing places should be located at distance from windows and exterior doors.

- Air pollutants : there are many air-borne gases and particles which can harm paper.

- Sulphur dioxide, produced from burning fossil fuels, and various oxides of nitrogen have the potential to damage paper. The air in a map library should be kept as free as possible of gaseous pollutants and abrasive dust particles. It is important that the air be filtered and circulates freely throughout the storage areas, with adequate space between maps and atlases. Even in not too hot climates, air fans may help in this regard by preventing stagnant air pockets where mildew can form.

-Fungi : fungi or mould develop in libraries when the relative humidity reaches 70 % and the ambient temperature is between 21°C and 25°C. As the humidity increases, the growth rate will rise and foxing brown spots caused by fungi may become apparent. In addition, spores from fungi float in the air until a suitable growth environment is present. Air-tight windows and doors will protect cartographic materials from fungi and moisture.

- Dust can be very abrasive and disfiguring, and can damage paper of maps and bindings of atlases.

- Smoke, from fires and cigarettes, is also a problem. Smoke leaves brown oily or tarry deposits on materials close by, while heat from fires can cause desiccation. In the drier tropical regions, dust can be a particular problem.
- Insects : paper is subject to attacks by many household and other pests including silverfish, bookworm, termites, moths, cockroaches. They can destroy paper by chewing and gnawing (even maps printed on thick paper), and their droppings leave stains and are often corrosive. Although these pests can be a nuisance in temperate climates, the problems of their control is far greater in hot wet conditions. The problem is that most of the products available to control the pests are often toxic to human beings and should be used carefully. Nevertheless, a book wax - such as Cire 212 elaborated by Centre National de la Recherche Scientifique and Bibliothèque nationale, existing in various colours - may be useful for dressing leather atlas bindings with the added benefit of repelling insects.
- Rodents : if rodents, especially rats and mice, invade the map library, the only thing to do is to contact an eliminator and try to eliminate which might attract them. A frequent and thorough cleaning of the storage places in the map library is vital if it is to be kept free of unwanted nuisances.
- Natural disasters : there is a number of natural disasters that can have a devastating effect on paper-based records ; the main ones are obviously floods, fires and hurricanes. If there is no need to be afraid of the third one in this country, the other two are « universal » ! Most of the time, the most severe damage is caused by water. Fire is obviously very dangerous but libraries, and especially map libraries, do not burn very easily.

### **Recommended environmental conditions**

To minimise damages caused by harmful environmental factors, the following guidelines should be followed:

1. Avoid extreme temperature and humidity, and protect the cartographic documents from natural disasters. The storage display area should, wherever possible, be at a moderate and stable temperature and humidity. Places to avoid are in the roof space, under the house or in the basement, garages or outhouses, over or near the fireplace, in wet places such as bathrooms or kitchens (do not smile... such storage places exist!), and on or along outer walls. Interior rooms are usually less subject to variations of temperature and humidity. In flood prone areas, it is particularly important that material be stored, where and when possible, out of the danger zone for risk of damage by water.

2. Reduce or eliminate as much as possible exposure to direct sunlight or prolonged exposure to strong artificial light. Keep curtain and blinds closed during the brightest part of the day. When art works such as ancient maps, portolan charts or aerial photographs hang on the wall, try to find a space out of direct sunlight radius.

3. Keep objects in a clean environment, far from dust and smoke, and free from animal and insect pests. The area should be regularly vacuumed, and looked for signs of animal or insect infestation. If necessary, shelves and cupboards can be sprayed with a residual insecticide after first removing your collections, and allowing the areas sprayed to dry before replacing it. Pest strips can also be used cautiously, as long as they do not come into direct contact with your objects. For total area fumigation, a reputable pest control company should be consulted. It is a good idea to discuss with the operator the chemicals to be used, choosing the ones which will not damage your collections.

4. Avoid the use of oil-based sprays, for they can leave a fine oily deposit on exposed surfaces. Good air circulation helps to avoid mould growth. Materials in boxes such as folded maps or flat sheets on shelves should not be so tightly packed in order to allow air circulation, especially in humid conditions. Periodic checking of mould or insect infestation is a good idea.

### **Preparation for storage**

Even when the environment and storage conditions are « ideal », some treatments might be necessary to put objects in a suitable condition for storage.

The storage of maps and atlases has an influence on their future condition. Equipment would need a special report, so a few comments here will be enough: steel horizontal cases, with shallow drawers, are recommended over wood since acid migrates from wood cases to the maps within. Acid-free paper folders are essential for maps. As a rule, ten sheet maps can be filed in a folder. A dust cover which fastens at the front of the drawer provides adequate protection.

Some steps to be considered for a good storage are:

1. Materials should be stored unfolded and flat wherever possible. Even if maps are made of a much stronger paper than books, folding and unfolding maps weakens the fibres in the paper, which eventually breaks apart along the foldlines. For any reasons, if it is not possible to store cartographic material unfolded, then it should have as few folds as possible : in order to avoid weakening a map, it is

recommended not to fold it more than once. Folds should be located wherever possible away from the areas of the map that contain important information.

Rolling of very large, flat maps onto suitable non-acid cardboard cores is sometimes recommended, but it may be difficult to flatten a large map that has been rolled for a long time. If a roll is used, its diameter should be sufficiently large in order to prevent the map from being rolled too tightly.

2. Extraneous objects - such as metal pins, staples, paper clips and rubber bands - should be removed carefully but only if the physical arrangement of the cartographic material is not interfered with or altered by such an action. They can be replaced with suitable materials such as plastic paper-clips or white non-acid cotton tape. Any other materials - plastic envelopes or sheets, wrapping paper, dried out and loose « sticky » tape - could also be removed if they are not integral parts of the cartographic material.

3. Loose dirt or powdery mould should be cautiously brushed off with a soft, dry brush such as a shaving or paint brush.

### **Storage methods and materials**

Most cartographic documents will benefit from some extra protection before being stored. This might be as simple as wrapping or interleaving with suitable non-acid wrapping paper or plastic such as « mylar », or placing in a suitable wrapper, folder, portfolio or box. Materials used for storage and display should, if possible, be of archival quality and should not harm the cartographic material being protected. Archival materials are generally considered to be stable, long lasting and free from contaminants.

The following materials are preferred for use with paper based maps if they can be obtained, and if their cost can be justified. However, even the provision of lower quality materials is usually better than leaving the cartographic materials totally unprotected.

- Paper : wherever possible, paper for primary protection should be made from rag or chemical wood pulp. It should not contain ground wood. Many archival papers are alkaline buffered. Archival papers have been made overseas for many years. Alkaline buffered papers can be used for almost all storage and display needs, although non-alkaline papers are recommended for older aerial photographic materials.

- Plastics : plastic materials should be relatively inert, and not give off harmful chemicals such as acids or plasticisers. Three suitable plastics are polyester,



polyethylene and polypropylene. In Europe, at least, many plastics used for storing food are made out of these materials. In particular, the ones identified as « microwave safe » do not contain plasticisers and so should be suitable for a storage use.

Plastic materials containing chlorine are to be avoided. The most common of these plastics is polyvinyl chloride, or PVC. It has the potential to harm the materials it is usually intended to protect, both through the migration of plasticisers, and by its degradation and breakdown into acidic gases.

There is a simple test for chlorine containing materials, based on a chemical procedure known as Beilstein test. It is based on the reaction of chlorine with copper compounds at high temperatures in a flame to give a greenish colour to the flame. At its simplest, this test needs a piece of copper wire, a cork, a source of flame such as a candle or a lighter and a sample of the plastic material to be tested.. To proceed to the test, insert the wire into the cork, which becomes an insulating handle. Then, hold the wire in the flame to burn off any impurities, the flame should be colourless or very slightly blue. Then touch the hot wire onto a small sample of the plastic material to be tested, and immediately return the wire to the flame. A green colour in the flame is a positive indication that chlorine is in the material being tested, and so it should not be used for your cartographic materials.

The use of plastic materials for storage of cartographic materials has been commonly carried out in temperate climates for many years. Its use in wet regions is rather more problematic : cartographic material stored in plastic, if it has already active mould growth, might be further damaged by such a storage. Cartographic material stored in plastic should be periodically inspected to ensure that mould growth does not occur.

« Encapsulation » is an efficient way to protect cartographic documents. It is generally a recommended technique which provides a physical support for maps, especially those in a fragile state : the map is placed between two sheets of polyester film. Static electricity holds the map between the polyester sheets. The main advantage of this process is its reversibility. Encapsulation protects the maps against tearing and exposure to dust and dirt. It is still possible to photocopy and to microfilm them through the polyester film.

One has to pay attention to the fact that encapsulation is not appropriate for maps which have inks and colours subjected to flaking. The static electricity may lift the particles of ink and colour from their surfaces.

If it is possible to deacidify and alkalis prior to encapsulating, one may prevent or retard further deterioration. If deacidification cannot be performed, encapsulation in polyester film is still recommended because increased protection is obtained through this method.

The use of polymers should be studied very carefully : the problem with this technique is its irreversibility. The principle is quite different from encapsulation (a map sheet between two polyester films) : polymers and paper form a new material that is no longer neither polymers nor paper but a composite that you cannot change forever. It is generally not recommended to use polymers with coloured cartographic documents.

- Cardboard boxes : there is a range of archival boards and boxes that are generally expensive. A satisfactory alternative is to use ordinary boxes as outer containers, and to line the box or to wrap your cartographic objects in archival paper or plastic before storing them in the box.

### **How does handling and display affect paper?**

A correct storage will reduce the chance of a future damage. However, it is but natural to wish to look at, to examine or to display some cartographic documents from time to time. But one should never forget that one of the best ways to reduce handling of maps is to implement effective complete cataloguing, indexing and classification schemes. So, by looking at the catalogue cards or the computer screen, the user will be able to determine which maps will be most pertinent before examining the maps themselves.

- Handling causes physical damage to the objects : tears, abrasion, formation of dirt and grease.

- Display of the unprotected cartographic material in particular can cause the nuisances cited above, and in addition harms the object because of the excessive exposure to light.

The following guidelines should help to reduce the chance of damage when cartographic items are handled or on display:

1. Always have clean, dry hands when handling cartographic materials.

Keep food and drink far away.(once again, do not smile...)

Do not touch the actual image area with your fingers ; this is specially important when handling aerial photographic negatives and transparencies. It is sometimes recommended that clean white cotton gloves be worn when

handling cartographic materials. These can be useful for the object could be soiled by fingerprints, but sometimes gloves put the object at more risk of damage because of the added clumsiness they impose on the wearer.

2. Provide some form of extra protection to the cartographic material, for example a suitable plastic bag such as mylar, or an archival folder, cardboard box or mount.

Ensure that the cartographic material is fully supported while it is being looked at. Maps and other large paper objects need to be laid out on a clean and cleared flat surface. Large books such as atlases should also be well supported during use.

3. If atlases, aerial photographs, drawings, engraved maps and similar materials are to be displayed, it may be a good idea to rotate them from storage to display on a regular basis so that they are not exposed to light for long periods of time. It is generally best to display cartographic materials - especially ancient maps - behind ultraviolet absorbing acrylic sheets to reduce the harmful components of light.

In certain conditions, it is recommended to turn the pages of a rare atlas on exhibition every two days.

4. Cartographic materials to be displayed in frames should be suitably mounted. Plastic acrylic sheets, rather than glass is preferred with the glazing material. It is recommended that the cartographic object is not directly in contact with the glazing material. A good quality framer should use archival materials if requested. Alternatively, there are many books which describe the procedures to be followed, and, in some cities, you can find « do-it-yourself » framing shops where you can use and choose your own materials.
5. If the cartographic material used is very fragile, it is better to make a copy for use (photograph, transparency, microform, scanned file, etc.) and store the original in a safe environment. For printed material, good quality dry-process photocopying is recommended. You can now find machines using « cold » light that does not harm the cartographic document. But one should pay special attention to photocopying : without any doubt, photocopying of cartographic materials is responsible for serious physical damage. When atlases are wide opened and strong pressure is applied to the spine area, the spine can be affected for ever. Photocopy also affects hand coloured maps and acid paper based cartographic materials. In this case, it is generally recommended to provide microfiches, microfilms or fac-similes instead of rare

originals. An alternative is to photograph your objects in black and white. Colour photographs are much more expensive and are not as long lasting as black and white, although they might be useful in the short term for multicoloured cartographic materials.

6. If notes or annotations need to be made onto any item, it is recommended to use a soft lead pencil. Try and find an obscure spot to make these notes. If possible, however, make notes on a separate sheet of paper.

### **How to treat damaged cartographic materials**

Some common problems which can be simply treated are:

- Mould : brush off cautiously loose surface mould in a well ventilated area, thus avoiding inhalation of the dust. If some stains remain, mould may be removed by wiping the contaminated area with a cloth slightly dampened with alcohol. In some cases, it may be necessary to fumigate in order to prevent cartographic materials from a recurrence of mould. Exposure to sunlight for an hour or so will help to inactivate the mould, but care should be taken with water painted hand coloured cartographic contours. Keep the storage environment dry to prevent regrowth.
- Dust and dirt : loose dust or dirt can be removed by carefully brushing or vacuuming. A soft, white eraser, used with very gentle pressure can be used to remove some surface dirt. Be very careful, however, in areas where there is writing or cartographic drawings.
- Crumpled, rolled or folded material : before flattening, these might need relaxing in high humidity for a short time. It is possible to make an improvised humidity chamber out of a clean, lidded plastic container : place about half a centimetre of water in the bottom, the place the cartographic objects to be relaxed on a rigid support suspended above the water level. Be sure not to allow your objects to come in contact with the water. Put on the lid, and leave the objects in the « chamber » until they seem more flexible, preferably for no longer than 24 hours. There is the risk of a mould growth if material is kept in a very wet environment for too long a time. When the objects are removed, they should be carefully straightened or unrolled and pressed between clean white blotting paper under a light weight for several days.
- Brittle material : some modern ground wood papers deteriorate and become brittle when getting old. If the paper has become brown, there is very little that can be done for such material. The best alternatives are either to copy the

information - by photography (photocopy will increase the damage) - or to encapsulate flat cartographic objects in clear plastic pockets. Polyester is usually recommended for this purpose, since it has excellent clarity and can be obtained in thickness which have good rigidity.

It is also possible to buy pre-made polyester pockets, open along one or two sides. These are an excellent protection.

It is sometimes possible to buy sheets of polyester. These can be custom-made into pockets by sealing the edges not with double sided adhesive tapes but either by warmth or by sewing.

But, in fact, the only efficient treatment for brittle cartographic materials is mass deacidification. Whatever the method, it is rather expensive but the process gives good results. The basic principle is rather simple : the aim is to neutralise the acids in the paper. In most cases, an alkaline reserve (often calcium carbonate or magnesium carbonate) is added to the paper to neutralise acids subsequently regenerated by natural ageing and air pollution. In practice, deacidification does not completely stop paper degradation but slows it down to a minor proportion. Acidity still exists in a macromolecular form and regenerates itself as long as cellulose is left. Nevertheless, studies have been carried out over many decades and show that deacidification using mainly calcium or magnesium salts does have a stabilising effect on the cellulose.

The first deacidification methods consisted in the individual treatment of each document and required the atlas to be unbound prior to treatment.

Today, one of the best compromises is to use of a vapour phase process. The penetrative properties of vapour seem to make it particularly suitable for mass deacidification : many atlases may be treated at a time and books do not need to be unbound for treatment. The process itself consists in placing the atlases or the map sheets in an autoclave containing a pressurised solution of methoxy magnesium methyl carbonate (WEI T'O process). It has been used in the Centre de Conservation du Livre de la Bibliothèque Nationale in Sablé-sur-Sarthe since 1987.

- Tears : Even if the cartographic document is produced in many copies and it is intended for a short life span, do not use pressure sensitive tape (« sticky tape ») for any cartographic material. The tape changes colour and becomes brittle with time. The adhesive is acidic and therefore, contributes to the deterioration of the map. In addition, the process is not reversible : once the tape is applied, it cannot be removed without causing serious damage to the paper.

Encapsulation of sheet cartographic materials in polyester pockets or folders will hold the objects together even if they are torn.

Minor tears can be repaired with mending a paper that is transparent and reversible with water. As an alternative, it is possible to use a technique requiring Japanese tissue and methyl cellulose adhesive or wheat starch paste.

- Damaged bindings : it is possible to have atlases bindings repaired or replaced by a specialist conservation binder. Such treatments can often be very expensive. A cheap alternative is to box the damaged atlas, without treating the binding itself. It is possible to have a variety of different styles of box custom-made by a commercial binder, or it is possible to adapt any available box with inserts or lining. Many old leather bindings suffer from the condition known as « red rot » (a powdering of the leather), often along the spine. Almost nothing can be done to treat it cheaply. In general, the use of leather dressing requires several treatments and regular inspections to be held in good condition. To achieve this aim, it is recommended to use a special wax for bindings against fungi and dampness.

- Wet materials : for wet paper cartographic materials, the best approach is to remove wetness with a blotting, and then by air drying with a cool fan and not a hair dryer!

Glossy paper atlas sheets needs to be carefully separated before they are dry, or else pages can be irretrievably stuck together. Once the cartographic material is dry, it can be pressed flat under light weights. If there is a large or varied amount of cartographic materials involved, it is better to call in an expert help. They will probably advise freezing the bulk of the material to stabilise it, prevent mould growth, and allow time to analyse the situation so that recovery can be proceeded cautiously.

### **Some particular problems of spatial documents**

There are no easy solutions to the treatment of some materials. Sometimes, items are a composite of many different materials - such as scrapbooks; sometimes, they use a technology which is either ephemeral, or which relies on proper processing at the time of manufacture to maintain a long life - such as photographs; sometimes the very large size of the cartographic document creates problems - such as outsize posters, planispheres or mapamundi, or very large atlases; sometimes the total amount of cartographic material in the collection is a problem itself (in France, we have more than 1 000 000 maps in the Département des Cartes et Plans de la Bibliothèque nationale de France and we are considered as

the third map collection in the world). Some solutions to these problems are discussed below.

- Scrapbooks : these can include a wide variety of materials on a wide variety of papers - clippings, drawings, photographs, souvenirs, botanical or geological specimens, etc. all find their way into scrapbooks. There is very little that can be done in the way of treating a scrapbook without totally altering the original concept : copying the images, remounting good quality paper, rehousing into an archival album, etc., all destroy the integrity of the original document. The least invasive treatment is to interleave the pages with suitable paper, box the album and store it correctly in good conditions.

- Photographs : properly processed black and white aerial photographs stored and handled correctly can be expected to last for centuries. Poor quality or poorly processed aerial photographs, especially many varieties of colour prints begin to degrade, fade or change colour only after a few years. If older photographs are fading or getting a silvery, or sometimes brownish, tinge, the best solution is to have them copied by someone of the photographic service of the institution, used to handle fragile materials or, if not, by a reputable commercial photographer. Coloured aerial photographs and slides, however, present great problems : it is very difficult to restore the colour once it has faded. Scanning the images on a CD-Rom or any other optical medium is at evidence the best way to keep spatial information available for centuries but it is also the most expensive... Copying onto black and white films may well be the best compromise to preserve the information the aerial photograph contains. All aerial photographic materials benefit by being stored at very low temperatures and in the dark. Albums and other materials used for the storage of aerial photographs can often harm the image. Paper should not contain lignin, and plastics should be inert. The so-called « magic » or self-adhesive albums are not recommended at all. The adhesive used can cause severe problems, and the plastic covering sheets are usually PVC.

- Outsize documents : wall maps raise special storage questions : due to the fact that they will deteriorate if they are stored hanging on a wall, it is recommended to store them in loose rolls including a non-acid paper sheet.

Very large atlases should be considered as portfolios and always shelved horizontally on a double-width steel shelving. The consultation of this type of cartographic document requires a desk reading slope which allows the reader to see an entire page without rubbing the volume against the edge of the table.

Smaller atlases may be shelved upright, but not on the fore edges since the hinges will weaken from the weight of the book.

- Large collections : for large collections, often belonging to national organisations, photographs, microfilms and microfiches might well be a viable alternative to restoring or preserving original cartographic materials. The best way would be to use the photographic service of the institution but reputable commercial microfilm companies should be able to provide advice and costing. Good quality silver halide microfilm will last in the same way as black and white photographs.

Usual 24 x 36 slides might be a relatively cheap solution, with the risk of colour fading as time pass ; it is also possible to provide microfilms but this solution is not quite adapted to large size documents ; the microfiche could be a satisfactory compromise if, apart from money restrictions, it is possible to have one map on one microfiche ; at last, a better but expensive solution is to copy the documents on large size transparencies that could be used for reproduction. These substitutes could eventually be used for the preparation of an analogic videodisk.

Although still expensive, digitalisation seems to be a very good solution for preservation of cartographic materials : the cartographic document is scanned point by point at any required definition and may be published on a floppy disc, a magnetic tape, an optical cartridge or a CD-Rom. The data may eventually be sent out of the institution through a telecommunication network.

### **Other sources of advice**

Many books have been written on the care of paper based materials. Some are good... but none has been written especially about maps or spatial information documents in general. It is best to avoid old books, since preservation practices are dependent of the knowledge on the behaviour of materials. Although written in English, there is one book easy to read and full of common sense and good advice:

Baynes-Cope, A. D.

*Caring for books and documents.* - 2nd ed. - British Library Preservation Office, 1989. - ISBN 0-71230-151-8 pbk.

Most National or State Libraries employ conservators and restorators to care for their own collections. Conservators employed in these institutions can also usually provide information and list of colleagues in private practice. Some institutions even offer a consultation service for a small price. However, if ever work is to be undertaken, ensure that both the scope and the cost of the work is fully understood before going ahead.



In the European Community framework, the Directorate General X has published in 1993 a *European Directory of acid-free and permanent book paper*. This booklet is freely distributed by the Commission of the European Communities.

The Bibliothèque nationale de France has been designated as the International focal point for the Preservation And Conservation - PAC - IFLA Core Programme. The Deutsche Bücherei in Leipzig is the Regional Centre for Eastern Europe. Although the PAC focal point does not have much funds to cover the cost of travel and living expenses for foreign visitors, it has been able to provide training in preservation practices and management. So, work is going on a world-wide scale to develop a standard system for the international communication of preservation decisions and actions.

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**RUSSIAN STATE MILITARY ARCHIVES  
THE PROBLEMS OF SECURING PRESERVATION OF  
CARTOGRAPHIC DOCUMENTS  
IN THE RUSSIAN STATE MILITARY ARCHIVES (RGVIA)**

**By A. D. Lazerson, K.V. Morsin**

**Abstract:** The report is dedicated to the problems of preservation of cartographic documents in RGVIA.

The practical aspects of preservation of cartographic records are examined in the report, and Russian State Military Archives are taken as example.

The aspects are the following :

- material and technical equipment in Archives, and problems linked with its acquisition and replacement,
- principles of conservation and questions of arrangement of cartographic records, control and ensuring of temperature and humidity conditions,
- rise of an unusual situation (damage of heating system) and the stages of its liquidation,
- description, registration and inspection of the finding aids.

The existing normative and methodical literature that examine the aspects of the description of cartographic documents cannot always be used in archival practice since its scheme of actions is rather cumbersome. We examine in the report the scheme of description of cartographic records and possible perspectives of the development of the finding aids to cartographic documents in RGVIA.

We make the following conclusions :

- the conditions of conservation and archival equipment in Archives, in general, satisfy the essential demands,
- the registration apparatus and the finding aids that exist in our Archives permit to register and to search efficiently the cartographic documents,
- we need a supplementary study of the questions linked with the description of cartographic documents, and we also need to create normative and methodical literature on the activities of archivists in emergency situations.

**Introduction**

The Russian State Military Historical Archives keep a rare collection of rare cartographic materials numbering about 130 thousands of storage units of 17th -

20th centuries. These are general maps of the Russian Empire, maps of provinces, plans of towns, fortresses, settlements and their neighbourhoods, hydrographic, astronomic, topographic maps, general atlases and world maps, military, historical maps etc. These documents are accumulated mainly in the collections of the Military Scientific Archives which is a component of the RGVIA - RSMHA, in the stock of the « Main Engineer Department », in the collection of military historical maps.

The cartographic materials of the Russian State Military Historical Archives are registered and described. The main scientific reference tool to the maps and plans kept in the Archives are « opisi » (descriptions) and the « Catalogue of the Military Historical Scientific Archives of the General Staff Main Department », vv. I-IV, SnP, 1905-1914.

The Russian State Military Historical Archives pay great attention to securing preservation of the documents, including the complex of cartographic materials.

They check up the presence and state of the stocks and periodically register the documents that require repair and restoration. Annually, the Archives hand over 150 square metres of maps for restoration to the laboratory of the Rosarhiv. More seriously destroyed documents are restored at the I. E. Grabar All-Russian Arts Scientific Restoration Centre.

All maps are stored in card-board cases or envelopes by storage units, which in their turn, are arranged on shelves in large-size card-board cases or boxes depending on the maps formats.

The present report will focus on the practical questions of storing cartographic materials taking into consideration the RGVIA - RSMHA peculiarities.

All cartographic materials kept at the RGVIA - RSMHA may be conditionally divided into three parts :

1. Materials of a general character having no direct relation to the military matters: general atlases and maps of the terrestrial globe, continents, countries and their particular parts, geodetic, hydrographic, geological maps, etc.,
2. Materials of military operational character : maps of billeting of the troops, plans of fortresses, fortifications, positions, layouts of the supposed location of the enemy troops, locality sketches etc.,
3. Materials of a military, historical and educational character : maps, plans, and schemes of campaigns, battles, sieges.

The stocks of cartographic materials may be also divided into three groups:

- The first group comprises the stocks fully or mostly consisting of cartographic documents. There are six such stocks in the Archives : these are the collections « Military Historical Maps, Plans, and Albums », « Maps of the Former Russian Empire », « Astronomical maps », « General Atlases and Maps of the Terrestrial Globe », « Maps of continents », « Military Historical maps, Plans, and Schemes ». About 13 thousands storage items are registered in these stocks.
- The second group includes the stocks with 30 to 80% of cartographic materials of the whole stocks. These are the stock « Main Engineering Department », the collection of the Military Scientific Archives, and the stocks containing materials of the Russian Empire, individual countries, and wars.
- The third group comprises the stocks with a minor and fragmentary quantity of cartographic materials. These are the stocks of military districts, armies, corps, divisions etc.

Further on, we shall examine only the stocks belonging to the first two groups.

The Russian State Military Historical Archives occupy the Lefortovsky Palace that was transformed into the Archives in the 1860ies. The building hardly meets the today's requirements for storing documents. The larger part of the shelves are made of wood, and the metal shelves are intended for non-standard boxes that are no longer manufactured. When boxes are destroyed, there is nothing to replace them. The storage shelves are double-storied and not all of them have ceilings. Special premises are meant for storing large-format documents.

Yet, there are very few such premises in the Archives. They are equipped with shelves specially intended for maps. And they are made of badly planed and badly fit wooden boards arranged at 10-12 cm distance one from another. To prevent destroying cases by badly planed wood, the archivists cover the boards with cardboard.

All rooms for storing large-format documents are equipped with ceilings. Unfortunately, the height of the upper storey does not permit to work standing erect and the spaces between shelves in some rooms are intended for taking out boxes but not cases.

It should be noted that in 1985, the VNIIDAD proposed to the Archives to design shelves for storing cartographic documents, but the proposed design, though envisaging replacement of the wooden shelves by metal ones, did not met the safety requirements and easy approach to the stored materials.

The depositories are equipped with thermometers and psychrometers, their showings being taken regularly. Unfortunately, the depositories are not equipped with air conditioners and it is rather difficult to correct the air temperature and humidity.

In general, the temperature in the depositories fluctuates from +10°C in September to 25°C in July. The average monthly temperature gradient is 3 - 4°C, that corresponds to the GOST rules.

As it was mentioned above, most cartographic materials are registered in the stocks together with the textual files. As the latter are kept mainly in boxes and the cartographic documents are kept in cases, they are located in different places. Besides, the unique files are kept in safes. For the operative searching of the particular locations, the depository maintains an auxiliary file that also has marks of an insurance copy availability for a particular document.

The unique character of the files is determined by the heads of depositories and completely depends on their competence. The unique ones are, as a rule, manuscript documents with fine arts materials that are often used, or those that have autographs of famous Russian state figures and generals. Most of the unique cartographic materials are kept in safes specially equipped for storing large-format files, i.e. enlarged in depth by 2 times. But the number of unique documents being so large, some of them are kept in the general depository. To prevent coloured imprints from damaging, the documents are interleaved with tracing-paper of mycolent paper; but the Archives have not enough of this kind of paper.

In order to prevent documents from damaging while in use, the Archives carry on work of making an insurance stock of particularly valuable documents. On the stocks of cartographic materials, such a work was carried out in the period 1981-1989. During this period, a little bit over 4 thousand storage items from four stocks were selected for insurance copying. In 1989, the work on singling out the particularly valuable documents among cartographic materials was stopped for the lack of time and the lack of qualified staff. The laboratory stopped copying on wide film in 1992. By that time, about 2 500 storage items were copied.

Earlier, the laboratory stopped insurance copying of atlases and albums. Maps came back from the laboratory crumpled, wrongly folded, and sometimes even torn. In short, the work on forming the insurance stock only partly justifies itself.

All small size cartographic materials are kept in boxes. The same concerns the maps stuck on cloth and folded. Some such maps are provided with special cases

of cardboard made even in the 19th century. These cases are very handy for storage but they tear when often used, whereas restoration of these cases is not practised. The multi-sheet maps left without cases once were put into files and thus kept unfold. However, this practice was rejected as these maps became deformed on bends. We have to roll the multi-sheet maps into kraft paper, tie them with cord, and thus keep them in boxes. Small-size maps are placed into special covers of « tetra-pack » paper. If, after restoration, it becomes impossible to put the map back into the case, the map is put into a file together with large format files and the case is kept separately from the file. These cases are lately used for packing and storing of suitable-size maps.

Cartographic documents of a large format such as atlases, albums, and non-standard files are stored in cases. First, the Archives used only one type of cases - 80 x 60 cm but then Sanct-Petersburg delivered cases of 75 x 60 cm and 70 x 55 cm. Later on, the cases were manufactured according to these three types. In the 1980ies, the Archives had already small cases for storing atlases 45 x 35 cm, and in the 1990ies, they ordered cases of 40 x 55 cm and 40 x 35 cm. At the same time, they registered the stocks of cartographic materials while changing the cardboard cases. But this work was not completed as in 1991, because of the damage of the heating system, a considerable number of cases and maps became seriously damaged.

On the whole, the quantity of cases and their sizes allow to change the larger part of large-format documents but the Archives has some non-standard files that need cases of special sizes. Such documents are kept either in two cases or in an ordinary case but with a strongly deformed flap. Such files are difficult to store together with other materials. In spite of changing the cardboard cases, in some cases, maps and atlases are kept still together, which leads to damaging maps and the case itself.

On the whole, the problem of manufacturing cases for storing cartographic documents is rather urgent for our Archives because the LMRD refuses to make cases of the necessary format. The Archives has to somehow solve this problem; and taking into consideration all difficulties, we may say that the work is being carried on rather successfully.

When giving maps for use, they are provided with envelopes (starting from the 1980ies from the kraft paper). Earlier, the envelopes were provided in the process of taking inventory, yet it took much time, so later on, they just marked in the inventory journals those maps that needed envelopes. When free, the archival

workers make envelopes for those maps. Yet a considerable part of the maps is stored in cases without envelopes.

In the process of taking inventory, the depository workers also do other work on improving the documents storage conditions:

1. When possible, the maps are smoothed,
2. Multi-sheet maps and atlases are packed into separate cases and are separate from the single-sheet maps,
3. When possible, the cases are broken into smaller units.

Registering and description of cartographic materials is done at the RGVIA - RSMHA in accordance with the « Main Rules of the State Archives Work ».

At the present moment, all cartographic materials are practically described (in « opisi ») and have more or less satisfactory titles. In those cases, when the titles and structure of the old description poorly reflect the stocks content, they remake « opisi » (descriptions). Now only the « opis » (description) of one collection is in the process of remaking, i.e. the cartographic materials « Military, Historical Maps, Plans, Albums ». Most files of this collection were stored in the town Jalutorovsk, and only recently, this collection was delivered into the Archives.

Description of cartographic documents is an important problem in the Archives. The titles of the most « opisi » (descriptions) were made in the 1950ies. The scientific training of archivists in that time left much to be desired. It especially concerned descriptions of foreign and historical maps. Wrongly translated titles, names, mistakes in determining locations of historical events - this is far from the full list of inaccuracies we met when working with the « opisi » (descriptions). When possible, the workers of the depository correct and specify the titles during taking inventory of the stocks.

The workers of the depository did large work on describing cartographic documents while taking inventory of the collection of the Military Scientific Archives. The files of this stock were described before the Revolution and entered in the « Catalogue of the General Staff Main Department Military Scientific Archives » SnP, 1905-1914. This catalogue numbered 30 880 storage items ; however, under the same number, they described files in parts and copies of maps. In the 1950ies, the files in parts were described and registered in the « Description of Multi-Volume Files » to the catalogue. During taking inventory in the 1970ies-1980ies, they divided maps by copies that were registered in the « Description of Multi-Volume Files ».

This work happened to be rather difficult. Many titles of the Catalogue became morally obsolete, descriptions of cartographic materials did not meet the modern requirements, the titles of documents in foreign languages were given without translation. Only in 1987, they started regular work on describing individual copies and parts with translation of the titles in foreign languages. The unsatisfactory state of titles in the Catalogue of the Military Scientific Archives and the « Description of Multi-Volume Files » urgently requires their remaking, yet at the present time, the Archives has neither time nor workers to do this work.

In the Scientific Reference Manual « Cartographic Documents of the State Archives », ed. by O. M. Medushevskaja, M., 1989, the author analyses the problems of describing cartographic sources, but the manual is intended for people with good scientific training. Thus, conversation of the scale of the old foreign maps into the metrical system often is impossible for the lack of the old linear measures in the reference books.

The work on describing maps often needs a large quantity of reference. Meanwhile, there are no norms for describing maps, and the norms for describing text files are too large. This is why the RGVIA - RSMHA uses some simplified scheme when describing maps :

1. Kind of the document, geographical data, and content,
2. Compiler (if available) and the year of compilation,
3. Publisher, place and year of publication (when circulated in many copies),
4. Number of sheets,
5. Method of reproduction,
6. Size of the map,
7. Scale in units accepted by the compiler,
8. Relief,
9. Language (for maps in foreign languages).

Annotation to the title is not included into the description.

In our view, such a scheme of description is sufficiently full and permits to avoid many mistakes in converting the scale to the metrical system, determining the map projection and other geographical data which, as a rule, are not shown on the map, whereas their calculation and definition takes much time and requires special training, and the Archives and depository workers usually do not have such training. The professional, in most cases, just needs the description of the map type, locality shown on the map, scale, and production year. Taking into consideration the fact that most of the cartographic materials of the RGVIA - RSMHA have already been described, the work on improving the scientific



reference tools should go in the direction of compiling an index of geographical names and settlements showing the maps archival code of these places as well as a separate index of the towns plans.

Creation of such alphabetical catalogues would permit to considerably optimise the system of searching the necessary information.

Accident events present a greater problem for archival workers. As a rule, they have to take solutions in the course of such events.

In this connection, we would like to dwell on the accident situation that happened in the RGVIA - RSMHA in October 1991.

On October 15, 1991 between 03 and 04 p.m., an accident happened in the heating system and water from the garret rushed down into the map depository.

Thanks to urgent notification and coordinated actions of the Archives workers, all documents were evacuated from the damaged room within two hours. The total volume of these documents came to 1 159 files (23 968 storage items).

All cases were placed between the shelves in the passages in the neighbour rooms. The documents from the most wet cases were taken out at once and placed on the upper ceilings.

During the next two days, the documents were sorted out into three groups :

1. Wet and humid documents from the wet cases (226 cases),
2. Documents and cases with high humidity that came into contact with the wet cases (322 cases),
3. Dry documents in dry cases (611 cases).

There were total 548 damaged cases or 47% of all cases stored in the depository. From October 16 to 22, all documents in wet cases were taken away and dried at the NITsKD in drying cabinets or naturally at the Archives depository. 711 files with total volume of 12 000 sheets were passed through the drying cabinets of the NITsKD. These were mainly multi-sheet maps and atlases. Certainly, the taken measures did not exclude a possibility of some documents being contaminated with mould. But the visual impression of many files at that time, and the work being done in time and drying of documents permit to say that those documents that were treated are now out of danger.

At the same time with drying, the staff worked on arranging the evacuated documents. All dry cases were taken to the neighbour depository and temporarily placed on shelves ; an index was compiled specially for these cases. The cases

with high humidity were taken to the available free premises and also placed on shelves. They were also provided with an index. The files were taken out from the cases and dried. This work continued till February 1992.

The files taken out of wet cases were dried and placed into new cases and arranged in the passages. By December 1991, the archival depository already had full lists of the evacuated cases location.

The next stage in liquidation of the accident consisted in establishing the working order in the depository rooms that were damage at the accident.

The ceiling, walls, and wooden shelves of the premises were covered with mould because of leakage and high air humidity.

It should be noted that mould distributed everywhere and made the premises practically unfit for storing documents. It was necessary to change the shelves equipment and to repair the rooms. Unfortunately, at this moment, the Archives had not enough means available for carrying out such complex works and for purchasing equipment. So, the Archives management, with the approval of the Preservation Securing Department and the VNIIDAD specialist, took the following decision :

1. To carry out forced drying of the premises, using for this purpose Jupiter lamps and fans with the total output 300 m<sup>3</sup> of air per hour,
- 2 To carry out manual disinfection of shelves and walls of the archival depository.

Drying of the premises started only on October 30 as, only by that time, the Archives received the necessary equipment. The work lasted from October 1991 to March 1992.

The drying resulted in ceasing the mould spreading on the depository walls and shelves.

In March 1992, the administrative service of the Archives started disinfection of the premises and carried out the following work :

1. Remove moulder from the depository walls and ceiling, the infected places being treated with a formalin solution,
2. Treat the depository shelves and ceilings with a formalin solution. It should be noted that this treatment was done repeatedly. It resulted in removing mould from the shelves. Later on, growth of the mould was not noticed.

The inspection made in April showed that mould on the shelves ceased to grow, the shelves became dry, growth of mould on the walls was not noticed.

All evacuated documents were taken back to the depository in May - June 1992. After that, they started taking inventory of the documents of the damaged stocks. At the same time, they changed the cardboard cases of the documents. This work is being continued till now.

The permanent control of the sanitary condition of the premise permits to say positively that, at the present time, there is no danger of the cases and documents contamination with moulder from the shelves.

Thus, all work on liquidation of the accident consequences may be conditionally divided into several stages :

1. Evacuation of the documents from the accident area,
2. Sorting out documents by the level of damage,
3. Urgent prophylactic work with the mostly damaged documents,
4. Determination of the degree of the premises damage,
5. Prophylactic work in the damaged premises and with the files partly damaged at the accident,
6. Compilation of a topographical index of the evacuated documents,
7. Repair of the premises,
8. Turning back the documents to their storage places with a subsequent taking of inventory.

The aim of all these measures consisted in the fastest possible liquidation of the accident and its consequences, in the minimum time and with the minimum losses for the Archives function.

### **Conclusion**

Summing up all above said, it is possible to draw the following conclusions concerning securing preservation of cartographic materials at the RGVIA - RSMHA.

1. On the whole and in general, the storage conditions and the available equipment meet the requirements to the documents on paper carriers and permit to perform operative charging of the files and their use. However the problems of the technological provision (shelves, cases, etc.) are rather urgent and need immediate solution.

2. The scientific reference tools available at the Archives, though not optimal, still permit to carry on accurate registering and to perform operative search of the cartographic materials. Further improvement of the STR seems to lie in creating auxiliary reference tools on the cartographic materials.
3. The scientific methodological working out of the questions connected with description and optimisation of the cartographic documents storage should be done on the basis of the real state of affairs at the Archives.
4. It is necessary to create normative methodological literature that would regulate the archivists' actions at the emergency situations.

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**ANALYSIS AND WAYS OF IMPROVING PRESERVATION  
CONDITIONS IN THE COLLECTION OF 16TH - 17TH  
CENTURY FOREIGN ATLASES IN THE NATIONAL  
LIBRARY OF RUSSIA**

**By S. A. Dobrusina and L. K. Kildushevskaja**

**Abstract:** The collection of foreign 16-17th-century atlases in the National Library of Russia is unique, both in its size and the range of authors, as well as in the number of new editions. It gathers over 450 volumes of masterpieces of world cartography. The superior historical and artistic value of this collection makes the problem of its preservation a matter of extreme current importance. The paper contains the results of analytical examinations of the stock. The main types of damages and binding characteristics have been revealed and classified. The conclusion states that the paper destruction in the course of its natural deterioration (storage) is caused likewise by external environmental factors and the ink applied to the paper. The paper presents statistical information describing the degree of safety in various items of the collection. It also describes a programme for their conservation.

The collection of printed books and atlases held in the National Library of Russia is among the country's richest ones, numbering over 170 000 bibliographic units. Of world-wide importance, both in size and richness, is the collection of West European engraved atlases of the 16th-17th centuries, containing over 450 volumes.

The 16th-17th centuries period was the time of cartographic rise and flourishing, triggered by the great geographic discoveries providing material for new maps and opening extraordinary vistas for the geographic outlook of mankind. Map-making was also largely affected by the major event in the 15th century culture, the invention of the printing press, followed by the practice of map engraving and printing. To meet the demands of commerce and navigation, atlases were published, systematic sets of maps and multi-purpose repositories of accumulated knowledge.

The earliest dated edition in the Division of Maps of the National Library of Russia (NLR) is a set of maps made by Ptolemy to supplement his « Geography »

published in 1508. On the whole, the work reflects pre-Columbian ideas in geography, but it also contains one of the first maps showing the recently discovered America - the « Universal Map of the Known World according to Recent Discoveries » by I. Ruysch (Rome, 1508). An end to the mixture of old and new geography, characteristic for the 15th century science, was put by the works of Abraham Ortelius. The NRL's collection contains 30 different editions of his atlases - the world's first printed atlas in the strict sense of the word. There are also 25 editions of one of the founders of science-based cartography, Gerhard Mercator, including the rare preliminary life-edition of 1585, published 10 years before the better known basic volume.

The Library also holds the country's only world atlas by Cornelius de Yode, 1593, of which the publication was never repeated ; one of the first printed marine atlases by Lucas Wagenar, whose importance in navigation cartography can only be compared to that of Ortelius in general geography ; several editions of the atlas of world city plans by G. Braun and F. Hogenberg ; many volumes of works by the predecessors and followers of Ortelius and Mercator - the atlases by Blaeu, Hondius, Janssonius and some others. The collection also contains assembled atlases, with maps made by some of the best engravers of the time.

16th-17th century maps were generally copper-plated, often hand-illuminated. Traditionally, there were rich ornamentation in the prevailing artistic styles, which made them similar to works of art, and their makers, to genuine artists. Thus, for example, A. Ortelius was a member of the famous guild of Saint-Lucas, an association of painters and engravers.

The superior artistic, historic and scientific value of the collection makes the problem of its preservation a matter of extreme accurate importance. To cope with the problem, analysis was performed in the condition of 343 volumes of foreign 16th-17th century atlases, both black-and-white and illuminated.

In the course of our examinations, we found destructions either typical for many paper-supported data, or characteristic for only the atlas collection. The most significant among the latter was paper disintegration due to effects of green dyes.

The generally recognised phenomenon of green dye lies in the fact that paper exhibits a strong brown colouring on its reverse side where there is green dye on the right side. Frequently, the dye itself turns brown, with the underlying paper getting unusually brittle, which results in fragmentary paper deterioration. Moreover, where the dye retains its colour, dark brown contours appear on the reverse side, corresponding to the green dye segments.

The most frequently used in Europe green dye, mainly in the Netherlands, Germany and Italy from the 12th to the 17th centuries, was basic or neutral copper acetate, the verdigris.

In Russia, the dye is called « iar'-medianka ». Its main advantage is the clear green colour. Often copper acetate has been used with lead or tin additives, to give other tints to the colour. Examinations made in Germany in the green dye of illuminated manuscripts also indicated basic copper nitrate - gerhardt, basic copper carbonate - malachite, a copper acetate - neutral gruenspan. Of all green dyes, however, copper acetate is considered to be the most reactive and the least stable.

There have been various hypotheses to explain the chemical nature of the dye's turning brown and paper's deterioration due to effects of green dye. The most reasonable opinion seems that cellulose degradation cannot be explained by a reaction according to an acetic mechanism only, nor can be regarded as an exclusively oxidation process. The presence of copper causes cellulose degradation both in acidic and alkaline media.

In the 16th-17th centuries, before the invention of paper-making machines, paper was cast by hand, with cotton, flax or rags, depending on manufacturing country, used as initial cellulose material. The random microstructural analysis of paper fibre in various samples, made in the Conservation Unit, indicated cotton cellulose in atlas paper.

The high quality of the raw material will ensure the strength and long life of the paper manufactured. Analysis of binding agents with fine-layer chromatography indicated the presence of glucose and aminoacides, thus permitting the conclusion of the presence of honey and gelatine, widely applied by artists. Paper pH determination with contact method showed the index in the interval of 5.5 - 5.7 on edges and in the areas free of green dye or printed text, and between lines.

This holds true for paper in good condition. In sections covered with green dye paper, pH value is lower, equalling 4.0 - 4.8, which confirms the idea of paper deterioration due to the presence of acids, at least at the initial stage of destruction. As regards to atlas paper in general, one may describe it as uniform in composition, devoid of mineral filling, with animal glue used as a binding agent.

While examining paper as an information carrier, all the indicated destruction were categorised, with the degree of destruction evaluated in each individual volume in terms of destruction forms (Table 1). The index « degree of

destruction » was used conditionally, to evaluate contribution of each individual destruction form to the overall process of paper deterioration in the atlases. The preservation degree in each atlas was defined as the difference between 100% preservation standards and the overall degree of destruction. Examination data illustrated by 3 atlases are shown in Tables 2 and 3.

Table 1		
Description of the collection of foreign atlases in terms of paper destruction forms		
Forms of paper destruction	Degrees of destruction	Number of volumes
Mechanical :		
Ruptures :		
on paper edges	10 - 15	53
in centre	15 - 20	69
deformation	5	1
losses	90 - 100	9
Deterioration :		
due to effects of green dye	95 - 100	6
due to effects of black ink	20 - 30	4
due to effects of printing dyes	10 - 20	
Physico-chemical :		
Contamination :		
overall	10 - 15	154
soiling (grease spots)	5	11
traces of glue	20 - 30	6
finger marks	5 - 10	144
foxings	10	53
Changes in colour :		
turned brown on edges	15 - 20	21
turned brown on one side only	20 - 30	3
overall brown	50	142
pigmentation	20 - 25	21
Biological damages	50 - 100	52







The main form of damage evident in all paper-supported data is the destruction related to natural material ageing. This is primarily manifested in changes in the paper colour, the paper turning brown, generally starting from edges, due to the absorption of air acidic components by exposed paper surfaces. The extension of brown spots over the page, evidently, occurs faster, since accumulation of the acidic products of cellulose deterioration catalyses further degradation.

This has a significant numerical support : in 9 volumes the paper deteriorates, 21 volumes exhibit edges turned brown, and 142 volumes overall turning brown. Changes in paper colour are often of a local nature, sometimes evident in irregular pigmentation, which is most likely related to the process of paper manufacture.

Trivial damages, resulting from frequent and careless use of the document, or inadequate storage condition are :

- ruptures in the centre or on edges (69 and 54 volumes respectively)
- general soiling (154 volumes).
- Frequent are the cases of foxing (53 volumes).

Regretfully, it must be maintained that periodic violation of storage regime are the causes of generating foci of biological damages. Generally, micromycetes appear on edges, where paper structure is often broken and the paper becomes loose. In 16 cases, micromycete growth in paper resulted in complete deterioration.

The relationship of deterioration processes to the appearance and condition of colour layer can be traced fairly well (Table 1). And, of the 342 volumes examined, only 6 exhibited paper in green-coloured sections as brown, brittle, cracking, ruptured or sometimes lost, and 3 more showed cracks and ruptures, in due time more illuminated atlases will certainly be destroyed, the green being the potential agent in the process.

In 86 cases, there was evidence of green dye turning brown and migrating to the reverse side, distinctly reproducing configuration of the dyed section, and also migrating to the right side of the next page (Table 4).

The picture of paper deterioration can be supplemented with losses on map margins where there are texts written in ferro-gallic ink. In three cases out of four, sections of lines have slipped out.

There have been also parallel ageing processes going on in the other data supporting medium, the printing dyes and, subsequently, in the text. First a red, and then a brownish stain appeared around the letters, the text became diffused, transferred to the reverse side and neighbouring pages, the paper colour changed.

In early printed books and newspapers drying oils were used as binding agents. Perforation of a page with printing dyes occurred during printing dye being applied to the page. In time, there have been only slight dye migration and changes with ageing - when a yellow or brown halo appeared along letter outlines. It is well known from the literature that early printers added to printing dyes copper or lead oxides to darken the black and quicken drying (1,6). Probably, the presence of copper oxides « contributed » to the process of dye (text) ageing. In 67 atlases, there is strong evidence of black printing dye migrating to the vacant area between the lines, which a brownish halo developing around the letters.

Analytical findings have permitted to distinguish between three conditional categories in the degree of preservation.

Table 4	
Defects caused by changes in text (pictures) with natural ageing	
Appearance and condition of data supporting material	Number of volumes
<u>Green water-colour</u>	
Migration to the reverse side	86
Migration to the neighbouring pages	8
Changes in colour	23
<u>Red water-colour</u>	
Migration to the reverse side	3
Migration to the neighbouring pages	2
<u>Black printing dye</u>	
Migration to the reverse side	9
Migration to the neighbouring pages	4
Migration between lines (halo around letters)	67
Changes in colour	12
<u>Ferro-gallic ink</u>	
Colour changes	3

1. Preservation degree 70 - 100% : the paper has changed colour due to natural ageing and effects of green dye, but retains its strength.
2. Preservation degree 50 - 70 %: the paper is brown and brittle.
3. Preservation degree under 50%: loss of paper, the remaining paper is brittle, crumbling when touched.

About 80% of the atlas collection can be referred to the first preservation degree, requiring stabilisation treatment to retard further deterioration. The remaining 20% belong to the second and third categories. They require repairment in combination with strengthening and stabilising operation.

In 1980-1981, the Conservation Unit of the National Library of Russia started investigations aiming to design a technology for the restoration and stabilisation of 16th-17th century atlases, deteriorating due to effects of green dye. Today, the technology has been designed and is being continuously applied and improved (2,9). It has been a success in repairing atlases and illuminated manuscripts in the National Library of Russia and in restoration units elsewhere. We have had ample opportunities to examine the restored material in depositories. The findings have been very convincing : the atlases repaired in 1983-1986 can now be referred to the first preservation degree. There have been no evident changes in the conditions of paper, colour layer or binding.

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## **PROBLEMS OF STORAGE AND PRESERVATION OF CARTOGRAPHIC COLLECTIONS IN THE RUSSIAN STATE LIBRARY**

**By Natalja. E. Kotelnikova and I. P. Degtyareva**

### **Abstract:**

1. The map Department is one of the young structural sections of the Russian State Library. It was organised in 1990, by which time the system of Library Departments had already been formed. The reading room and storage room, given to the Department, were unsuitable for the handling of the cartographic items and for working with them.

2. The problem of the organisation of the cartographic stocks were not comprehended theoretically, namely the form of the publication (sheets, reels, books and so on), its size, the peculiarities of its external design and so on, were not registered, the practice of the management of the cartographic stocks in foreign libraries was not got through. As the horizontal storage of the maps and atlases was assumed as the basis of the shelving, errors in organising the stock sprang up. While putting the maps into binders (in two sizes), the publishing form got broken as their cases were destroyed. While ciphering the atlases, their size in the horizontal position was left out of account and plenty of room went for naught in cabinets and it eventuated in inconvenience in handling the stock while serving the readers.

3. The management of new editions has found itself in an impasse as the storage is overfilled now and there is no space for further housing the stock.

4 The temperature and moisture conditions and the presence of metallic dust originated by the conveyer situated in the storage room have a harmful effect on the preservation of publications. The conditions of the sanitary air cleaning; of the stock have been violated.

5. Any way out of this situation is possible for the preservation of the unique cartographic stock solely on condition that new premises are given to the Department, which will be fitted out with special equipment corresponding to the demands of the scientific organisation of the cartographic stock.

The Department of Cartographic Publications of the Russian State Library possesses one of the largest cartographic collections in the country. Today, the

collection numbers 245 788 units, including 221 000 maps, which are kept on 138 double shelves, and 23 771 atlases, which take up 64 double shelves. The domestic cartographic collection makes up more than half of the total volume of the Library's stock.

The history of the establishment of a separate collection and of the separate Department of Cartographic Publications is a long and difficult one. The Department of Cartographic Publications originated in the Rumyantsev Museum since N. P. Rumyantsev's collection boasted of about 500 units.

From the reports of the Moscow Public Museum, it follows that, from the day of its establishment, the Museum constantly acquired maps and schemes, and they also came in as deposit copies. A substantial source of increasing the cartographic collection were the donations of Russian geographers, travellers, scientists and cultural workers.

A substantial contribution into the building-up of the Library's collection of maps and atlases in the first decades of its existence were the duplicates received from the Imperial Public Library. (The latter began to receive deposit copies in 1810). The formation of the cartographic stock as of a separate collection progressed in stages.

In the first years of the Library's existence, cartographic materials were either included into the thematic collections of the Museum, or else they were placed among books and graphic publications. The principle of their distribution among the different collections of the Library was based on their outward appearance and the format of the publication. For many years, the maps and atlases laid in disorder, and it was only in the 20s of the 20th century that their systemisation was begun, and then these materials began to flow into the operating collection. The construction of a new depository prior to the Great Patriotic War (1941-1945) made it possible to establish collections based upon the type of publications. The problem of the creation of a specialised Department was solved in the end of the 1950s.

In 1960, the Department of Cartographic Publications became an organisationally separate and specialised subdivision of the National Library.

However, by that time, there was no longer space enough in the new depository, which would have allowed the arrangement on its shelves of the large-format cartographic collection. The Department was allotted approximately 400 square metres of space, which was disposed on four tiers, which immediately created difficulties in the arrangement of the collection.

The problem of organisation of the cartographic collection had not been theoretically developed in advance. In other words, the form of the publications (leaf materials, rolls, books, etc.), their format and specific features of their superficial lay-out had not been taken into account and the practice of organisation of cartographic collections in foreign libraries had not been investigated. Because the horizontal storage of maps and atlases was accepted as the basic principle of arrangement, many mistakes were made in the organisation of the collections. The maps were packed into folders and cases of the formats, and, in this way, their initial form was distorted since the cases in which they were kept had been thrown away. In those instances, when atlases were coded, regardless of their format in the horizontal position, much place in the book-cases was wasted. Such an arrangement of materials also created many inconveniences for the librarians, when they took out the books the users asked for.

The depository was equipped with double shelves, which were intended for the holding of books and which were unsuitable for maps and atlases. The collection is internally divided into domestic and foreign publications and they are given different codes. The domestic publications receive the code «Ko», and the foreign ones «K». This code is followed by the number of the book-case and shelf, and, finally, by the number of the publication.

The publications that are rarely demanded were arranged on the lower tier whereas those, which were in high demand, were kept on the middle tiers. As the depository was already equipped with stationary book-shelves, there was no place where sectional book-shelves could be put up, and so it was decided to pack the maps into cardboard folders.

In the first years of the creation of the collection, the organisation of the materials was the major problem the Department aimed to solve. The collection was not large and it could be easily packed into folders of which one or two were kept on one shelf.

However, in the 30 years of the Department's existence, the collection increased two times, and now, we do not have the necessary space for its ordered arrangement. Each book-case now holds from 12 to 14 shelves (instead of the initial 10 shelves), and each shelf hold 3 or 4 folders, which are tightly packed with the sheets of maps.

The problem of arrangement of annual new acquisitions, which number from 1 000 to 1 500 units, is into the foreground. It has become difficult to handle the overloaded folders from the shelves, and under the pressure of the big weight, the leaves in the folders become crushed and deformed. The organisation of storage of



atlases is also inadequate. In one book-case, both huge (100 x 50 cm) and miniature (10 x 5 cm) atlases are stored. Large-format atlases, instead of standing vertically, lie in heaps on the shelves, and being very heavy, they press on the publications that lie beneath them, thus spoiling their bindings, jackets and backs.

We lack adequate library furniture for the storing of cartographic materials held in rolls and tubes. The depository is not equipped with ventilation facilities and this aggravates the physical preservation of the collection. The temperature and humidity regime and the enhanced content of metal dust in the air, which comes from the conveyor, installed in the depository, has a pernicious effect on the preservation of publications. The absence of sockets in the depository makes it difficult to clean the holdings with a vacuum sweeper. The technical equipment of the Department and its further development had not been initially thought out.

The only way out of the existing situation would be the reconstruction of the depository and the construction of the a new building, or the allocation of new accommodation. The staff of the Department has worked out on the conception of the technical re-equipment of the Department including the map depository. This concept has found reflection in the scientific report « Prospects of activity of the Department of Cartographic Publications after the reconstruction ».

The technical re-equipment of the Department should, first of all, be directed toward the creation of comfortable working conditions for staff and good conditions for the domestic of the collection.

This measure should also favour the quick delivery of materials to the users. In order to achieve this goal, the following measures should be taken :

- 1) to efficiently arrange the collection of cartographic materials on one plan according to the diversity of forms and formats, and the specific features of the materials of which these publications are made, call for the installation of a special transport system for the delivery of these publications to the reading hall,
- 2) to allocate separate places for the storing of atlases, leaf materials, cartographic materials on microforms and on unconventional media. Special conditions of storing (regulation of humidity, temperature and light) for each separate file should be worked out,
- 3) an isolated depository for materials of limited use should be allocated,
- 4) for each file of this kind, the following special equipment should be envisaged :

- universal shelves for atlases, would be suitable for the arrangement of large-format materials,
  - large shelves on rollers for the storing of heavy and large-format atlases,
  - sectional book-cases for the storing of leaf materials,
  - special equipment for the storing of maps, packed in rolls and tubes,
  - special map-folders for the keeping of large-format sheets in a suspended position (for rare materials),
  - special computerised card catalogues,
  - special book-cases for the storing of microfilm, microfiches and other unconventional media,
- 5) apart from all this, the depository should have a number of special tables for work with cartographic materials and for the preparation of these materials for restoration and repair of bindings,
- 6) it is also necessary to envisage a special room, which would be situated next to the reading-hall, in which publications would be prepared for issue to users and reservation.

Proceeding from the foregoing statements, we consider it as necessary for the staff of the group for acquisition and organisation of collections to include the following specialists ; one selection officer with a cartographic education, senior librarian ; one senior librarian, responsible for the work with the collection ; one chief editor and three librarians (for the selection of materials and the issue of the materials to users, and for current work, involved with the acquisitions and organisation of the collection).

The staff should be allocated a room, situated near the depository and the external transport system, which would deliver materials to the Department. A group for the processing of materials should be established within the Department. The room (or hall) should be provided with the following facilities :

- 1) a computerised working place for the selection specialist,
- 2) a computerised working place for the librarian, who is responsible for the collection (this worker should have a channel of communication with the electronic catalogue for maintaining the special card catalogues, for computerised coding, the marking of publications and their retrieval in order to register the publications and control the collection, in general etc.),
- 3) a working place for the rest of the member of the group.

- 4) a special table for the arrangement of cartographic materials, which are being processed.

The problem of restoration of cartographic materials is also an urgent one. The establishment of the Research centre for restoration and conservation, attached to the Department of Cartographic Publications, made it possible to extend the range of activities involved with the restoration, not only of book monuments, but also of specialised collections, including the collection of maps and atlases, too.

The restoration of cartographic materials calls for the exploitation of different methods and ways of restoration of publications, and that is why the individual approach to these materials is practised here since this approach helps to preserve the paper, inks, the form of the publications and their bindings.

In order to solve the problems of restoration of the unique cartographic collection, it is necessary to conduct jointly with the Research centre for restoration and conservation, an analysis of the state of preservation of publications and develop a programme of conservation of these materials.

Thanks to the support of the Research centre, the Department has been able to train a specialist in the field of restoration of cartographic materials. The lack of space and the necessary materials does not allow the Department to restore publications on the spot, and we have to send the documents to the Research centre and work on the materials there, and this, of course, makes this procedure more complicated.

In the final part of the report, we must note that the cartographic collection of the Library calls for special attention from the standpoint of its preservation for, with years, the importance of cartographic materials grows since they represent a reflection of natural and social reality.

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## **CARTOGRAPHICAL DOCUMENTS OF RUSSIAN STATE ARCHIVES OF MEDIEVAL MANUSCRIPTS**

**By I. A. Balakaeva**

**Abstract:** « Cartographic documents of Russian State Archives of Ancient Acts (RGADA) »

About 700 thousand cartographic documents of the 17th - 19th centuries of different kinds are conserved in RGADA. Among them, are Russian drawings of the 17th century. They are the most ancient cartographic representations of land properties in Russia (such documents are preserved in the funds of central institutions of 17th century such as the records of Boundary Archives, that became part of RGADA, the cartographic collections of Moscow State Archives of Ministry of Foreign Affairs, of Moscow Archives of Ministry of Justice, of the Senate, and the boards of local institutions and monasteries.

Taking into consideration the increasing demand for study of the cartographic documents, we have created in RGADA new finding aids and improved the existing ones. We have also made available the important finding aids created before the Revolution.

In 1984, we elaborated in our Archives together with collaborators of the All-Union Research Institute on Records Management and Archives methodical recommendations « Specific character of description of cartographic documents of 17th - 19th centuries ».

We constantly realise actions to improve the conditions of conservation of cartographic documents in order to assure the preservation of the archival records in RGADA ; the methods of conservation are examined in the report. The experience of our Archives in registration of the cartographic materials will be interesting to the participants of the seminar linked with the problems of conservation of the documents, their registration and description in State archival repositories and libraries.

RGADA has custody of about 700 000 cartographic documents (drafts, plans, maps, atlases) which date from 16th to the beginning of 20th centuries. We can see among them Russian drafts of 17th century (it is the earliest preserved cartographic pictures of localities of Russia), documents of « Mezhevoj arkhiv » (land-surveying archives), cartographic collections of « Moskovskij Glavnyj

arkhiv Ministerstva inostrannyh del » (Moscow chief Archives of Ministry of Foreign affairs) and « Moskovskij arkhiv Ministerstva justicii » (Moscow Archives of Ministry of Justice), of Governmental Seat and Boards, local and ecclesiastical institutions.

The drafts of the 17th century are the only relics, which reflect the methods and ways used by home cartography in the earlier periods of its evolution. The most part of them are included in collection of RGADA. It was revealed and took the account in Archives about thousand of drafts (among them 456 from fund of « Pomestny prikaz, » « Votchinnaya kontora i Votchiny department » (Office of estates, Board of patrimonies and Department patrimonies), 379 from fund « Prikaz Tainyh del » (Office of private affairs), 59 from fund « Razriadny prikaz », 57 from cartographic collections of MGAMID and MAM'Ju). The work of exposure of drafts in Archives still continues.

The drafts of the 17th century can be divided by territorial indication and by object of cartography into four groups : drafts of settlements, courtyards, land-ownership's and localities. The drafts of settlements represent drawings of cities, villages or fragments of them (streets).

The number of these preserved documents is not considerable, but we dispose of numerous references of widely spread practice of drawing maps of cities in this period. The drafts were sent as usual to « vojevods », together with accounts of cities, estimate and engineering books (« stroyelniye knigy »). The drafts of settlements include also the drawings of tsar villages, the most part of them concentrates in Prikaz Taynih del. We can find there the drawings of various streets in Moscow, the drafts of courtyards with detailed demonstration of inner buildings.

The drafts of land-surveying subject compose the most numerous group among cartographic documents of the 17th century. We can see among them the documents, which were composed after land-ownership disputes, the drafts of courtyards, free lands (« pustoporozniye ») and also drafts as supplements to petitions of confirmation of the right of land-ownership. The drafts of estates also concern the drafts which are for away from land lawsuit. Surveying drafts of localities were used as a matter of fact for the movement of armies or commercial caravans.

The cartographic documents of the 17th century are still insufficiently investigated up to date. It is necessary the detailed acquaintance with these drafts, and also with marks on them and with structure of accompanying record-keeping documentation. The absence of modern apparatus critics in Archives is the serious

obstacle in the matter of this problem. « Arkhiv Mezhevoj Kantselarii », joined in the ranks of RGADA, has been one of the largest archives of the pre-Revolution period. It was « ...the most complete collection of original plans and land-surveying books, most precious for land-owners and government, with information about all grants and lots without exception, and also many others land-surveying materials, which represented the picture of land-ownership on all the territory of Empire ».(\*)

After the Revolution, Arkhiv Mezhevoj Kantselarii was preserved as independent institution rights up to 1939. At present, the documents of Arkhiv Mezhevoj Kantselarii, being component part of RGADA, are involved broadly in scientific work and are used by specialists of various types.

Mezhevoj arkhiv includes the documents of general and special land-surveying in Russian provinces (« gubernii »), collections « Plans of allotments of general and special land-surveying » (1792-1917) (more than half a million documents), « Provincial, district and cities maps, plans and atlases of general land-surveying » (more than 7 000 documents from 1766 to 1891). Mezhevoj arkhiv was increased also by documents of Elizabethan and Ingermanlandition land-surveying. Mezhevoj arkhiv is also equipped with a card-index (containing about 2 millions cards) with references to written and cartographic documents of funds.

Various cartographic documents are concentrated in collections of Archives and first of all in « Cartographic department of MGAMID library » (more than 10 thousands documents for the period from the 16th to the 20th centuries). We can find among them atlases (astronomical, terrestrial, naval, of Russia and foreign states), maps of four parts of the World, general maps of Russia, provincial maps, maps of foreign states, naval maps and maps of the theatres of war.

The drafts of the 17th century plans of cities and allotments have custody in fund « Maps, plans and drafts of MAM'Ju ». Inventories of these collections have need in perfection, because of their little degree of information in present time. We can find in several sections of Senate, Berg-kollegia, Kamer-kollegia funds maps, enclosed to documents, with pictures of Russian state frontiers, okrugs, river basins, newly discovered islands, woods, cities with their suburbs, fortresses, factories, mines, courtyards, different apartments.

A sizeable number of RGADA's maps and plans are included in documents (private funds, a number of State Archives of Russian Empire funds (« Gosudarstvennyy arkhiv Rossiyskoy Imperii »), « Moscovskaya politsmeysterskaya kantselarija », « Dvortsoviy arkhiv » (Palace archives). A part of them is not even mentioned in inventories. Much work has been done by

Archive research fellows in direction of exposure of cartographic documents, enclosed to records.

Taking into account increasing need of scientists in research of cartographic documents, much work has been done in RGADA in direction of creation and improvement of apparatus critics. It was brought into light reference books of pre-Revolution period. In 1984, it was elaborated in RGADA, in collaboration with VNIIDAD scientific fellows, a guide of recommendations « Specific character of scientific inventory of cartographic documents of 17-19 centuries ». Archives took part in elaboration of them with "Reference book of cartographic terms ». It was inventoried on the basis of new methods for cartographic documents of the 17th century: fund « Pomestniy prikaz, Votchinnaya kontora, Votchinniy department ». The work will be continued in other complexes, so as we suppose the creation of a common catalogue of drafts of the 17th century, which have custody in RGADA.

On the basis of scientific research of RGADA cartographic documents, we can retrace the forming and development of Russian maps in connection with the evolution of theory and technics of cartography. The diversity of information, which is contained in cartographic documents, allows us to attribute these records to the national treasure of our country. The research fellows of RGADA try their best for preserving this treasure and for giving opportunity for scholars to work with it.

(\*) - pr. N. A. Mescherskiy., Arkhiv Mezhevoj Kantseliarii // Zhurnal Ministerstva Justitsii, 1896, N 7, P. 215.

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## **DIE KARTENSAMMLUNG DER DEUTSCHEN BÜCHEREI**

**By Henrik Otto**

Die Kartensammlung der Deutschen Bücherei unterscheidet sich hinsichtlich ihres Bestandes von Sammlungen anderer vergleichbarer Bibliotheken. Haben diese umfangreiche ältere Kartenbestände, auch in den verschiedenen Beschriftungssprachen, so beschränkt sich die Sammeltätigkeit der Deutschen Bücherei auf Karten und Atlanten mit deutscher Beschriftung, soweit sie ab Januar 1913 erschienen sind. Von großen Kartenlieferungswerken, z. B. der Landesaufnahmen und der geologischen Landesanstalten, wurden aber auch die vor 1913 erschienenen Lieferungen beschafft. Die Bedeutung der Sammlung liegt damit in dem nahezu vollständigen Bestand neuen und neuesten deutschsprachigen kartographischen Materials.

Ende 1989 umfaßte die Kartensammlung rund :

- 76 000 Kartenblätter
- 28 000 gefaltete Karten
- 3 825 Wandkarten
- 3 460 Atlanten.

Der Bestand an Wandkarten ist der größte einer deutschen Bibliothek. Globen gehören nicht zum Sammelgebiet.

Die Räume der Kartensammlung befinden sich seit 1963 im 1. Obergeschoß des Nordwestflügels des Bibliotheksgebäudes. Der Kartenlesesaal nimmt eine Fläche von 76 m<sup>2</sup> ein und ist mit 6 großen Kartentischen sowie mit einem Leuchttisch ausgestattet. In diesem Raum sind die Kartenkataloge, eine Handbibliothek mit kartographischer Fachliteratur, Spezialbibliographien und Atlanten untergebracht. Ferner sind hier der Dokumentationsdienst Geographie des ehemaligen Deutschen Instituts für Länderkunde in Leipzig und der frühere Dokumentationsdienst Kartographie aufgestellt.

An den Leseraum schließt sich, durch eine Glaswand getrennt, das 320 m<sup>2</sup> große Kartenmagazin an. Dessen Grundausrüstung mit Wandkarten- und Rolljalousieschränken zur Aufbewahrung der Kartenblätter stammt aus den Jahren 1915—1916. Diese aus Holz gefertigten Spezialmöbel erwiesen sich als so zweckmäßig, daß sie lange Zeit in der gleichen Art nachgebaut wurden. Für die



Aufbewahrung der aufgezogenen und gerollten Wandkarten wurden besondere Kartenschränke von 4 m Höhe mit ausschwenkbarem Rahmen konstruiert. Jeder der gegenwärtig 52 Wandkartenschränke enthält 8 Reihen, die mit etwa 70 Karten besetzt werden können. So ist es möglich, den Wandkartenbestand auf engem Raum staub- und sonnengeschützt unterzubringen. Bei den Rolljalousieschränken haben sich die festgelegten Abmessungen des Innenraumes der ausziehbaren Schubfächer — 100 cm Breite, 91 cm Tiefe, 6 cm Höhe — bewährt. Die Höhe der Schränke von 110 cm ermöglicht es, sie gleichzeitig als Tische zum Ausbreiten von Karten zu verwenden.

Der Bestand an Karten hat sich so stark vermehrt, daß bereits vor einigen Jahren ein zusätzlicher Magazinraum außerhalb der Sammlungsräume in Anspruch genommen werden mußte. Die Aufstellung der Karten erfolgt nach den auf numerus currens basierenden Signaturen, das bietet raumökonomisch große Vorteile. Karten in gefalteter Form und Atlanten wurden bis Ende 1959 signurmäßig wie Bücher behandelt und im allgemeinen Magazin aufgestellt. Ab Januar 1960 wurden dafür besondere Kartensignaturen vergeben und die Objekte im Kartenmagazin aufgestellt. Die Signaturenvergabe gestaltet sich folgendermaßen:

Kartenblätter: Signaturkennzeichen T mit vorgesetztem Eingangsjahr und nachfolgender laufender Nummer, z. B. 1980 T 15,

Gefaltete Karten und Atlanten ab Eingangsjahr 1960 : Signaturkennzeichen K mit nachfolgendem Eingangsjahr, Formatangabe und laufender Nummer, z. B. K 1980 A 17;

Wandkarten, kleines Format bis 125 cm Breite : Signaturkennzeichen V mit laufender Nummer, z. B. V 315,

Wandkarten, großes Format: Signaturkennzeichen W mit laufender Nummer, z. B. W 2115.

Die Erschließung der in der Deutschen Bucherei eingehenden kartographischen Veröffentlichungen erfolgt durch Bekanntgabe der Titel in gedruckten Bibliographien und durch die Kataloge der Deutschen Bucherei.

Wie alle in der Deutschen Bucherei eingehenden Neuerscheinungen werden die Titel der kartographischen Veröffentlichungen - auch die des Auslandes mit deutscher Beschriftung - in die von der Deutschen Bucherei bearbeiteten Allgemeinbibliographien aufgenommen. Alle Neuzugänge werden in der « Deutschen Nationalbibliographie » verzeichnet.

In der Deutschen Bücherei sind die vorhandenen Karten und Atlanten in folgenden Katalogen verzeichnet:

Im Alphabetischen Hauptkatalog, im Verleger- und Institutionenkatalog, im systematischen Kartenkatalog und im alphabetischen Katalog der Kartensammlung.

Für die Benutzung der Kartensammlung ist in erster Linie der systematische, in der Kartensammlung aufgestellte Kartenkatalog wichtig. Auf einen gesonderten alphabetischen Katalog hatte man zunächst in der Kartensammlung verzichtet. Ab Erscheinungsjahr 1965 ist jedoch ein solcher aufgebaut worden, der noch retrospektiv ergänzt wird.

Der systematische Katalog besteht aus drei in der Ordnung übereinstimmenden Teilen, einem Katalog, der die von 1913 bis zum 8. Mai 1945 erschienenen Titel enthält, einem zweiten Teil, in dem die bis 1973 erschienenen Karten und Atlanten erfaßt sind und - nach Einführung der «Regeln für die Alphabetische Katalogisierung» - einen dritten Teil für Erscheinungen ab 1974. In der Gliederung des Kataloges wird zunächst unterschieden zwischen Landkarten, Seekarten und Atlanten. Die Landkarten sind nach dem regionalen Prinzip gegliedert, also in Erdglobenkarten, Karten mehrerer Erdteile, einzelner Erdteile, einzelner Länder usw. Innerhalb dieser Gruppen wird folgendermaßen sachlich geordnet :

1. Allgemeine geographische Karten (z. B. die Blätter der amtlichen Landesaufnahmen),
2. Physiogeographische Karten (z. B. Physikalische Schulwandkarten, orographische, hydrographische, geologische, erdmagnetische, meteorologische, klimatologische Karten, Bodenkarten und Wetterkarten),
3. Biogeographische Karten. Sie veranschaulichen die Verbreitung von Gruppen der Fauna und Flora auf der Erdoberfläche,
4. Verkehrs-, wirtschafts-, bevölkerungsgeographische Karten und alle Karten, die die Beziehungen des Menschen zur Erdoberfläche wiedergeben.
5. Politische Karten. Unterabteilungen hierzu sind die historischen (Geschichts-) Karten und die Verwaltungskarten.

Die Seekarten sind regional nach Ozeanen, Randmeeren und Küstengebieten erschlossen. Bei den Atlanten wird in der Gliederung zwischen allgemeinen Atlanten, Regional-, Schul-, Heimat-, Autostraßen-, historischen Atlanten und Spezialatlanten unterschieden.

Der systematische Kartenkatalog gibt somit Auskunft, welche Karten und Atlanten über ein bestimmtes Gebiet vorhanden und welcher Art diese sind.

Astronomische Karten und Atlanten sind im Hauptsachkatalog der Deutschen Bücherei verzeichnet. In Auswahl findet man sie auch im Kartenkatalog. Zur Erschließung der amtlichen Kartenwerke dient ferner eine Sammlung von Einteilungs- und Übersichtsblättern, auf denen jedes einzelne in der Deutschen Bücherei vorhandene Kartenblatt mit dem Auflagenjahr verzeichnet wird.

Zur Kartensammlung gehören auch sogenannte nichtgeographische Karten. Das sind Objekte, die zwar in Form von Kartenblättern oder Wandkarten vorliegen, als Kartenwerke mit entsprechender Signatur inventarisiert werden, aber nichts mit Kartographie zu tun haben, z. B. Anschauungstafeln für Unterrichtszwecke.

Der umfangreiche Kartenfundus ermöglicht in Verbindung mit den entsprechenden Räumlichkeiten das wissenschaftliche Arbeiten unter günstigsten Bedingungen. Es bieten sich darüber hinaus gute Voraussetzungen zur Durchführung von Fachtagungen und Ausstellungen.

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## **PAC REGIONAL CENTRE RESTORATION OF MAPS**

**By Henrik Otto**

The collection of maps in the Deutsche Bücherei only deals with maps, atlases with German inscriptions as far as there have been published from 1913 onwards. That means until now :

- 100 000 maps in sheets
- 30 000 folded maps
- 4 000 wall maps
- 4 200 atlases

The stock of wall maps is the largest in a German library. Globes do not belong to the subject of the collection. The rooms of the map collection are situated on the first floor of the building. Its reading room covers an area of 76 m<sup>2</sup> and is equipped with 6 large special desks and one illuminated table (Leuchttisch). Next to the reading room, there is the store room which covers an area of 320 m<sup>2</sup>. Its genuine equipment with cupboards for wall maps and roll fronted cupboards stems dates from the years 1915-1916. Special cupboards, of which the height is 4m, with hinged frames were constructed for the storage of mounted and rolled wall maps. Each of these 52 cupboards contains 8 rows, which can be filled with about 70 maps.

The roll fronted cupboard with their fixed interior measure of drawers (width 100 cm, depth 91 cm, height 6 cm) have proved useful. You can also use the top of these cupboards as a work top for reading maps.

The storage of folded maps is managed as follows : about 15 maps are bundled in an open cardboard box which is placed on a normal book-shelf.

Not only large size, but also special features of materials can make the conservation and restoration treatment difficult. Such features can be :

- large size documents, either rolled or folded,
- instable coloration,
- damage by inks and corrosive pigments,
- surface of prints covered by special waxes or varnishes,
- unstable floppy backing.

These and other factors are the background of the opinion that maplike documents need a special treatment which could be :

- dissolving of gummed up materials (enzymes, steam),
- fixing of pigments,
- neutralisation,
- treatment of damage caused by ink and paints,
- duplication materials and their usage,
- encapsulation,
- different kinds of storage.

### **Dissolving of gummed up materials**

The main point is how far is it possible to work with water or steam on the original substance. You can use steam with traditional, but also new materials, for dissolving gummed materials. Simple compression of Filterkartons are as good as the new synthetic materials such as « Gore-Tex » or « Cappillary matting ». For very special problems, you can make use of enzymes or organic solvents.

### **Fixing of paints and pigments**

There are still lots of risks in this field and only two ways of handling this problem. On one hand, you try it by pure research and chemicals. On the other hand, you can find pragmatists, who prefer the physical way. None of them provides a final result. We think, that the way of pragmatists has not too many risks, because you work with different types of cellulose, derivatives in combination with steam treatment. By careful application of these substances, you should not expect bad side effects.

### **Neutralisation**

The neutralisation and the deposition of an alkaline reserve can be achieved through different means. Neutralisation can be done separately during the conservation / restoration process.

The possibility to add enough alkaline substances in the glue, so that they could function as a neutralisation agent, make it easier to work on sophisticated damaged spots. The simplest way is to use a glue, which is added to CaCo and MgCo in any concentration, or any mixture.

In this application, are the demands of crystalline sizes and a appropriate distribution of carbonates fulfilled without disadvantages of wet treatment. Do not

forget, in this context, that some of these pigments can react as an indicator with colour changing. It is possible to deacidify by waterfree organic solvents, solved active substances. This way permit to treat very sensitive objects.

### **Treatment of damages caused by ink and paints**

At first, you should eliminate the cause of these damages. Then, you could stabilise the damaged parts as best as possible. The cause of eaten away ink and paint is influenced by heavy metal ions, like iron and copper in hydrolytic and oxidise events. Recent publication confirm the removing of heavy metal ions by wet treatment will use of a vacuum table. The old conception, that the heavy metal ions will be distributed by wet treatment in the healthy parts, has not been confirmed presently. It is useful for the stabilisation of sheets of paper which are damaged by eaten away ink and paint, and recommended for the local paper splitting technique.

### **Duplication materials and there usage**

Very often, it is necessary to duplicate maplike documents, because lost parts, tears and other damage forbid to use these. In relation to the size of the maps, these could be duplicated with special papers as well as with textile materials. We distinguish three main methods.

The duplication material will be put on in a waterfree application. Normally, the maps will be laminated with materials made from polymers or industrial coat papers. The disadvantage is the irreversibility of this process. The advantage is the map can not change its sizes and keeps its authenticity equal. This is an important point of view at the beginning of every work.

To work on a vacuum table is an up-to-date technique. Thus, you can work on a stable and flat surface and therefore, the treatment can be very careful. To pull on of large sizes maps on new textile backing materials is a usual way. The biggest disadvantage is that the size of original is changing through the contact with water.

### **Encapsulation**

Encapsulation means that the original is left after the welding of the edges protected between two polyester foil laying. Now you can watch it very well, because polyester is clear like glass. The foil is permanent and very stable against chemical reaction.

But a characteristic of polyester also is that an original inside of such an envelope can not breathe. That is a reason for the development of a micro-climate, which is very bad for the ageing of the original. Therefore, you should open the edges through small interruption in the weld, or by opening the surface like tiny holes. This would be an ideal result.

The decision whether the maps are stored, unrolled or hanging depends on the storage environment. The resources of the building, the available space, the available finances, the frequency of use and the size of the collection, together with other factors, will decide on the exact type of storage. A small remark about the usual rolled storage : it is better if the sheet is rolled around, then it is rolled into a cardboard tube.

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## STATE AND PROSPECTS OF THE SCIENTIFIC PRESERVATION OF CARTOGRAPHIC MATERIALS

**J. F. Burtseva**

**Abstract:** The collection of cartographic documents stored in the Russian State Library is the country's greatest one, sought after by specialists and researchers in various fields of knowledge. The preservation of this unique cartographic stock is a part of the complex and many aspects of the problem of the preservation of holdings of the Russian State Library.

The specificity of the storage of cartographic documents proceeding from the technological peculiarities of this given kind of documents, the technical equipment, researches in the conservation of documents are also specific.

Restoration of cartographic documents, principles of the selection of documents for the restoration, priority of the restoration work, variety of methods and ways of the renewal of documents, differentiated approach towards the choice of methods and ways for the restoration of cartographic documents, quality estimation of the accomplished restoration operations are discussed.

Training restorers, continuing professional education of keepers of cartographic documents is an important question.

The collections of the Russian State Library (RSL) are unique, not only in terms of volume and value (the Library boasts of hundreds of valuable collections), but in the universality of themes, chronological depth, language coverage and diversity of types of the collected documents too. The collection of cartographic publications is one of the largest collections of this kind in the country.

Practically every day, the librarians are faced with this dilemma: to use a certain publication or to conserve it. A decision in favour of the first or second variant, impedes the possibility of the successful realisation of the other variant. The consequence of the limitation of usage of the collection, a measure which favours a longer period of preservation, is a lower level of satisfaction of the users' demands, but the intensive usage of documents leads to the worsening of their physical state. The only way out of this situation is to preserve the documents in



order that they be used, yet used in a way which would favour their preservation. This means that a balanced conception of preservation and the availability of the collections should be worked out.

The ensuring of preservation of documents is the main functional task of libraries, archives, museums and other organisations which store cartographic documents. The pooling of their efforts, and the coordinated work of specialists in different fields : chemist, biologists, physicists, and the integration of sciences, brought about a situation in which the conservation of documents developed into a specific subject field of integrated knowledge, which is limited by the circle of functional tasks and founded on contemporary conceptions of natural sciences. Problems dealing with the conservation of paper-based documents were studied and developed particularly intensively. In the last two decades or so, the level of these activities reached a high degree of theoretical generalisation, which made it possible to assess the speed and mechanism of the ageing of paper to forecast its longevity, and to create new durable cellulose-paper materials and successfully solve problems of restoration and bioprotection of documents.

Restoration represents an important aspect of activities, directed toward the support of preservation of documents. Restoration of cartographic documents on a paper base can be realised through different methods. Some of these methods originated long ago and were improved empirically ; they finally crystallised and today they occupy a firm place in the restoration practice. Other methods appeared relatively recently, and since they were based on a sound scientific foundation, they found their way into the restoration practice too. This came about due to a number of advantages that they possessed and they are already replacing some old and tested methods. The most deeply inset « classic » or traditional method of restoration calls, as a rule, for tedious manual labour and includes many separate and various procedures (the preparation of the document for restoration, the reconstruction of the missing parts, the mending of tears and fractures, etc.

The classic method of strengthening fragile and deteriorated cartographic materials on a paper base includes two methods, which are technically much alike though they use different materials. In the first instance, cloth (gauze or coarse calico) is used, whereas in the second instance, thin paper is applied. However, in both cases glue, made of wheat flour is used. Along with the positive aspects (strengthening of the structure of the document, consolidation of the base, a well nigh ideal levelling of the surface, and removal of fractures), the classic method of restoration has a number of substantial shortcomings (appearance of lustre and of a « mirror-like » surface, the loss of natural indications of the age of the document). When the document is reinforced either by cloth or by paper, the

weight and volume of the restored document increase two-fold, and sometimes even three-fold. Besides this, the quality of restoration is determined not only by the technical aspect, but by the fact how the restoration will affect the subsequent longevity of the document. The classic method, with the application of flour glue, dresses the documents with carbohydrates which are easily assimilated by mold fungi and this circumstance increases the danger of the infection of documents. That is why if the mycological analysis shows the presence of live spores of the fungi on the document, obligatory disinfecting is performed prior to the restoration. Moreover, the method of disinfecting should be chosen individually for each document.

In order to create bioprotection, non-volatile antimycotic agents are used. The neutralisation of acidity and the buffering of excessively acidified paper, particularly with the application of a chalk suspension, creates a certain reserve of mycotic resistance in the document.

Despite a number of negative points, the classic method has played and continues to play a positive role in restoration practice, since it has increased the life-time of many documents and has, in this way, made them available for study and use.

The prevalence of a large amount of documents written or printed on paper, which age rather quickly, has created a critical situation. Many large libraries see the solution of this problem in the augmentation of restoration activities and their mechanisation, and so today mechanised methods are being intensively developed.

The method of strengthening documents practised simultaneously with the restoration of the missing parts with the help of pulp (the « filling-up method ») immediately on its introduction into restoration practice, showed itself to be a progressive and economic technique. The sheet casting machine used at the Research Centre for Conservation and Restoration of documents is a right-angled metal tank with an open top a conic lower part which is connected with a vacuum plant. The sheet-casting mould is used for the reconstruction of the missing parts of the sheet. However, it has its limits since it can be used only for the restoration of those cartographic materials the format of which does not exceed the size of the surface of the mould.

The process of lamination (the covering of the paper with a layer of film) is also used in the conservation and restoration of cartographic materials. Lamination may be ordinary or double, i.e. it can be applied to only one side of the document or to both sides. For small format documents, two-sided lamination is used since after the reinforcement of only one side of the documents, the paper may twist by reason of the different degree of tensioning of the surfaces of the two sides

Extremely fragile documents are additionally strengthened with mica tape or thin cloth. The film is placed between the paper and the reinforcing material which serves as an adhesive substance. The lamination method is suitable for the restoration of cartographic materials with a text printed on both sides.

Lamination is, in the main, a « curing » method and it should not be used widely and without due control. This method is recommended for documents which are in such a poor state that they cannot be restored by any other method.

However, even in such extreme cases, certain measures directed toward the removal of negative effects - dirt, acidity, micro-organisms, first of all, should be taken prior to the lamination. Before beginning the lamination, it is necessary to remove all factors of destruction (the reasons and their consequences), which exist within the document itself. If this is not done, these factors, in combination with the process of lamination, can even become stronger and in this way make the restoration useless.

The method of restoration, consisting in the splitting (or the separating into layers) of the document and the reinforcing of it from the inside with strong papers originated more than a hundred years ago, when there were very few craftsmen, who had restoration skill and they kept the secret on some of their techniques. The transparent paper, which was in those times used for the gluing of fractures of the document, veiled the text and lessened its readability. That was the reason why restorers aimed to find such a method of restoration which would make it possible to save a document with a text printed on both its sides without changing its outward appearance. The idea of a restoration method, which envisaged the splitting of the paper sheet and its strengthening from the inside seems tempting. It is successfully used in the restoration of cartographic materials with the text printed on both sides. The use of Japanese silk paper or the domestic mica-tape paper lends the document greater stability and guarantees its longevity. However this method calls for great skill and virtuosity on the part of the restorer.

Such are the main methods and devices used by the Research Centre for Conservation and Restoration of Documents in Moscow. It should be stressed here, that going by the state of the document, which the specialist assesses in the course of a visual, microscope and chemical analysis, he chooses the most optimal method of restoration for each concrete document.

The problem of support of preservation of library documents in their contemporary form is a complex and multi-aspect one. There are many approaches to the problem and it cannot be solved only through the efforts of separate, even large libraries, archives and other related institutions. It is obvious today that the

complex solution of all problems of conservation of documents at the present stage, the extension of research, and of organisational and pragmatic issues, will be possible only if an integrated system of protection of documents will be developed. The Research Centre considers the working out of such a system to be the main direction of functional studies in the field of preservation of library collections. This work on the system includes the forecasting of the state (physical, chemical and biological) of library collections, modelling of processes of document storage, establishment of principles of organisation and functioning of the ecological system in a closed space (the depository), creation of durable and bioresistant materials, with especially prescribed properties, for the conservation of documents.

The development and extension of activities, involved with the preservation of library collections, calls for the support of these activities by highly qualified specialists, who are able to realise the entire complex of measures for the conservation of documents. The specific nature of the profession of the conservator and the restorer of documents lies in the fact that along with skill, a highly artistic restoration calls for knowledge in the field of chemistry and physics, biology and bibliology, art and history. Starting with this year, the first school for the training of conservators and restorers of documents, for archives, museums and libraries has begun to function within the framework of the Research Centre for Conservation and Restoration of Documents.

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## SOME EXPERIENCE OF RESTORATION OF CARTOGRAPHIC DOCUMENTS

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**Abstract:** One of the most difficult problems that rises in front of the restorers during their work deals with cartographic documents covered with some substance.

As a rule, the only use of the methods of restoration in their classical version with traditional methods of chemical analysis does not lead to the desired results.

The task is complicated by the impossibility to foresee the effect of different substances on the elements of dye stratum and texts that are under covering substance.

In the report, we try to illustrate general tendencies of the approach to restoration of such a kind of documents by a concrete example.

We got for restoration a military map of Pillau (Eastern Prussian dated from the end of the 18th century - beginning of the 19th century. It is evident that the map is saturated with some unknown substance to give it strength against the effects of atmosphere, and to increase its operation qualities.

The base of the document is broken in three parts. All the previous attempts of its restoration did not succeed. In the result of the analysis, we have obtained the composition of the unknown substance (bees wax), and have elaborated the plan of restoration.

In the Federal Archives located in Moscow, there are stored a large quantity of the most various cartographic materials. So, our laboratory often deals with documents of this kind. The cartographic materials brought to us for restoration are very different in their manufacturing technology, in formats, and in the various states of damages that should be eliminated in the process of restoration.

There are a lot of problems arising when working with cartographic documents, and it is impossible to analyse each of them in our report. So, I am going to speak only about one problem that is the most interesting and difficult, both from the practical and theoretical points of view. Some of the aspects are, in our view, rather debatable. We mean restoration of the cartographic documents coated with some substance.

As it is well known, the coating substances are often used in manufacturing maps in order to increase their working qualities, i.e. mechanical durability, atmospheric stability, etc. Depending on time and place of manufacturing, they used various coating substances beginning from natural and to modern synthetic polymers. It should be noted that the coating substances have quite a various ability of penetrating into the paper base of the document. Sometimes, the substance just stays on the paper surface, but sometimes, it penetrates the paper and is actually a kind of impregnation.

The use of only the restoration methods in their classical variant using the traditional methods of a chemical analysis in working with cartographic documents coating with some substance, are often not sufficient. It is especially difficult when the map or plan is made in a complicated technique and when various means of painting and writing were used in the process of manufacturing.

In my paper, I tried to illustrate on a concrete example the general tendencies and approaches employed in our laboratory for the restoration of documents of such a kind.

I am going to speak about restoration of a map coated with a substance of unknown nature - the military plan of the fortress near the town of Pillau. This town was situated in East Prussia on the Frisch-Gaf flowing into the Baltic Sea. The fortress near the town protected the entrance into the Frisch-Gaf. Manufacturing of the said military plan is dated about the late 18th - early 19th centuries, the place of manufacturing is unknown. The plan is made on paper and written in German.

The imprint and texts are on one side of the document, the paintings being done in the water-colour technique.

It is considered that water-colours were widely used for colouring drawings, beginning from the 15th century. The Pillau plan was made in the typical technique : the sketch was put on the paper with the help of a pencil, then the main contour lines were outlined with Indian ink, and then the drawing was water-coloured. They used special methods of putting water-colours - washing out and pouring.

The Pillau plan was manufactured with water-colours of green, yellow, red, orange, grey tones, brown ink, and black Indian ink.

The whole surface of the document is covered with a coating substance of unknown nature. The coating in this case is a kind of impregnation as the paper base of the document is soaked through with it. The coating is transparent on the

whole but on the numerous small lines of fractures and bends it is not transparent and of a white colour.

The plan is torn into three parts, and, on the other side along the breakage lines, there are signs of a gluing substance left from the previous restoration that was not successful. Besides, the plan has two sticky labels and three stamps, that means the document belonged to different departments at different times. The stamp colour got through and, in some places, damaged the imprint.

We consider that the first obligatory condition for restoring the documents of such a kind consists in identifying the unknown coating substance which is done by corresponding methods. When working with the Pillau plan, we chose infra-red spectroscopy and chromatography-mass spectrometry. As a result, we received the data that permitted to fully identify the unknown coating substance as a mixture of bees wax and wool wax. It should be noted that the principles of choosing the analysis methods, working out their methodology and the methodology of interpreting the received results would make a separate theme beyond the present paper.

Identification of the unknown coating substance as wax permitted to explain its white colour on the breakage lines and the bends of the document as the result of uneven internal stresses and transformation of the wax in these places, from the amorphous into the microcrystalline state.

Later with the help of the traditional chemical methods of analysis, it was found out that the remaining parts of the gluing substance on the reverse side of the document was flour paste.

Thus, the pre-history of the document submitted for restoration becomes clear. The plan coated with wax was torn into several parts.

The attempts to restore the document in an ordinary way were not successful because of the paste low adhesion to wax.

The next, and may be the most important and disputable question that had to be solved, consisted in choosing the principal direction of restoration of the documents covered with a coating substance. Here, I would like to digress a little bit from the subject of restoring cartographic materials and to look at the subject in a much wider way.

The problem of coating substances is one of the most interesting and may be the most often discussed by the restorers of different trends - from the ancient painting to sculpture. The opinions much differ in this question, may be much more than in an other question. Are we right to intervene in the work of an

ancient master ? What were his goals in coating his work ? Whether he had some other motives beside the technological and pure functional ones ? What historical load does this coating bear at the present moment ? Is it worth to cover the restored object with a new coating ? Historians, archivists, art critics, together with specialists of scientific natural profile, play an important role in discussing these problem in all fields of restoration.

When working with the Pillau plan, we, together with the keepers of the document - the specialists of the Russian State Military Historical Archives - discussed three possible variants :

- 1) Removing the old coating substance and restoration with the methods of the classical restoration of documents without covering the document with a new coating,
- 2) Removing the old coating substance and restoration with the methods of the classical restoration of documents with covering the document with a new coating (identical to the old one or of modern synthetic materials),
- 3) Keeping the old coating substance and choosing non-traditional methods and materials of restoration.

When choosing the most optimum of these variants, we followed the following considerations :

Most likely that the wax was put on the plan for purely practical aims - first of all in order to prevent the non-water-resistant water-colours, Indian ink, and ink from getting under water and moisture, and to permit using the plan in the open air. This assumption was confirmed later. Large quantity and small particles of soot were found on the coating - evidently, the plan was used in its time directly on the theatre of military operations.

Probably, the document was coated just with wax, as, at that time, wax was the best coating substance meeting the requirements of military maps. Paraffin, the closest analogue of wax, that is cheaper and that makes non-sticky coating excluding dusting was used only in 1830. At the present time, this main functional feature of wax as a coating substance providing a possibility to use a document in the open air is fully lost.

Now, the presence of a protecting coating substance on the Pillau plan, in our view, turned from the positive to the negative factor.

The work of researchers with the drawing is complicated by the optical unevenness of the coating caused by the presence of a large quantity of small



white lines. Besides, when working with the document, even with great care, it gives new white lines caused by unevenness of stresses appearing in the wax. Some stickiness of the coating substance also negatively affects the physical durability of the document.

Among the positive moments of the document coating substance, one can certainly mark its historical technological information. Having analysed all these arguments and considerations when working out the problem of the principal direction of the Pillau plan restoration, we, together with archivists, have come to the conclusion of advisability of removing the old coating substance, i.e. wax, and restoration of the document by the methods of classical restoration without covering the document with a new coating.

The variant of coating the document with a coating substance of some modern synthetic polymer was rejected as not answering the purpose of the further storage, use, and studying of the said historical source.

The next important question arising after taking the principal solution of removing the old coating in the process of restoration is the question of the practical realisation of this solution.

Naturally, the main problem of employing one or another reagent for removing the wax consists in the relation of this reagent to all elements of the water painting, texts, and later stamps.

Usually, we start selecting of a reagent on the basis of our knowledge of the techniques and ways of putting a coating substance on the document by the old masters. As a rule, the used method is reversible. And employment of this method in the reverse direction is in most cases absolutely harmless for all elements of the imprint and text.

When doing this work, it was assumed that a so-called « cold method of putting wax » was used for covering the document with wax. Both the « cold » and « hot » methods were known from the ancient times and from times immemorial were widely used for putting wax on various surfaces (for example, in encaustics). If, with the « hot » method, the wax is melted, with the « cold » method, the wax is put on the surface as an emulsion that is prepared by dissolving wax in the corresponding solvent. From the ancient times, they used turpentine as a solvent.

So, we suggested turpentine as the first reagent to try removing the old coating substance from the Pillau plan. However, unfortunately, we could not use turpentine for removing the wax coating from the document as, at the first test, we

found out that it caused significant spreading of the paints entering into the stamps composition and stamped later on the wax.

So, we had to exclude turpentine from the suggested solvents and to continue searching of the suitable reagent. In our searching, we based on the physical chemical features of the dyeing staffs used in water painting.

In this case, it would be a mistake to speak about « water painting in general » without chronological and geographical limitations. There exist rather various ways in the materials and physical chemical features in antique painting, medieval, the 20th century European painting, Near and Far East painting, etc. It is known that the 18th and early 19th centuries broke the old seclusion of the European countries, so that, now, it would be impossible to speak about some colourful materials of one or another European country. The new inventions and materials in the field of dyeing staffs were immediately distributed among all European capitals and trade centres. This is why speaking about the 18th and 19th centuries, it is possible to speak only in the general European scale concerning the water painting elements.

Thus, not having any data about the exact place of the document manufacturing place and taking only into consideration its European origin and rough time of manufacturing, we generalised the data on the physical chemical features of the imprint components of the said period and chose a number of suitable solvents.

For our further work, we chose benzene, benzol, and carbon tetrachloride.

Later on, having compared all experimentally received and literature data on dissolving wax, dyeing staffs used in the water painting technique and in the modern stamps imprints, we ultimately stopped our choice on benzol.

Using benzol, we removed the coating substance from the Pillau plan and then we restored it, using the common methods and materials of the classical restoration.

In conclusion, I would like to mention once more that, in our view, the plan of restoration of cartographic documents covered with some coating substance, beside all other questions directly concerning restoration, should obligatory include the following three points :

- 1) identification of the unknown coating substance,
- 2) the scientifically grounded decision of the necessity in its removing. This question should undergo a complex expertise, and not only natural scientific but also historical and artistic,

- 3) working out of the methodology of removing the coating substance (of course, if the decision about its removing is taken). The main requirement should concern a securing complete preservation of all the elements of painting and text in the document.

We are sure that real scientific restoration of cartographic materials covered with some coating substance is possible only after a careful study of these questions.

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## THE LAMINATION OF CARTOGRAPHIC EDITIONS

By E. S. Chernina

Document restoration by lamination - thermoplastic films and composite materials application on paper by the use of a Yugoslavian impregnator (« Strojotechna ») - have been conducted in the Document Conservation Department of the National Library of Russia (NLR) since 1968.

Before introduction and during further working, the method was studied in details, the results were accounted in several articles and reports and therefore, the object of the present information is to direct our attention to some features of laminating just only cartographic editions.

Individual leaves, book jackets, soft covers, newspapers, posters and maps are restored by the lamination method in the National Library of Russia. There are two press plates, heated by electricity, and two rollers in the impregnator. Between the plates, the materials are heated up and the film is softened; between the rollers, the softened film is pressed into the pores and cavities of paper. For processing, a packet is to be made up : two outer rigid liners, two inner antiadhesion liners and a restored document with a film placed on the both sides of it (or on one side - according to the chosen method).

Now, the most suitable film, which is produced by home industry, is a polyethylene film. Good results are also obtained with the composite materials which have a polyethylene underlay in their structure :

- polyethyleneterephthalate (lavsan) film with polyethylene underlay,
- polyamide film with polyethylene underlay, a restoration composite worked out in the National Library of Russia,
- restoration paper with polyethylene underlay.

In all cases, when restoration material containing polyethylene is used, its attachment by pressing is accomplished at 115°C and at 1 minute exposure of a packet between the plates. These conditions have no injurious affect on paper and colour print.

Film application permits to increase the durability of document, to protect the paper from dirt and dust, diminishes the effect of light and air pollution, helps

documents to bear possible changes in keeping conditions of storage, protects them from moisture.

An important side of multicoloured maps restoration is the increase of colour saturation after film attaching : blue colour becomes more blue, red colour becomes more red, etc. Owing to this, the outward appearance of a document improves considerably. One of the main damages, caused to maps by readers, is the abrasion of paper and print. The film, even being thin, permits to protect a document from abrasion.

The increase of paper durability by lamination depends on many factors - kind and thickness of the film, mode of attaching it - on one or on both document sides - paper composition and mass of a square meter, degree of its damage. As a rule, the maps are printed on dense paper with the mass equal to 70 - 160 g/m<sup>2</sup>, consisting of wool cellulose with durable semi-finished additives; as long ago as the 1960ies, according to the standard there was bleached rag pulp in the composition of cartographic paper, later and now; according to the present standards cotton lint is added in it. The paper such as that is permanent enough, durable and it is well strengthened by the application of thin polyethylene film (30 μ thick) even without restoration paper.

For instance, a modern map is printed on paper with the mass of 120 g / m<sup>2</sup> and folding resistance equal to 7 double folds. After application of a 30 μ thick film on both sides of the map, the value of this index increases to 100 double folds. However, such strengthening is sufficient only when maps are of small format, are stored in the form of separate sheets and are rarely given to readers.

In case of often using and folding up for storage, when they are to be bended and unbended many times, the lamination with thin film is not enough : they need additional strengthening with paper or cloth. A special note should be taken to the spots which undergo bending - unbending. On the paper with the mass equal to 140 g / m<sup>2</sup> and more, coated with thin film, these spots are destroyed sometimes even more rapidly than without coating and, so, need protection.

The use of the impregnator permits to restore the maps of different formats. If the size of a map is smaller than the working size of the impregnator plates (1 050 x 750 mm), the process is easy and does not take a long time. The maps of large formats are cut in two or in several parts and every part is laminated separately - the film is applied so as to reserve a vacant strip of film (or with restoration material). The parts of the map are joined on a table by the use of a special device for film welding or a solderer. There are several versions of map lamination with film:

1. film and restoration material (paper, cloth) application only on the reverse side,
2. film application on the right side, film and restoration material - on the reverse side,
- 3 film application on both sides,
4. film and thin restoration paper application on the right side, film and dense paper (cloth) on the reverse side.

Besides the already mentioned, the essential versions, many additional ones are used, they are bound up with local strengthening of a document in the spots of breaks, bends, on corners, etc.

Lamination is far from being used for all kinds of documents. This accounts in the main for two undesirable occurrences:

1. When the film is applied, the texture of paper surface changes. If we use polyethylene film the texture depends on a liner, it is possible to make the paper surface glossy, mat, rough, linen-faced, etc. But, in all cases, the texture of the paper surface will differ from the original one.
2. Removal of the film from a document presents a complicated problem. It is possible to do it by heating in a solvent. According to safety regulations, this process is to be realised in special conditions. Therefore, on applying the film on a document, it is necessary to remember possible irreversibility of restoration.

The foregoing shortcoming limits the use of the method. Now, in the National Library of Russia, the modern maps (dated from the 20th century) which are in intensive handling are restored by lamination. Recently, the curators of the collection proposed to laminate the maps dated from the earlier period - the 19th century. Many of them are in a bad condition. It will take plenty of time to restore them, so the maps may not « live » till restoration. Long term restoration practice showed that the laminated maps are well preserved. Apparently, this problem - the lamination of the maps dated from the 19th century - will be solved in the nearest future by curators and restorers in common. Now, this work is carried out as an experiment and only with the damaged maps which has some duplicates.

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## **PRESERVATION OF LEATHER BINDINGS OF CARTOGRAPHIC ATLASES**

**By O. I. Perminova**

**Abstract:** The paper sets forth the scientific grounds of the necessity to elaborate a method for the conservation of ancient leather bindings. The impact of various factors on the preservation of leather bindings is gone through. An analytic method of the control of the ageing of leather bindings is proffered. This conservation method consists in general stages : the mechanical cleaning, the chemical purification, the neutralisation of the surplus acidity, the blocking of the noxious influence of captions of iron and copper, the moistening and strengthening of leather bindings, the greasing. An advantage of the proffered conservation method in comparison to the known ones is that it allows to conserve leather bindings without work consuming operations of dismantling them.

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## **STUDYNG OF THE POSSIBILITIES OF USING THE HOME MADE FILMS AND CHEMICALS ON THE DEVELOPING DEVICE « PENTAKTA ».**

**By Z. A. Bektimirova and L. B. Andreeva**

**Abstract:** The possibility of using native films and chemicals utilisation at microfilming equipment « Pentakta » was analysed in the process of experiment. The various variants of films and chemicals utilisation have been examined :

1. The films ORWO MA-8, MK-7 1 - the ORWO solutions,
2. The films ORWO MA-8, MK-71 - the solutions in accordance with GOST 13.1.301-86,
3. The native films TASMA MFN, MFP - the ORWO solutions,
4. The native films TASMA MFN, MFP - the solution in accordance with GOST 13.1.301-86,

The most important film's sensitometric characteristics regarding considered variants have been estimated accordingly. The recommendations regarding the ORWO and TASMA films developing in the solutions with native chemicals utilisation have been given accordingly.

The problem of studying the possibilities of using the home made films and chemicals when working on the microfilming device « Pentakta » arose in connection with the price rise and then, with the complete ceasing of supply of film sets and chemicals of the « Orwo » firm, on the one hand, and the necessity to revise and correct the typical regulations of making microfiches of the insurance stock and the usage stock that were worked out by the NITsKD SSSR as far as in 1987, on the other hand.

The enterprises of our country that use films of the « Micrat » type possess about 300 sets of the « Pentakta » equipment that should be used with the home made films and chemicals.

In accordance with the « Standard Technological Regulations of Making Microfiches of the Insurance Stock and the Usage Stock », it was envisaged to use side by side with the firm « Orwo »'s films also the home made films. However, at the time, when these « Standard Technological Regulations... » were compiled, our industry only planned production of the format films for making microfiches



of the Micrat MFN and MFP types. During the next years, the PA « Tasma » started production of the MFN and MFP films, and then, appeared a real possibility of using them in the filming, copying processes and in chemical photographic processing at the "Pentakta" cameras XFP E 120 and E 130.

It was advisable to analyse the following variants of using the films and chemicals:

1. Firm « Orwo » films MA-8, MK-71 - Firm « Orwo » solutions,
2. Firm « Orwo » films MA-8, MK-71 - solutions according to GOST 13.1.301.86 « Reprography, micrography. Halogen-silver films. General technological conditions » and « Standard Technological Regulations... », 1987,
3. The PA « Tasma » films MFN and MFP - solutions according to GOST 13.1.301-86 and the « Standard Technological Regulations... », 1987. and also to test these variants in the normal express regimes on the machine « Pentakta » E 130,

The tests were performed by evaluation of the main sensitometric characteristics by GOST 10691.6-88 and their correspondence to the « Standard Technological Regulations of the Insurance Stock and the Usage Stock ».

According to GOST 13.1.301-86, the phenidone-hydroquinone developer UP-2MF is recommended for processing the films MFN and MFP. The high resistance of the emulsion layer of the said films permits their processing at a higher temperature, i.e. in the « Pentakta » regime. The developing formation given at the « Standard Technological Regulations... » is a modification of the formation UP-2MF and differs only by the content of hydroquinone, soda, potash bromide, and higher content of pH of the solution. In Table 1, are given the developing formation by GOST 13.1.301-86 and the « Standard Technological Regulations ».

Table 1			
Name of substance		UP-2MF (GOST)	UP-2MG (STR)
Developing solution		mass in gr.	
1	Phenidone	0.6	0.6
2	Hydroquinone	6.0	6.0
3	Sodium sulphite deh	40.0	55.0
4	Sodium carbon	31.0	55.0
5	Potassium bromide	4.0	10.0
6	Distilled water	to 1 l.	to 1 l.
7	pH of solution	10.2	11.4
Fixing solution		mass in gr.	
1	Sodium thiosulphate crystalline	250.0	200.0
2	Potassium sulphate pyro	30.0	/
3	Sodium sulphite deh.	/	27.0
4	Acetic acid	/	10.0
5	Water	to 1 l.	to 1 l.
6	pH of solution	4.0 - 4.5	3.5

The films were exposed at sensitometer TsS-2M at  $T = 2850^{\circ}\text{K}$  during 0.05 s.

The processing was done in solutions of the original « Orwo » formation and in processing solutions formations given in Table 1, at the normal and express regimes.

The sensitograms were measured at densitometer « Machbeth ». The values of contrast coefficient, light sensitivity, maximum and minimum density ( $\Psi$ ,  $S_{0.2}$ ,  $D_{\text{max}}$ ,  $D_{\text{min}}$ ) received on the sensitometric curves are given in Tables 2-5 in comparison with the NTD norms.

When choosing the processing regimes for the Mirkat type film, the main criteria of the optimal processing are achieving of the recommended contrast coefficient and completeness of fixation and washing of the material. Table 6 gives the contrast coefficients of films MA-8, MK-71 (Orwo) as well as films MFN and MFP at the tested variants of processing.

With the view of testing preservation of the insurance stock microfiches at long storage, we did artificial ageing of microfiches with sensitograms in camera Tabai at  $T = 70^{\circ}\text{C}$  and  $\Psi = 60\%$  during 270 hours with the successive evaluation of the microfiches condition.

The negative microfiches MA-8 and MNF after ageing showed yellow image of various intensity, which means non-sufficient removing of the silver salts at fixation both in the « Orwo » fixation and in the home fixation.

Sensitometric characteristics of Film MA-8 ORWO at processing in the Developing Device « Pentakta E-130 » at the normal and express regimes with various formations of the developing solutions.

Table 2						
Formation of processing solutions		Regime XFO	Contrast coefficient $\Psi$	Light sensitivity SO.2	Maximum density D max.	Minimum density D min.
Norm by NTD			2.5	1.0	2.5	0.12
N° of experiment						
1	ORWO	Normal	3.40	2.2	> 2.5	0.06
2		T = 34°C	3.24	2.2	> 2.5	0.06
3			2.50	2.0	> 2.5	0.06
4			2.80	1.9	> 2.5	0.06
1	ORWO	Express	1.65	2.1	> 2.5	0.08
2		T - 39°C	2.24	2.0	> 2.5	0.08
1	UP-2MF (GOST)	Normal	2.60	2.8	> 2.5	0.05
2		T = 34°C	2.75	3.2	> 2.5	0.05
3			2.65	2.8	> 2.5	0.05
4			2.45	4.0	> 2.5	0.05
1	UP-2MF (GOST)	Express	1.50	3.2	2.0	0.06
2		T = 39°C	1.50	3.6	2.0	0.06
1	UP-2MF (STR)	Normal	3.20	3.9	> 2.5	0.06
2		T = 34°C	3.00	3.0	> 2.5	0.06
3			3.10	3.1	> 2.5	0.06
4			3.15	3.0	> 2.5	0.06
1	UP-2MF (STR)	Express	3.00	2.8	> 2.5	0.06
2		T = 39°C	2.90	2.08	> 2.5	0.06

Sensitometric characteristics of Film MFN TASMA at processing in the Developing Device « Pentakta E-130 » at the normal and express regimes with various formations of the developing solutions.

Table 3						
Formation of processing solutions		Regime XFO	Contrast coefficient $\Psi$	Light sensitivity SO.2	Maximum density D max.	Minimum density D min.
Norm by NTD			2.7	1.0	3.0	0.12
N° of experiment						
1	ORWO	Normal	3.30	0.50	3.0	0.05
2		T = 34°C	3.30	0.50	3.0	0.05
3			2.70	0.70	3.0	0.05
4			2.50	0.40	3.0	0.05
1	ORWO	Express	2.00	0.40	2.45	0.07
2		T = 39°C	1.50	0.35	2.40	0.07
1	UP-2MF (GOST)	Normal	2.65	0.65	3.0	0.06
2		T = 34°C	3.05	0.45	3.0	0.06
3			2.75	0.60	3.0	0.06
4			3.30	0.45	3.0	0.06
1	UP-2MF (GOST)	Express	1.25	0.55	(*)	0.08
2		T = 39°C	1.25	0.60	(*)	0.08
1	UP-2MF (STR)	Normal	2.90	0.55	3.0	0.08
2		T = 34°C	3.05	0.55	3.0	0.08
3			3.00	0.60	3.0	0.06
4			3.10	0.60	3.0	0.06
1	UP-2MF (STR)	Express	3.00	0.45	3.0	0.08
2		T = 39°C	3.15	0.48	3.0	0.08

(\*) - D max. was not registered as the film was not fully exposed.

Sensitometric characteristics of Film MK-71 ORWO at processing in the Developing Device « Pentakta E-130 » at the normal and express regimes with various formations of the developing solutions.

Table 4						
Formation of processing solutions		Regime XFO	Contrast coefficient $\Psi$	Light sensitivity SO.2	Maximum density D max.	Minimum density D min.
Norm by NTD			1.6	0.2 - 0.6	3.0	0.07
N° of experiment						
1	ORWO	Normal	1.80	0.10	(*)	0.04
2		T = 34°C	1.90	0.10	(*)	0.04
3			1.65	0.10	(*)	0.04
4			1.70	0.10	(*)	0.04
1	ORWO	Express	1.20	0.06	(*)	0.04
2		T = 39°C	1.10	0.06	(*)	0.05
1	UP-2MF (GOST)	Normal	2.40	0.11	> 2.5	0.04
2		T = 34°C	2.15	0.10	> 2.5	0.04
3			1.95	0.10	> 2.5	0.04
4			1.85	0.10	> 2.5	0.04
1	UP-2MF (GOST)	Express	1.00	0.07	(*)	0.05
2		T = 39°C	0.95	0.08	(*)	0.05
1	UP-2MF (STR)	Normal	2.10	0.1	> 2.5	0.04
2		T = 34°C	2.10	0.1	> 2.5	0.04
3			2.05	0.1	> 2.5	0.04
4			2.05	0.1	> 2.5	0.04
1	UP-2MF (STR)	Express	1.95	0.1	(*)	0.05
2		T = 39°C	1.75	0.1	(*)	0.05

(\*) - D max. was not registered as the film was not fully exposed

Sensitometric characteristics of Film MFP TASMA at processing in the Developing Device « Pentakta E-130 » at the normal and express regimes with various formations of the developing solutions.

Table 5						
Formation of processing solutions		Regime XFO	Contrast coefficient $\Psi$	Light sensitivity SO.2	Maximum density D max.	Minimum density D min.
Norm by NTD			1.6	02 - 0.6	3.0	0.07
N° of experiment						
1	ORWO	Normal	3.50	0.1	> 2.5	0.05
2		T = 34°C	3.15	0.1	> 2.5	0.05
3			2.80	0.1	> 2.5	0.05
4			3.00	0.1	> 2.5	0.04
1	ORWO	Express	1.80	0.1	> 2.0	0.05
2		T = 39°C	2.00	0.1	> 2.0	0.05
1	UP-2MF (GOST)	Normal	3.30	0.1	> 3.0	0.05
2		T = 34°C	3.30	0.1	> 3.0	0.04
3			2.90	0.1	(*)	0.04
4			2.75	0.1	(*)	0.04
1	UP-2MF (GOST)	Express	1.50	0.1	(*)	0.04
2		T = 39°C	1.50	0.1	(*)	0.04
1	UP-2MF (STR)	Normal	4.30	0.1	> 3.0	0.04
2		T = 34°C	4.80	0.1	> 3.0	0.05
3			4.40	0.1	> 3.0	0.04
4			4.50	0.1	> 3.0	0.04
1	UP-2MF (STR)	Express	3.80	0.1	> 3.0	0.04
2		T = 39°C	4.0	0.1	> 3.0	0.04

(\*)- D max. was not registered as the film was not fully exposed.

Contrast coefficients of Film MA-8, MNF, MK-71, MFP at processing in the Developing Device "Pentacta E-130" in various developers and temperature regimes.

Table 6						
Formation of processing solutions		Regime XFO	Contrast coefficient $\Psi$	Light sensitivity SO.2	Maximum density D max.	Minimum density D min.
Norm by NTD			2.5	2.7	1.6	3.0
N° of experiment						
1	ORWO	Normal	3.40	3.30	2.40	3.50
2		T = 34°C	3.25	2.50	1.95	3.15
3			2.50	3.30	2.15	2.80
4			2.80	2.70	1.85	3.00
1	ORWO	Express	1.65	2.00	1.00	1.80
2		T = 39°C	2.25	1.50	0.95	2.00
1	UP-2MF (GOST)	Normal	2.60	2.65	1.80	3.30
2		T = 34°C	2.75	3.05	1.90	2.90
3			2.65	2.75	1.65	3.30
4			2.45	3.30	1.70	2.75
1	UP-2MF (GOST)	Express	1.50	1.25	1.20	1.58
2		T = 39°C	1.50	1.25	1.10	1.50
1	UP-2MF (STR)	Normal	3.20	2.90	2.10	4.30
2		T = 34°C	3.00	3.05	2.10	4.80
3			3.10	3.00	2.05	4.40
4			3.15	3.10	2.05	4.50
1	UP-2MF (STR)	Express	3.00	3.00	1.95	3.80
2		T = 39°C	2.90	3.15	1.75	4.00



The analysis of the films tests results given in Tables 2-6 shows that the equipment « Pentakta » can be used for making microfiches while using the home made films and chemicals. The physical and mechanical features of Films MNF, MFP ensure normal passage of the films through the tracts of the shooting, developing, and copying units. However, the lower light sensitivity of Film MNF in comparison with Film MA-8 (approximately in 5-6 times) requires a considerable increase of exposition and decreases the productivity of the shooting process.

Processing of the negative films MA-8, MNF and the positive films MK-71 and MFP in the ORWO and UP-2MF (GOST) developers at the normal regime allows to receive the sensitometric indexes recommended by the NTD. The express regime considerably changes the photographic indexes, and the contrast coefficients do not reach the set values. The said shortcoming is completely absent when working with the developer UP-2MF (STR), and, when passing from the normal regime to the express regime, the contrast coefficients of the films do not practically change. Yet, Film MFP should be processed in this developer as it overdevelops even at the express regime.

If several developing devices are available in the laboratory, it is advisable to process Film MFT separately in the developer UP-2MF (GOST) at the normal regime and to develop all other films at the express regime in solutions UP-2MF (STR).

When making the insurance stock microfiches on the negative films MA- 8 and MFN and when processing them in the device « Pentakta E-130 » at any recommended regime, it is necessary to do additional fixation and washing. These additional operations should be performed in the device « Pentakta » after the main processing according to the following scheme : soaking in water - fixation - washing.

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## **PETITE HISTOIRE DES GLOBES**

**By Alain Roger**

Dès l'Antiquité grecque (III<sup>e</sup> - II<sup>e</sup> siècles avant J.-C.), des astronomes concluent que la Terre est ronde. Quelques globes célestes et terrestres sont réalisés, mais aucun n'a été conservé.

La production de globes se développe vraiment à la Renaissance, avec le renouveau des sciences et les Grandes Découvertes. L'Allemagne du Sud, carrefour des humanistes et des marchands, devient le premier foyer de production de globes. Ils sont, dans un premier temps, peints à la main ou gravés sur du métal.

L'invention de l'imprimerie au milieu du XV<sup>e</sup> siècle permet de multiplier à bon marché les textes et les images. Les globes sont alors composés de « fuseaux » gravés sur bois ou sur cuivre, puis imprimés sur papier, découpés et enfin collés sur des boules. Ils sont le plus souvent produits par paires, associant un globe terrestre à un globe céleste qui représente les étoiles groupées en constellations. L'image du ciel, connue dès l'Antiquité, a subi peu de modifications au cours des temps.

La Flandre et les Pays-Bas du Sud deviennent au XVI<sup>e</sup> siècle un important centre scientifique où s'épanouit la gravure en taille-douce (c'est-à-dire en creux sur une planche de cuivre). Les conditions sont réunies pour produire des globes de qualité et Gérard Mercator (1512-1594) laisse une oeuvre importante.

Le XVII<sup>e</sup> siècle voit s'affirmer la suprématie des Pays-Bas du Nord. L'habileté des graveurs et des cartographes néerlandais va de pair avec la puissance maritime de leur pays, minuscule, mais doté d'un immense Empire commercial. Les globes hollandais sont diffusés dans l'Europe entière jusque vers 1670 environ.

La France de Louis XIV conquiert alors un rôle de premier plan dans l'avancement de la cartographie. L'État encourage les progrès des sciences car ils servent les prétentions d'hégémonie et la gloire du roi. Une élite internationale de savants travaille à perfectionner la connaissance du monde. La clientèle des marchands de cartographie s'étend à tous les publics cultivés. Les globes bénéficient d'une place de choix dans les bibliothèques réunies par un nombre croissant de particuliers.

À partir de 1750, les grands voyages maritimes complètent les dernières inconnues de la carte du monde. L'Angleterre triomphe avec les voyages de James Cook qui précisent la configuration de l'Australie et de plusieurs îles de l'Océan Pacifique. De grands intérêts économiques sont en jeu. La concurrence est également rude dans le domaine de la cartographie et chaque pays a tendance à réserver ses globes à l'usage de ses compatriotes.

Au XIXe siècle, la production des globes devient plus industrielle. Elle doit alimenter les institutions scolaires et universitaires tandis que les voyageurs recherchent ailleurs des documents plus détaillés. Les particuliers se contentent d'objets produits en série. L'image du monde étant presque définitivement précisée, les globes ont alors perdu un peu de leur mystère et de leur valeur symbolique.

### **La fabrication des globes**

« Nous ignorons, écrivait Robert de Vaugondy, géographe du roi Louis XV, par qui et en quel temps ces instruments ont été inventés ». Il est certain qu'on en connaissait l'utilité du temps d'Archimède.

Bien avant Ptolémée, les premiers cosmographes de l'Antiquité grecque connaissaient la sphéricité de la terre. Il semble que Pythagore se soit rendu compte qu'elle n'était pas le centre du monde mais une planète comme les autres.

Les Arabes, dès le Xe siècle, construisaient des globes célestes et terrestres dont un certain nombre subsiste aujourd'hui, notamment dans les collections françaises. Les globes étaient toujours en métal (alliage de cuivre et de zinc) et gravés en creux.

En Europe, le plus ancien des globes gravés est signé Nicolas Cusa, 1444. Le plus ancien globe de bois peint manuscrit est de la main de Martin Behaim. Il est décoré de miniatures, de blasons, de pavillons. Le navigateur allemand l'avait réalisé à la demande des échevins de Nuremberg en 1492, à la veille de la découverte de l'Amérique. Dernièrement, j'ai eu l'occasion d'aller à Nuremberg lors du convoiement de la copie de ce globe que détient la Bibliothèque nationale de France. J'ai pu juger de son état catastrophique : la lisibilité a pratiquement disparu du fait du vernis passé sur le parchemin au XIXe siècle.

La tradition des globes peints et des globes en métal gravé se poursuit au XVIe siècle, en même temps que se répand l'emploi de fuseaux gravés destinés à l'impression. Après Blaeu, les globes sont construits sur un axe de bois, appelé « os de mort », étroit en son milieu, renflé aux pôles. La sphère est fabriquée en

carton fait de papiers collés les uns sur les autres, et recouverte d'un enduit tourné à une dimension scrupuleuse puisque les fuseaux imprimés devront se coller exactement en place.

La fabrication de la sphère en carton s'effectue par collage de fines couches de carton, sur une matrice métallique. L'opération se fait en deux phases. Les deux hémisphères obtenus seront joints au niveau de l'équateur après avoir monté l'os de mort à l'intérieur. Cette jonction est le talon d'Achille des globes. Il n'est pas rare de les voir se fendre à ce niveau après des coups ou un changement brutal d'hygrométrie.

Les fuseaux gravés sur papier vergé sont soit d'un seul tenant du pôle nord au pôle sud, soit en deux parties (hémisphère nord, hémisphère sud) plus les deux pôles. La gravure est surtout réalisée à l'eau-forte, retouchée au burin.

### **La rareté des globes**

Les globes de grande dimension sont souvent construits avec des planches de bois de bateaux échoués. Ce bois abandonné pendant des années à la mer ne bouge absolument plus.

Les grands globes de Coronelli sont fabriqués de cette façon. Le bois est recouvert de plusieurs couches de toile mélangée à du « blanc d'Espagne ». La dernière toile, plus fine, est peinte de façon magistrale avec une exactitude de la cartographie assez remarquable.

Pourtant, dernièrement, lors de la restauration des globes de Coronelli du Musée des Beaux-Arts de Lille, nous nous sommes aperçus que leur fabrication était exclusivement en toile plâtrée, ce qui est, à notre connaissance, rarissime.

De nos jours, les globes sont très souvent en matière plastique et un peu impersonnels. Pourtant, un intérêt nouveau suscite un nombre croissant de collectionneurs pour ces magnifiques objets que sont les globes anciens.

La rareté de ces globes provient notamment du peu d'intérêt qu'y consacrent les gens au cours du XXe siècle. Les fabricants ont pratiquement disparu de nos jours ; les globes sont presque tous fabriqués en Asie, bien que des fabricants italiens, scandinaves... et français tentent de maintenir la tradition.

Durant la Révolution française, un nombre important de globes a disparu, victime de la fureur populaire. En effet, les sans-culottes cassaient allègrement ces sphères. La fleur de lys, le signe conventionnel qui indiquait le Nord, représentait

pour ces révolutionnaires le symbole de la Royauté. Les guerres de 1870, 1914-1918 et 1939-1945, n'arrangèrent pas les choses.

Une publicité parue dans un journal du XVIIe siècle incitait les possesseurs de globes à remettre à jour la cartographie. Les anciens fuseaux étaient prélevés et remplacés par de plus récents.

Utilisé comme matériel éducatif durant les XVIIIe et XIXe siècles, le globe a pratiquement totalement disparu des établissements scolaires aujourd'hui.

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## **DESCRIPTION DE L'ÉTAT DE CONSERVATION DE DEUX GLOBES DE CORONELLI ET OPÉRATIONS DE RESTAURATION**

**By Alain Roger**

D'environ 1,10 m de diamètre, ces deux globes de Coronelli appartiennent au Musée des Beaux-Arts de Lille. Ils nous ont été confiés pour restauration ; ces deux globes sont en papier vergé et gravés (burin et eau-forte).

En général, les montages traditionnels des globes sont présentés verticalement, penchés à 23°5 par rapport à l'axe central. Les deux globes de Lille sont montés horizontalement, c'est-à-dire que les deux pôles vont d'est en ouest. Ils sont montés sur des supports en chêne très ouvragés, dans le style du XVIIIe siècle.

### **Le Globe terrestre**

L'état général de conservation est catastrophique et présente une surface encrassée due à une oxydation du vernis et à l'accumulation de poussière. Cela a entraîné une disparition partielle des écritures et des tracés, notamment des petits caractères. On distingue néanmoins la couleur du levé des frontières de chaque pays, de l'équateur, des tropiques et de l'écliptique (vert, rouge et jaune).

Des frottements divers et des déjections de mouches sont répartis sur toute la surface du globe. Les espaces usés, endommagés, sont particulièrement sensibles à l'humidité et à la saleté.

De forme rhomboïdale, les fuseaux en papier vergé de 125g ont pour longueur 66 cm, 9,2 cm dans leur plus petite largeur et 27,7 cm au niveau de l'équateur. On constate de nombreux plis assez importants sur toute la longueur, ce qui trahit un manque important du diamètre du globe, ainsi que de nombreuses restaurations avec un papier brun. À certains endroits, l'espace entre les fuseaux est de 5 à 10 mm.

Les deux pôles de 36 cm de diamètre sont très altérés. Ils ont été remplacés partiellement, lors d'une restauration antérieure, par du papier brun très acide.

On peut déceler au toucher la désagrégation du plâtre.

### **Le Globe céleste**

Les altérations sont identiques à celles du globe terrestre avec, en plus, une perforation sur environ toute la largeur de six fuseaux, la boule étant tombée

lorsque les pieds se sont écartés, ce qui a entraîné une cassure de la barre transversale.

Néanmoins, ce trou a permis de visionner l'intérieur du globe, et ainsi de révéler sa fabrication exacte. Les deux hémisphères constitués de huit bandes plâtrées, de facture différente, sont cloués sur un cercle de bois au niveau de l'équateur. Une armature croisée en bois donne une cohésion à l'ensemble.

### Les supports en bois

Les pieds sont en très mauvais état et ont déjà été restaurés avec des vis et des plaques métalliques.

État des parties métalliques:

Absence des collures du solstice axe en métal tordu.

### Traitement des globes

Les globes ont été démontés et d'abord confiés à l'atelier de menuiserie.

Laboratoire

Au laboratoire de Recherche des Monuments historiques, ont été effectuées des analyses sur la composition du vernis, de l'enduit, des différentes toiles et de l'acidité du papier.

Les toiles sont composées de fibres cellulosiques lignifiées. L'identification se fait par l'observation microscopique des coupes transversales colorées au rouge de Ruthénium.

Résultats:

N° de toile	Armure	Nombre de fils/cm		Identification des fibres	
		chaîne	trame	chaîne	trame
1	toile	11	10	lin	lin
2	toile	14	14	lin	lin
3	toile	9	8	lin	lin
4	toile	9	9	chanvre	chanvre
5	chevron	10	12	chanvre	chanvre
6	chevron	9	12	chanvre	chanvre

La numérotation des toiles de 1 à 6 correspond à l'ordre de superposition, la toile 1 étant la plus interne de la calotte, la toile 6 la plus externe. Sur l'échantillon n° 5 de couleur grise, la coloration est externe à la fibre. Les toiles n° 7 et n° 8 n'apparaissent pas sur l'échantillon du globe donné au laboratoire. Elles ont été données séparément.

Résultats:

N° de toile	Armure	Nombre de fils/cm		Identification des fibres	
		chaîne	trame	chaîne	trame
7	toile	6	6	lin	lin
8	chevron	9	12	chanvre	chanvre

Analyse des constituants:

La coque supportant le papier, la colle de restauration du 19e siècle et le vernis de surface ont été analysés par fluorescence X, spectrométrie infrarouge et coloration spécifique sur coupes minces.

La coupe est constituée de carbonate de calcium encollé, communément appelé « Blanc d'Espagne » ou « Blanc de Meudon ».

La colle de restauration est une colle de gélatine rendue pratiquement insoluble par l'ajout de formol.

Le vernis de surface est un vernis à l'alcool ou à l'essence composé d'un mélange de gomme laque et de résine Dammar.

Cette approche permet l'identification des matériaux, la connaissance des techniques et contribue aussi à une meilleure compréhension des altérations et de leurs causes.

Nettoyage:

Un brossage délicat à la brosse douce est recommandé pour enlever l'excès de saleté et les particules de poussière ; les déjections de mouches sont enlevées mécaniquement à l'aide d'un scalpel.

Pour dévernir, le solvant employé est composé de 30 % de white spirit, 30 % d'éthanol et 30 % de Méthyl-éthyl-acétate. On a dissous le vernis à l'aide d'un tampon imbibé d'une petite quantité de solvant ; l'opération est répétée plusieurs



fois dans une pièce aérée et équipée d'une hotte aspirante. Il faut réduire le temps d'exposition au solvant, particulièrement nuisible à la santé.

L'opération terminée, la cartographie redevient lisible et les couleurs retrouvent leur éclat.

La manipulation des globes s'est révélée très difficile à cause de leur poids. On a fabriqué un bac en métal époxy de 1,50 m de côté et de 0,80 m de hauteur. Celui-ci est rempli de sable déshydraté (P6 de Bitumatic) afin de stabiliser le globe pour sa restauration et d'absorber l'excès d'humidité. Un tissu ouaté est glissé sous le globe afin d'éviter tout contact direct de ce dernier avec le sable.

### **Dépose des fuseaux**

Dépose totale des 24 fuseaux et calottes des pôles. Pour cette opération délicate, on a procédé à la vapeur. Les fuseaux étaient déjà doublés d'un papier journal (« L'Aurore ») lors d'une première restauration à la fin du 19<sup>e</sup> siècle. Papier pauvre en cellulose et riche en lignite, l'acidité a été absorbée par le papier vergé.

Après la dépose totale, on a procédé à la désacidification du papier gravé dans un bain de borax.

La restauration à plat a été faite sur une table lumineuse. Les fuseaux traités sont tendus et encollés sur du papier Bolloré 12g (papier fabriqué en France, à partir de fibres végétales agglomérées par un adhésif synthétique. D'aspect proche du papier japon, le papier Bolloré a été retenu pour les caractéristiques suivantes :

- faible hygroscopicité mais une excellente tenue à l'eau,
- perméabilité identique au papier japon,
- isotropie : taux d'élongation à l'humidité dans les deux sens identiques.

La chalcographie du Louvre ayant, coïncidence heureuse, conservé les plaques de cuivre originales, on a pu imprimer un jeu complet de fuseaux et de calottes sur un papier vergé ancien similaire.

Les lacunes sont comblées avec des morceaux prélevés sur les fuseaux, et les calottes disparues sont remplacées intégralement. Les déchirures sont comblées avec de la pâte à papier.

### **Restauration des boules de plâtre**

Le plâtre pourri, fêlé et effrité a été enlevé. Des morceaux de toile moisie ont été prélevés et désinfectés en autoclave.

Pour la perforation de la boule du globe céleste, on a utilisé du matériel thermoplastique. On a découpé, dans une plaque perforée de 2 mm d'épaisseur, les contours préalablement déterminés à l'aide d'un carton. Puis, on a baigné ce morceau dans de l'eau chaude (environ 55°C). Après quelques minutes, la matière devient transparente et il suffit alors de la placer sur une partie saine du globe pour que cette dernière épouse instantanément la forme et puisse durcir. Le moule est placé à l'intérieur de la boule abîmée. Grâce à une source de chaleur (sèche-cheveux) il adhèrera immédiatement, renforcera ainsi la brèche du trou et facilitera la restauration.

Les toiles éclatées, déchirées, sont cousues puis renforcées par une bande plâtrée.

Le mélange de plâtre utilisé est spécialement conçu de manière à se rapprocher le plus possible de l'original : une part de peau de lapin, une part de blanc de Meudon, une part de Kaolin. Ce mélange est déposé en fines couches successives à l'aide d'un gabarit. Les fissures sont alors agrandies, assainies et comblées avec du plâtre dentaire.

Une fois le plâtre sec, on ponce plusieurs fois à l'aide d'un papier de verre en commençant par le grain le plus fort pour terminer par le grain le plus fin. On obtient ainsi une surface parfaitement lisse et uniforme.

Des feuilles d'acétate, très fines, sont collées (collasine) sur l'ensemble du globe, puis également poncées. Cette opération importante permet d'isoler le plâtre du papier.

### **Repose des fuseaux**

Cette opération délicate demande une grande dextérité, le papier s'étant légèrement allongé.

On a tracé méticuleusement sur le plâtre l'emplacement des fuseaux préalablement numérotés. On a encollé la moitié de la sphère puis positionné les fuseaux légèrement humectés. Ce travail doit être effectué rapidement, avant le séchage de la colle afin de permettre un bon ajustement. Ensuite, on applique l'ensemble à l'aide d'un plioir avec un papier intercalaire. On laisse sécher 48 heures avant d'effectuer la même opération sur l'autre moitié du globe.

### **Réencollage**

Une fois les restaurations sèches, le globe a été préencollé à saturation avec une solution 2 % de méthylcellulose. Cela évitera au vernis de pénétrer à nouveau dans le papier et fixera les couleurs.

### **Retouches**

Les restaurations sont simplement mises au ton. On vernit une première fois le globe, puis on effectue les retouches.

### **Revernissage**

Le globe a été reverni avec deux couches de vernis gomme laqué qui sont facilement réversibles,

### **Conservation**

Il a été fabriqué une cloche en altuglas d'un diamètre légèrement supérieur au globe ainsi qu'une table d'horizon en altuglas bleuté, le tout supporté par quatre pieds, également en altuglas.

Cette protection est complètement indépendante de l'oeuvre et la protégera contre les retombées de poussière et d'éventuels chocs.

### **Conclusion**

Il a fallu cinq mois de travail à cinq restaurateurs spécialistes, ce qui représente plus de 2 000 heures de travail, pour mener à bien les opérations de restauration de ces deux globes.

Les deux globes ressuscités sont désormais exposés dans le nouveau musée des Beaux-Arts de Lille.

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## **RESTORATION OF LARGE SIZE DOCUMENTS AND THEIR DUPLICATION ON A TEXTILE BASE**

**By L. P. Ivanova**

**Abstract:** There is a considerable quantity of documents of space information (maps, diagrams, draughts, plans, etc.) in the Federal Archives of Russia.

These documentary materials have large injuries of mechanical character, soiling, old sticks and destruction of the basis. Their treatment is very complicated because of a large surface to restore. Usually, for the restoration of such documents, was used a duplication of their medium on a mycalent paper base. Such a method is rather good for documents of a small surface that do not need folding after their restoration. Otherwise, we can see cracks and breaks in the places of the bends of mycalent paper.

We use the duplication of the documents of large size on a textile base of 100% cotton to increase the quality of their restoration. The developed method is used for 2 years and, by the present time, there are only positive references of the archivists as to the method.

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## **AUTOMATIC SYSTEM FOR COPYING AND RESTORATION OF TELEMETRIC IMAGES**

**By A. N. Balakirev, N. E. Moskalenko, Kh .G. Tadjidinov**

**Abstract:** Since 1959, more than 20 launches of Russian, automatic interplanetary stations producing photo-TV surveys of the Moon, Venus, Mars and Phobos surfaces have been made in Russia. Images received were transmitted by radio link to the Earth and were written on magnetic tapes. The main feature of the phototelemetric data (PTD) is in their uniqueness.

In connection with that, a task has been set up before in RSDSRC to provide the PTD safety by means of rewriting documents on new magnetic tapes in the digital standard format, and the task of partial restoration of visualised photo-TV images. The automatic system of processing of PTD (ASPPTD) was made for that purpose as the soft-hardware for the digital processing of the PTD.

The digital restoration allows to remove various defects, including :

- gradation defects (distortions in visualisation of optical density,
- frequency-contrast ones (disturbances of image sharpness),
- colour defects,
- local (in the form of dust, scratches, strips and dots) defects.

A restoration of unique photo-TV images of the surface of the Moon, Venus, Mars and Phobos were made by means of the ASPPTD.

The information of the image files is contained in the database MAGTYPE.

At the end of the 1980ies, the Russian Space Documentation Scientific Research Centre (RSDSRC) developed and put into industrial operation the Automatic System for Processing of Photo-telemetric Documents (ASPPD), aimed at visualisation, restoration and copying for security purposes (in digital form) of the data fixed in these documents (1).

Phototelemetric documents (PTD) are the images of the surface of natural space bodies (Moon, Venus, Mars, Phobos) transmitted from space vehicles to the Earth by radio link in the form of coded radio signals and written on magnetic tapes. Such information also can be called « phototelevision image » ; this term is used in various sources for this type of telemetric documents. Since 1959, more than 20 launchings of space vehicles producing the phototelevision shootings of the

surface of these space bodies has been made in our country. The information which had been received is unique and have a great importance for the development of modern space techniques, space explorations and planetary physics.

The PTD adopted to the state storage in the RSDRC had been received from 22 space vehicles from 1959 up to 1987. In spite of special measures taken during the transmission of radio signals from space vehicles to the Earth (pulse-code and frequency modulation), there are various defects in the PTD caused by radio-technical interferences, such as errors, noises, attenuation of the level of legitimate signal.

Moreover, many photos of the Moon and Mars are of insufficient contrast, lowered definition and irregularity of background. There are pulse noises in the most part of signals ; these noises cause image defects, which are analogous to the presence of dust and scratches.

Because of the line-by-line transmission of telemetric data, the sound background of signal becomes non-isotropic (the noise level is different in two neighbouring lines when the correlation in two neighbouring points of the same line is high). The records were made at non-standard equipment in different formats. The long-term storage in unsuitable conditions led to damages of many magnetic tapes, such as breaks, warnings, crumbling of magnetic layer.

This is why for the conservation and further use of PTD, it was necessary to rewrite them on new magnetic tapes in the single standard format, to visualise them (to form lines and stills of images) and to restore ; all this allowed to get more full and qualitative data about transmitted stills of images. The RSDRC adopted to storage PTD with various types (analogous and digital) and parameters (characteristic of frequency modulation, format of digital coding) of records. Hardware and software of the ASPPD allow to bring all the PTD into the single digital form in the Unified System of Computer Standards, which widens the circle of the consumers of phototelemetric information as much as possible.

Analogous frequency-modulated records are preliminary processed at the demodulator. Then, the videosignal is subjected to the numbering at the special electronic computer by analogous-to-digital converter (digitaliser) and recorded in standard form to the magnetic tape; the recording can be made in the form of a video file. The PTD initially presented in digital form are brought to the standard format with the help of specially developed re-coding programs.

The hardware of the ASPPD is divided into the following subsystems:

- reproduction of the initial data,
- demodulation, numbering, conversion and recording of data,
- visualisation and restoration,
- copying for security purposes in the single digital form.

The software of the system which is processed at the RSDSPC contains:

- system of programs for numbering, re-coding and rewriting of phototelevision images ;
- system of programs for visualisation and restoration of images.

For the visualisation of images with the help of colour half-tone display of high resolution, the scientific workers of the RSDRC developed the programs for data transformation into video files (each element of image is presented as a number in diapason from 0 up to 255) and for the forming of geometrically correct image stills, from the continuous line-by-line record of the signal on the magnetic tape.

This system allows to realise the restoration processing of images on the electronic computer both in automatic and in interact regimes (2).

The analysis which had been carried out during the development of this system allowed to divide the defects of telemetric images into the following groups :

- geometrical ones which determine the distortion of image form,
- gradation ones which determine the distortions of optical density,
- frequency-contrast ones which distort the image sharpness,
- colour distortions,
- local ones, in the form of little spots, strips and scratches.

The restoration processing of phototelemetric images consists of the following operations :

- analysis of the defect with the help of the electronic computer and the timation of mathematical models parameters,
- choice or processing of mathematical methods (algorithms) for the defect elimination,
- defect elimination with the help of programs which realise the chosen algorithms,
- visual estimation of the restored image on the display screen,
- output of the received image to the photographic film and its recording on the magnetic tape.

The defects analysis by the means of electronic computer, the estimation of the mathematical models parameters and the choice of the algorithm for defect elimination are the very important stages of the automated restoration of phototelemetric images. The defects are estimated by their quantitative characteristics ; for example, the gradation defects are ascertained by the histograms of the optical density distribution ; the sharpness defects by the wideness of the blurring zone in the image of object which had earlier sharp contours.

The ASPPD software realises various algorithms for the elimination of each type of defect. The result of restoration depends directly on the correct choice of the algorithm.

The elimination of defects by the means of special programs is carried out on the basis of the numerical value selection of the processing parameters. The estimation of parameters is carried out by the test restoration of image and by the operative representation of mathematical conversion results in the visual form on the display screen. After the choice of programs and the experimental estimation of their parameters, all the images are processed on the electronic computer and, then, the visual analysis and estimation of the received results are carried out on the display screen.

The output of restored image to the photographic film is realised by a special arrangement for photographic images output.

By the means of the ASPPD, the scientific workers of the RSDRC carried out the restoration of phototelevision images of surfaces of the Moon in different foreshortenings (including the first images of it's reverse side (3)), of Mars and Venus (these images were transmitted to the Earth by the Soviet automatic interplanetary probes in 1959-1982) and also of Phobos (1987). The restoration consisted in the filtration of pulses and strips, the elimination of local defects and noises and the scale transformation.

After the restoration we may note the defect elimination and a considerable improvement of the quality ; all this allows to unmask a number of details which had been invisible before.

Further development of the space filming equipment led to the necessity of additional software processing for the restoration of modern phototelevision images ; for example, these ones which had been transmitted from the « Phobos-2 » automatic interplanetary probe (1987). In this case, the survey was carried out by the arrangement with charge communication ; it led to a considerable



heterogeneity of background in the image stills. Earlier, this defect could be eliminated in the ASPPD with the help of the momentary or double signal processing by the one-dimensional recursive filter (4). But because of the fact that Phobos images turned out with a very important contrast and with very sharp contours, such processing proved to be unacceptable.

The researches showed that the background for such images could be presented in the following form:

$$D = G(x, y) = a + a_x x + a_y y + a_{xx} x^2 + a_{xy} xy + a_{yy} y^2 \quad [1].$$

where  $x, y$  = Cartesian coordinates on the image ;  $a - a_{xx}$  = coefficients which are constant for all the points of the given still.

These coefficients can be determined by the method of least squares by the image brightness taken in sufficiently large number of points (not less than 12) which are distributed at the still evenly. During the selection of points, it is necessary to avoid the specific places with very dark or very bright elements. The method of least squares allows, not only to find the coefficients, but also to estimate their exactness. The image at the given still can be presented as a certain function of coordinates, in the following form :

$$I = F(x, y) \quad [2].$$

Then the calculation of background heterogeneity can be described as the difference :

$$I = I - D + C = F(x, y) - G(x, y) + C \quad [3].$$

For the digital images, the calculations by the formula [3] come to the point-by-point subtraction of background brightness found by the formula [1] from the initial background brightness and to addition of the empirical constant  $C$ , for the being of received brightness  $I$  in necessary diapason (from 0 up to 255).

Such processing was carried out for 14 Phobos images and it showed the considerable improvement of images quality. The little details which earlier had been masked by the background heterogeneity now became visible.

For the preservation of information about PTD, the ASPPD laboratory created (on the basis of « dBASE IV » system for database control) the MAGTYPE database ; it contains various information about visualised stills of photo-television images which were restored in this laboratory and are kept at the RSDRC (a tape number, a file name, dimensions, date of restoration etc.). It is possible to turn to this database with the following inquiries:

- data selection at the files of visualised PTD stills (at concrete file, at a few ones, at a few files with given parameters),
- data selection at the other database attributes (at concrete ones, at a few ones and at a few ones with given parameters).

Further development of the ASPPD will be carried out in the direction of rise of the level of automation for the restoration on the basis of personal computers and broadening of the opportunities for the using of this system for the processing of phototelemetric documents which are not phototelevision images. Such documents are also taken to the state storage in the RSDRC. The uniqueness and the historicity of PTD demand to process the new software for its thorough scientific study and analysis of the development of physical processes in the Solar system by the means of comparison of the images received in different time.

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## NEW PROTECTIVE LAYER FOR CARTOGRAPHIC PRODUCTION

By **O. V. Portnova, N. G. Barabanova, A. V. Pebalk, I. Ye. Kardash**

**Abstract:** The process of coating moistureproof poly-para-xylylene (PPX) layers by vacuum-deposition on cartographic production manufacturing on various kinds of materials (various sorts of paper, synthetic film, materials, photopaper) is developed.

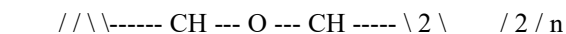
High protective properties of PPX-coatings from the influence of external factors (humidity, solutions of salts, acids, alkalis etc.) are marked.

Physico-mechanical properties of cartographic samples on the basis of paper with PPX-coating have been investigated, their improvement in comparison with unprotected samples has been established.

Investigation is carried out on the base of assortment of cartographic production of Moscow Aerogeodesic Enterprise. The conclusion is done, that the use of PPX-coating for protection of cartographic production on the basis of paper will allow to prolong essentially the time of its service both in the fields and in the room conditions and also to improve its aesthetics appearance.

In conditions of new economic relations home and foreign markets of cartographic production can be won on conditions of improvement its aesthetics appearance, operation properties and increasing the period of its exploitation. New opportunities in the decision of these tasks are opened thanks to the development the technology of deposition moistureproof poly-p-xylylene (PPX) coatings on the samples with various nature of their surface.

Poly-p-xylylene represents itself aromatic polymer which molecular unit consists from benzene ring and two methylene groups para-position :



Various derivatives of PPX with substitute groups in benzene ring as well as in methylene groups are known.

Thanks to it excellent dielectric properties, high resistance to most solvents and corrosives (oxides of nitrogen, sulphur, etc.), dimensional stability and very low

permeability PPX-coatings and its chlorine substituted derivatives find today application for protection of printed boards, integrated circuits, hybrid circuits and other devices of radio- and microelectronics.

PPX films and coatings one can received by the process of gaseous pyrolytic polymerisation of cyclic di-p-xylylene ([2.2] - paracyclophane) which is a white, crystalline organic substance with melting point 285 - 287°C.

In Moscow Aerogeodesic Enterprise and Karpov Institute of Physical Chemistry, the investigations were done concerning the possibility of forming of PPX-coatings on the surface of cartographic production manufacturing on various sorts of paper and new properties which it received in the result of this process.

The process of forming of PPX-coatings on samples of cartographic paper of various sorts and fragments of reprints of topographic maps was carried out on automated vapour deposition equipment « Š-400 » which was worked out for protection of printed boards and other devices of radioelectronics. The largest size of plane device which one can coat on this equipment is equal to 250 x 300 mm with the total square of the surface 300 sq. dm.

The samples of cartographic paper with PPX-coating showed high protective properties during their standing in atmosphere with relative humidity 98 % for 72 hours, immersion into water for half an hour, standing in atmosphere of organic solvents (acetone, ether, hexane, etc.) for 24 hours, immersion into dilute solutions of common salt, sulphuric and hydrochloric acids, sodium hydroxide for 5 - 10 minutes.

After these tests, no swelling, no destruction or colour change of the samples were observed under visual observation.

Physico-mechanical properties of cartographic samples from paper of the grade « A » and « B » with the 100 μ thickness of each sample were investigated. The protection of these samples with the 1,0 μ PPX-coating led to strengthening and increase elasticity of the paper approximately twice in comparison with unprotected samples.

Linear deformation of various grades of cartographic paper was determined by measuring changes of the dimensions of the samples of the paper after influence on them by water and following drying in accordance with standard 6780-89 « Methods of determination of lines deformation ».

Linear deformation was determined after treatment by :

1. Water
2. Water and air at the temperature 23°C

## 3. Water and air at the temperature 60°C

Analysis of the results point to that the character of linear deformation for all grades of cartographic paper after its protection with PPX-coating remains previous : lengthening of dimensions under wetting and shrinkage - under following drying. The value of transversal linear deformation of paper with polymer coating was 2,5 - 3,5 times lower compare with unprotected paper.

After drying at the temperature 60°C, the shrinkage of the paper with PPX-coating becomes more uniform in longitudinal and transversal directions and it does not exceed 0.2 % for all grades of cartographic paper.

Investigation of the humidity of cartographic paper was done in accordance with standard 1352519-71 « Methods of determination of humidity ». The essence of this method is based on determination of the loss of the mass of the samples under drying to constant mass. The protection of cartographic paper with PPX-coating decreased its humidity on 0,5 - 0,7 %.

Investigation of whiteness of cartographic paper was done in accordance with standard 7690-76. The method is based on measuring optical density in dark blue region of the spectrum at the effective wave length 457 nm. The powder of barium sulphate as standard sample for determination of whiteness was used. Investigations showed that the value of whiteness for the samples of the paper of the grade « A » and « B » with PPX-coating does not change compare with unprotected paper and is equal to 87 %. For the paper of the grade « B » with PPX-coating the value of whiteness is equal to 85 %.

The test on sunlight stability of circulation reprints of topographic maps with PPX-coating to influence of sunlight, change of temperature and humidity was done by express-method with the help of technical means, which imitate the influence of nature factors in the conditions of map storage in room conditions beyond room window glass. For making accelerated tests the device « Xenotest-450 » of firm « Heraeus Original » (Germany) was used. With the help of this device daily changes and influence of such nature factors as light, temperature and humidity of air on paper samples were initiated in automatic regime by the help of special rule-program. As the source of light xenon-lamp of 4,5 kW power with intensity of radiation 64 W/sq. m in the region of wave length 280 - 400 nm was used.

During the tests, the next parameters were chosen : temperature of the air - 23°C, humidity - 60 % (corresponding to conditions of working apartments). Insulation of the samples on the device were carried out during 30, 80 and 185 hours, which

is corresponding to 2,5 and 12 years of influence on the samples of natural factors in the conditions of working apartments. Cartographic paints of 2 558 series, which are usually use for printing circulation reprints of topographic maps, were tested. The basic colours of paints were investigated: black (2558-01), greenish-blue (2558-38), light-brown (2558-61), orange (2558-10) and green (2558-43).

The samples of cartographic paints and fragments of circulation reprints with polymer protection and without PPX protection layer were tested.

Stability of cartographic paints was determined by their visual estimation after insulation according to eight-mark system with the usage of standards (for determination of stability of paints) of dark blue textile materials according to standards 10761-75 and 9733.0-83. Furthermore, the stability of cartographic paints was determined by measurement on densitometre behind various light-filters optical density of initial samples and the samples after insulation during 30, 80 and 185 hours. It was established that both method - visual and sensitometric - give identical results and can be use to estimation the stability of cartographic paints.

PPX-coating has high chemical stability, it does not interact with five investigated paints, it does not change their colour balance and density. After 80 hours of insulation of samples decreasing of paints density was observed and in less extent in the samples with PPX-coating protection. Process of ageing of polymer layer was observed after insulation of the samples during 31 hours.

Among the cartographic paints of 2558 series the largest stability to light have black and greenish-blue paints with large format files and the case is kept separately from the file. These cases are lately used for packing and storing of suitable-size maps.

The samples of cartographic production with protection from PPX-coating differ by high aesthetics properties : flat surface without folds, wrinkles, dents, mat surface without patch of light and shades, higher smoothness, etc.

So as the result of the presence of PPX-coating, the samples of cartographic production receive new properties such as increase of strength, moistureproof. Cartographic documents of a large format such as atlases, wall and educational maps become more uniform in longitudinal and transversal directions and it does not exceed 0.2% for all grades of cartographic paper.

So the usage of PPX-coating is the way of creation of low deformed cartographic production with aesthetics appearance on the low-grade cartographic paper. In

some extent, this technology process can substitute the process of lamination of demonstrative, wall and educational maps.

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**AUTOMATED SYSTEMS FOR CARTOGRAPHIC  
INFORMATION RETRIEVAL USED IN CARTOGRAPHIC  
INFORMATION SERVICE DEPARTMENT OF THE  
MAPPING PRODUCTION ASSOCIATION  
« KARTOGRAPHIA »**

**By Natalja B. Yegorova, Yev. Gonsovsky, L. Antonova**

**Abstract:** Cartographic Information Service Department of Mapping Production Association « Kartografia » disposes of two systems destined for information search about :

- cartographic sources (maps, charts, atlases, etc.),
- features to map out (settlements, power plants, sea ports, airports, protected areas etc.).

Software has been implemented by Gbase Data Base Control System with adoption of Turbo Pascal Language.

Hardware is represented with a computer IBM PC/XT. Data output is issued in two operations :

- on user's demands when they may request any combination of retrieval keys,
- under catalogue arrangement conditions either in standard, or in arbitrary orders.

Cartographic Information Service Department (OSKS), incorporated in Mapping Production Association « Kartografia » (PKO « Kartografia »), disposes of two automated system intended for information retrieval about :

- cartographic sources (maps, atlases, reference materials, etc.),
- mapped features (settlements, electric power stations, airports, etc.),

These systems furnish data for personnel of :

- PKO « Kartografia », for purposes of map compilation and up-dating which are effected by the editors and other specialists with the use of a cartographic information,
- OSKS, for solutions of sample statistic problems, of matters with map depot stocks, of questions of cartographic documents selection for exhibitions, conferences, etc.



- Federal Service of Geodesy and Cartography of Russia (to serve the objectives of making of management decisions).

The above-cited systems could be used in potentiality by the cartographers working in the field of science and technology, and also by the specialists of building construction, exploration of mineral resources, ecology, planning, etc.

The automated system for retrieval of cartographic document information (so called KADIPS) is intended for data gathering about cartographic sources and operates on the bases of the following concepts :

1. The KADIPS data base includes information about the main cartographic sources presented with the maps and atlases being edited by the Federal Service of Geodesy and Cartography of Russia (one copy is sent without fail to OSKS address), and also the foreign cartographic publications demanded by the specialists of PKO « Kartografia », and proceeding from production requirements; these creations are purchased abroad.

In addition, the KADIPS data based includes the bibliographical description of a cartographic system (approximately 4 000 units), stored in the depot of the Russia State Library. In 1991, PKO « Kartografia » has completed the works regarding the bibliographical records conversion into the KADIPS format.

At present, the data base amounts 17 000 record units.

The information supplies are carried in the form of :

- maps and atlases catalogues with indexes (see Supplement 1,2)
- request grants with print out of the complete or condensed document description (see Supplement 3)
- information bulletins of the new accessions (see Supplement 4)
- before-mentioned information forms are recorded on the diskettes. The database for cartographic sources with software and instruction manuals are also offered for the markets.

The cartographic source description is executed on the bases of the descriptive language for information retrieval which was worked out for KADIPS specially and implemented with the « Thesaurus for information retrieval of the cartographic sources under territorial attribute », V.1, M.,1987 and the « Thesaurus for information retrieval of the cartographic sources under the map contents and projections », V.2, M.,1987. The using of the descriptive language for information retrieval with reflection of the generic, specific, synonym and associative connections between the significant information retrieval concepts such as area, contents and projection, ensure a single description of the sources

and then, push up the effectiveness of the required information retrieval. This is the example of the descriptive classes :

- 1 193 SEA WATERS DINAMICS
  - ☞ SEA AND OCEAN WATERS (192)
  - WIND-DRIVEN WAVES (195)
    - SEA AND OCEAN CURRENTS (197)
    - TIDES AND LOW-TIDES (199)
    - TSUNAMI (200)
  - II PERILOUS NATURAL PHENOMENA (385)
  
- 2 4989 IONIAN ISLANDS
  - ☞☺☺ Zakynthos (Zante) I.
  - Kerkira (Corfu) I.
  - Kefallinia (Cephalonia) I.
  - Sevkas I.
  - ☞ GREECE (4980)
  - II IONIAN SEA (1235)
  
- 3 53 CENTRAL PROJECTION
  - gnomonic
  - ☞ AZIMUTHAL (1)
  - II ORTHODROMIC (36)
  - PERSPECTIVE (38).

where « ☞ » designates correspondingly generic, « ● » specific, « II » associative, « □ » and « ☞☺☺ » synonym connections.

A number of concepts in the language for information retrieval amounts accordingly for the aspect « area » (6 000 units), « contents » (about 800 units), « projection » (approximately 200 units).

The language for information retrieval also includes, with a view of a list, the terms through the following aspects:

- form of a source (65 units),
- bibliographical standard (14 units),
- source pattern (20 units),
- purposes (36 units),
- relief representation method (25 units),
- language of an explanatory text (115 units),
- place of publication (country) (205 units),
- publishing house (600 units),
- surveying method (14 units),
- place of storage (300 units).

All above-cited aspects are under the retrieval besides the description format includes : « Title of the cartographic sources » (unretrieved key), « Scale », « Year of publication », « Coordinates », « Nomenclature », « Feature name » (retrieval keys).

All these keys form, in the whole, the retrieval image of a document and present the complete characterisation of the searched source. The memory capacity of the retrieval document image makes up 500 bytes. The demand for information retrieval could include either one or several retrieval keys in different combinations.

Practically, the number of the retrieval keys for a demand do not exceed 4 or 5.

The retrieval directions for a demand are being formed by means of the corresponding codes of the retrieval keys connected by the characters of the logical functions, also by the characters « equally », « more », « less », « unequally », « fall within an interval ». For example, the retrieval directions for the demand « Comprehensive atlases for the Africa territory » published from 1980, will be presented in the following way :

TR = 6000 & SD = 901 & VD = 1 & GP = 1980-1993.

Taking into account that some retrieval keys of KADIPS could have cartographic sets (for instance « year of publication », « area », etc.), it is provided that the information alternative is possible with first description of each block. It makes possible the choice on inquiry of priority information by called keys (of basic territory, basic contents, etc.), which code is indicated at first in accordance with the indexes regulations.

The most characteristic requests to the system are e.g. :

- Germany's cartographic documents retained in PKO « Kartografia »,
- tourist maps of UK publication
- cartographic materials published in 1985-1992, for the USSR territory with the following contents : vegetation, nature protection, soils, and stored in PKO « Kartografia ».

The KADIPS software is designed on the basis of the control system by database with usage of Turbo Pascal 6.0 language, and is intended for service in the operation conditions of the system MS-DOS of the edition 3.0 and more, which is functioning with PC/XT/AT and other overlapped computers.

The system GBASE makes available to carry out the following applications :

- data input and correction,
- data removal from the base,
- creation, correction and conduct of the vocabulary system (thesaurus),
- data selection from the base in line with specified criteria,
- catalogues formation and their read-out to a printer,
- catalogues index set-up and their output to a tape punch,
- data output without systematisation (responses on the demands).

2. Now, OSKS also implements the works on the creation of a factographic database for the following catalogues :

- electric power plant of the World countries (5 000 units),
- airports of the World countries (2 000 units),
- sea ports of the World countries (2 000 units),
- protected areas of the World (4 units),
- populated places of the system work formation countries (20 000 units),
- cites of the World over 1 000 000 inhabitants (160 units),
- settlements of the World countries and their capitals (about 200 units).

By this time, the database for the initial three above-mentioned catalogues has been created.

The software and hardware are the same as used in the case of the KADIPS system.

The list of basic retrieval keys for every mentioned system are cited below:

- Electric Power Plants - type, capacity, fuels, number and capacity of the power sets,

- Airports - name of city served by the airport, latitude, longitude, status, category,
- Sea Ports - category, freight turnover, latitude, longitude,
- Protected Areas - kind, surface area, latitude, longitude, administrative unit name of the first order,
- Populated places of the CIS countries - administrative significance, settlement pattern, year of foundation, number of inhabitants, map nomenclature, names of district, region, dates of decrees on renaming, abolishment, transference.
- Cities over 1 000 000 inhabitants - number of inhabitants, latitude, longitude.
- Settlements over 2 000 inhabitancy - status, number of inhabitancy, latitude, longitude, administrative units of the first and second order.
- Area and population of the World Countries and their capitals - area of a state, number of inhabitancy of a state, name of a capital, number of inhabitancy of a capital.

The names of the continents, countries, features are keyboarded in Russian and Roman alphabets for every system. The retrieval keys imply the title of cartographic and monographic sources which provide the proper information, some descriptive attributes, the parameters defining a feature position.

The program makes provisions of modifications output for every retrieval key in 2 variants, concerning a feature : either all modifications (e.g. settlement renaming, variation of the sea port turnover etc.), or data output applied only to a latest change (see Supplements 5,6).Information for every factographic system could be presented in the form of a catalogue of standard or unspecified mode, which is systematised by the territorial attribute. In case of name change, the user is referred to a new name (see Supplements 7,8).The program allows the factographic data base exportation in the format DFB.

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**RESOLUTION OF THE SCIENTIFIC AND PRACTICAL  
SEMINAR « PRESERVATION OF MAPS AND OTHER  
SPATIAL INFORMATION »  
30 SEPTEMBER 1993, MOSCOW, RUSSIA**

On the initiative of IFLA's Section of Geography and Map Libraries, and with the help of the Preservation and Conservation Core Program, a scientific and practical Seminar « Preservation of Maps and other spatial information » was held in the Russian State Library in Moscow, from 26 September to 1 October 1993.

Specialists from Russia, France, Germany, Latvia, Czech Republic, and other countries took part in the work of the Seminar.

The organizers of the Seminar were the Russian State Library, the State Archive Service of Russia, Production Association « Kartografia », State Geodetic Service of Russia, several libraries and research institutes.

The Seminar's work showed that, in Russia, the depositories are not properly equipped for the long lasting storage and use of valuable unique documents. There is a shortage of room for arranging the storage of collections. Special equipment for copying the large-scale and multicolored materials and making a close stock and a stock for urse is urgently needed.

As a result, the opportunities of storage of cartographic documents in Russian libraries are not map and other spatial information equipment, so functional and appropriate furniture and equipment is required.

The system of training and education for document restorators does not exist in the country, so the creation of a special training course for map restorators is an urgent goal to reach.

At present, the storage of spatial information shows the necessity of making the long-term program for its preservation. It is the main goal that should be the creation of the non traditional information media stock, school of restorators and the system of interaction in the field of restoration and usage of spatial documents.

The Seminar thanks IFLA, the Section of Geography and Map Libraries and the PAC Core Program for their expertise and hopes for a further collaboration.