

Historic Materials and Their Diagnostic in Lithuania

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1. Abstract

Historic building materials and their investigation and close cooperation among conservation scientists and restorers in the field of preservation of cultural heritage are surveyed in the article.

2. Introduction

Lithuania is situated in the East of the Baltic Sea. The neighbouring countries are Latvia, Byelorussia, Russia and Poland.

The capital of Lithuania is Vilnius, one of the country's oldest and finest cities.

Geographic situation of cold and wet climate predetermined the remains of our cultural heritage. The cultural monuments in Lithuania are made of relatively short-lived materials that are vulnerable to climatic changes. Lithuania is not rich in natural stone, so the main local construction materials were timber, clay, fieldstones, lime and its products. That is why we have so many products made of wood, clay and artificial stone based on the lime technology. The clay was used for producing bricks, tiles and domestic goods and rarely enough, mixed with the cut straws, clay was used to build utility buildings in the farms.

Lithuania had registered about 19 000 objects, complexes and sites of cultural heritage. The most significant and numerous part of heritage of wooden architecture is vernacular: homesteads of peasants and estates, sacred buildings, memorial monuments, crosses and small chapels in the countryside.

The major part of the heritage in the cities are masonry buildings: castles, churches, palaces, dwelling houses, engineering structures (defensive architecture, bridges) and so on.

On the list of cultural heritage there are 62 urban monuments-towns and small towns. Historical buildings were often designed by professional architects and reflected local stylistic trends of a concrete period (czarist Russia and European stylistic trends). The most distinguished is the Old Town of Vilnius.

In 1995 the Old Town of Vilnius was inscribed into UNESCO World Heritage list and represents the artistic endeavour of many generations.

3. Historical Survey

The first buildings in our country were made of wood (timber) in the beginning of the second millennium. The remains of these buildings can be only found in the archaeological excavations.

In the 13th century the first brick buildings were constructed. They were built of stones and bricks. The bricks were bound with white-lime mortar and brown lime mortar using the Baltic method of brick lying (manner).

Since the 14th century the Gothic buildings made of red bricks dominate in the country. The interiors are mostly decorated with mural painting. In the 16th century the most beautiful Gothic Saint Anne's church in Vilnius was built of red profiled bricks.

In the 16th century the Renaissance style buildings were already plastered. We can also find many facades decorated with mural painting (including the sgraffito technique). The interior vaults were decorated with modelling. One can find many examples of sculptural decorations of natural marble.

The first Baroque buildings were built in the 17th century. The buildings were plastered and decorated with mural paintings and white or polychromic stucco mouldings. The imported natural marble from Italy was used for finishing in the church Pazaislis.

The St. Peter's and Paul's church is the richest example of Baroque architecture not only in Lithuania, but in the whole Baltic region as well.

In the 18th century the buildings of Neo-classical style were plastered, decorated with mural painting and stucco polychromic modelling. Gypsum plaster was also used in decoration.

Since the second half of the 19th century the buildings of historical styles (except the Neo-gothic) were plastered and richly decorated with mural painting and modelling. The gypsum modelling was used not only in the interiors but in the exteriors as well.

The metal art objects were used in historic exteriors and interiors in all times.

The use of cement was very early (approximately in the middle of the 19th century). It was imported from England or Russia. The concrete was started to use in 1913.

4. Historic materials and crafts

The historical sources about the developed system of the guilds and still existing examples of historic buildings and finishing prove the high level of craftsmanship in Lithuania. The various techniques of plasters, various types of paints, mural paintings, stucco modellings (ornamental plaster), gypsum mouldings, various techniques of artificial marble, sandstone and metal plastic art, gilding and silver plating; painted imitations of precious materials (e.g. precious woods or marble); wood art objects layered with metal coverings can be found in our historic buildings.

Many of the buildings and decorations were made by professional architects, sculptors and painters from Western Europe. These artists brought the new technologies to Lithuania.

During the ages the craftsmen tried to protect the surfaces of materials by using natural preservatives. The wooden surfaces were burnt, treated with wax, varnished or painted. Masonry buildings were plastered to protect masonry, and painted to protect the plaster and for the aesthetical reasons. So the traditional materials were used in building, reconstructing and conserving the historic buildings until the middle of the last century.

5. Research and Conservation works 1950-1990

After the Second World War the problem of rebuilding and reconstructing the demolished historic buildings appeared. In 1950 the Scientific Workshop of Restoration - the first institution of conservation in Lithuania was established. Architecture researchers, constructors and art historians were employed there. The need and the idea to establish a department of technical research appeared.

In 1970 the laboratory of chemical research was founded. The specialists of chemistry, physics, biology and technology of building materials worked in the laboratory. In 1972 the research groups of timber, monumental painting, and silicate materials were completed. During the 20 years of activities the laboratory developed the complex methods of research. In 1987 there worked 20 professionals (2 of them were doctors of sciences).

Since the beginning of conservation works in Lithuania, the major part of research work was carried out in the field of architectural surfaces. Since the foundation of the Laboratory the activities were focused to:

- Identification of historic materials: masonry-binding brick and fieldstone, plaster, paint receiving layer, painted layer, protective layer
- Identification of historic techniques,
- Damages, deterioration or alteration of historic materials,
- Substantiation and selection of conservation materials and methods,
- Recommendations for the conservation-restoration works,
- Inspection of the quality of conservation works.

Department of Technical Research applied different methods of research: chemical analysis, petrographical-mineralogical, X-ray diffraction, spectral, chromatographical, micro-chemical analysis of pigments and organic bindings, artificial aging (climatic chamber); biological-mycological research; physical research of building materials; monitoring of microclimate regime of some historic buildings. Some of the research was carried out at the Institute of Geology.

The experimented methods of conservation were tested in practice as well (cleaning washing, mechanical cleaning, chemical cleaning), desalination, consolidation, preservation of surface), The practice was based on the composition of historic materials, the existing physical condition or the character of destruction, and on the principle of reversibility. We operated together with the technologists of restoration when applying all the new methods. The role of restoration technologists was always very important in the protection of heritage objects, since we did not educate conservation or restoration specialists in Lithuania until 1998.

The Research Group of Timber made biological and microbiological research; identified the phytopathogenic origin of the fungi; prepared the projects of timber conservation for every object under restoration. All the known materials and methods of antiseptics were tested and individually chosen for every object (e.g. the methods of panel, cold bath, cold and hot bath, spraying-painting and fumigation). Practice had proved that not all the methods were suitable for timber conservation, because of the high toxic level or the difficult method of application. The group developed the methods of impregnation and conservation of moss, tow, straw and reed roofs for Lithuanian Skansen museum. The group also dealt with the problems of conservation of historic architectural timber (Skansen buildings, Baubliai museum, wooden crosses, etc.); biologically living wood (Stelmuze oak tree) and archaeological timber (arsenal of the lower castle in Vilnius).

The Research Group of Monumental Paintings researched and identified mural paintings and painted pictures of different periods and techniques and the character of destruction. The group have tested and applied many new materials and technologies for gluing the layers of paintings, consolidation and protection of surfaces. The group investigated the conservation materials and the causes of their aging; or the influence of the atmosphere. The group prepared recommendations for the conservation and restoration of painting. The major objects were Pazaislis church and convent, Vilnius Cathedral, the All Saints' church, St. John's church, Bernardines' church (all in Vilnius) and Vilnius University.

6. Composition of historic materials

The composition of historic materials depended on local custom and available materials. In Lithuania sand and lime are the major components of traditional materials.

Analysis of the historic materials provide useful information on its ingredients and their proportions (binding agents / aggregates). In early times the river sand (with mini impurities of

sink), and late- quarry sand was used. Binding agent – lime patty came from heated limestone. Quick lime was mixed with water to “slake (hydrate) the lime. Beside the clean limestone we can also find kinds of limestone with the impurities of magnesium carbonate. The magnesium lime was used for building works. The cleaner lime was used for finishing works. In most cases mineral and organic additives were used in Lithuanian historical materials. Casein was very popular organic binding agent in all times and in all historic materials. Casein was used to prepare plasters and paint interiors and exterior surfaces. Another organic additives were eggs and oil used in paints. Straw or animal hair was usually added to historic materials as a bind.

Mineral additives were brick grains and dust, marble grains and dust, charcoal grains and dust.

Traditionally historic materials are applied as a multiple-layer process, sometimes consisting of two or three coats. The aggregate of the first layer usually is the roughest (proportions (1:3), the middle layer –is of medium rough (proportions (1:3 - 2:5). The third (finishing) coat consists of very fine grade of sand and lime (1:1).

7. Constituents of historic paints

The three major types of paints were used in painted historic buildings : water based paints, oil based paints and mixed paints.

- Whitewash: lime patty, pigment resist alkali –earth pigments (ochres, sienas, umbres,...). Used in interior and exterior.
- Water based paints: Water, pigments and a binder (hide glue, gelatine or gums). Usually used on interior plasters surfaces.
- Casein paints: lime patty, pigment, milk. There were various recipes. Used in interior and exterior.
- Oil based paints: Linseed oil, , a hiding pigment (usually white lead) and coloring pigments.
- Tempera: Water, egg yolk, pigment. Used for decorative aims.

8. Research in 1990-2001

In 1991 the political situation changed. Lithuania restored its independence and the mass process of privatization started. The Department of Technical Research was restructured into the Division of Chemical Research and into private structures. But the specialists, who moved to the private structures did not manage to work on the new market conditions and their companies disappeared. In 1993 the Division of Chemical Research was restructured again as the Laboratory of Technical Research and joined the Center of Cultural Heritage. The Center of Cultural Heritage is inventorying and listing the objects of cultural heritage. Today the Laboratory consists of only 4 specialists – technologists of restoration (2 of them are doctors of sciences).

Now we produce the research of more applied (advisory) character – we usually work on a special conservation object. We think that it is very important to make *in situ* test for the historic materials, techniques and character of destruction.

We examine mural painting, stucco decoration and other architectural surfaces together with restorers, we turn attention to the techniques and damages and we propose future conservation works.

We take conservative but informative enough samples that are very important during the whole process of research.

The number and size of the samples should be the minimum necessary to gain the required information without doing damage to the historic buildings.

We take the samples of different sizes, depending on the value of the object.

The sample should be in the form of lumps (in one or a few compact fragments), not crumbled or powdered. One half of the sample is for the analysis in laboratory, other half—is labeled for the collection.

For example in the case of mural painting layer – we take the minimum – just for the micro-chemical analysis for identification of pigments and of binding agents and by establishing a full sequence of paint layers (chromochronology). In the case of plaster – we take bigger samples, because we need to identify the composition of the materials and the granulometric composition of the aggregates. We also need to prepare cross-section analysis for the mineralogical petrographical analysis. Samples usually are taken from the places that were already damaged mechanically, and where the structure of material is intact. The *in situ* test is very important for the future works of conservation and restoration.

Sampling operations were very important for examination salts and biological deterioration on the architectural surfaces.

The substantiation and preparation of the conservation project depends on this research.

The Laboratory has collected a lot of research data that can broaden the history of architecture, art history, history of building techniques and the history of restoration as well. Our Laboratory has collected the file indexes of samples of historic materials and samples of cross-sections. This catalogue is and will be the base for educating the local restorers and for the future conservation and restoration works.

Together with the changes in the political and economic situation in the country, the attitude towards our research changed as well. Entering the EU, we must to modernize our laboratory and the equipment. We need to change destructive research methods into non-destructive or the minimum destructive, according to the EU recommendations. We understood that long time ago, of course, but the problem was the financial condition of our country. The government of Lithuania makes a lot of effort to protect the cultural heritage but the financial resources are limited. The cultural heritage is investigated and conserved very slowly and many valuable objects vanish while waiting for the conservation. The funding for the cultural heritage tends to decrease every year, while the private owners are not interested in financing the research of cultural heritage. So, our Laboratory also face the problems.

9. THE PROBLEMS OF OUR LABORATORY

1. The lack of modern research equipment
2. The lack of working places
3. The lack of theoretical and methodical literature and information
4. Training of specialists
5. Language problems

10. SUGGESTIONS

These activities are proposed looking forward to cooperation between the EU member countries and the countries on their way to EU:

1. International research projects and demonstrational conservation projects in Lithuania, using the new equipment and commonly prepared projects of conservation works.

2. The practical realization of prepared projects on the cultural heritage objects in Lithuania.
3. Public and common discussions about the projects.
4. Training of Lithuanian specialists at the EU research and training centers.

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