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NEW MATERIALS FOR SAFEGUARDING CULTURAL HERITAGE

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STATE-OF-THE-ART REPORT
(position paper)

1. THE MAIN CATEGORIES OF MATERIALS, currently used in Romania

Materials that can be *stricto sensu* understood as "new", are not very easy to nominate precisely apart from other materials.
There are, of course, those materials that exist only from a relatively short period of time. I will start my attemp of analysis beginning with these.

1.1. CONSOLIDANTS

Silicate composites mainly in the form of ETHYL SILICATE are used for consolidation treatements of porous and rigid elements of architectural facades and various decoration.
These treatments are used for stone, mortars, brick etc.
Ethyl silicate is soluble, so it is sensitive to water. The treated parts should receive a hydro-repellent treatment consecutive to the consolidation.
Silicates are largely used in paints for facades for new buildings mainly, but also for historic restoration works. the problems of compatibility should be seriosly taken into account (some criteria are briefly discussed further on).
There exists now in Romania a distribution system of silicate products of good quality, but also of less adequate materials and the selection is very important.
Waterglass is not currently used, as the problems of incompatibility are generally known. Synthetic materials such as (poly)vinyl acetate, (poly)acrilics or epoxy resins are generally avoided lately.

1.2. WATER REPELLENTS

Silicone resins, siloxanes, silanes, stearates are beginning to be used for architectural facings treatments;they are generally available, but as for all materials, especially new ones, a good and documented selection is necessary for every work in particular. It is not easy to make a good judgement concerning real qualities and compatibility, and it is necessary to verify technical data and publicity information, and not taking them for granted.
Acryl components and synthetic substances are regarded more circumspectly in the last years.
Water repellents are also used for anti-capillar treatments in horizontal layers, injected in drilled perforation through masonry at the level above the humidity source, and as additives in anti-capillar mortars.
The solvents are very important, and the rate of the solution of course.
The most common solvents are mineral spirits; water emulsions become available also.

1.3. CLEANING MATERIALS AND TECHNIQUES

They should have been presented before 1.1. and1.2. according to the succession of the operation, but I preferred the criterium of the relative importance of new materials in each field.

Water is used whenever possible; when it is not sufficient, solutions of non-agressive substances are used (bicarbonate compounds for example). These solutions are applied directly or in compresses. The compresses are of special clay (as the sepiolites - magnesium oxides), of cellulose or mineral fibre. Until now we used traditional techniques for applying the treatments, but mechanical spray systems of compresses are, in the principle, available.

Solvents and detergents are generally avoided.
Different materials and techniques for "micro-sanding" become available, from alumine micro-povder to dolomite and natural organic substances as nut shell or peach core powder. In the principle, the cleaning powder should be less hard than the surface.

1.4. MATERIALS FOR STRUCTURAL INTERVENTIONS
New materials as polypropilene grids, carbone fibre, kevlar, have not yet been used according to my present-day informations, but there is a distribution system and a few projects in initial phases.
The reinforcement of fractured parts of small and medium sie are generally made with inox steel or bronze rods; steel is avoided because of corrosion problems. Hydraulic lime mortar is used rather than concrete when possible. Cement wit low salts content is available, too.
Perforation of high precision on long depth in masonries is available; rods of stainless steel or kevlar in these peforations are intented, instead of steel.

1.5. OTHERS (miscellanea)
In this paragraph I shall mention some metarials of a small impact so far in Romania.
Some substances and procedures for the treatment of cements and concretes seem to be interesting, especially for the control of agressive chemicals (alcaline salts etc.), for new and for existing elements containing cements.
Treatments for concrete impermeabilisation could be interesting, we are at the level of information, a distribution system exists.

Another category may be undestood as materials that are not new in themselves, but are new compared to those originary included in the specific historic buildings.
There are some cases of use of Eternit-type plates to replace wooden shingles, which are more sensitive. The plates are cut and placed in the forms and dispositions of the originary shingles. Still, this method is restricted to particular cases, depending on their character, for reasons of authenticty.
Cement tiles are generally not accepted by the National Comission of Historical Monuments.
There are some examples of constructive re-integration of destroyed parts, using different materials and techniques than those of origin. Many chuches have lost their lantern towers, spires or bell towers, made of brick or stone masonry. Thea have been (or are intented to be) replaced with lightweight structures, of wood or metal, and mortar facings on lightweight support. The images are rather suggestions of the originary, rather than remakes, for reasons of authenticity on one side and integrity on the other side. (the church in Vernesti, XVIIIth cent, M.Opreanu, Dan Ionescu, structre engineer,(realised); church Coltea in Bucharest, XVIIth cent, Constanta Carp, architect, L. Spoiala, struct.eng.; Plaviceni, XVIIth cent, M. Opreanu, Dan Ionescu, projects, and others).

As a conclusion for this chapter, materials of all uses in conservation are now available; most importantly, the knowledge exists at the levels of conception, decision and realization. Several specialists are connected at international levels (I myself have ateended several international events, including the International fair

DENKMAL 2000 in Leipzig). There are bulding firms members of AEERPA (Association Europeene des Entreprises pour le Patrimoine Architectural), etc.

2. MAIN CRITERIA FOR THE USE OF NEW MATERIALS:

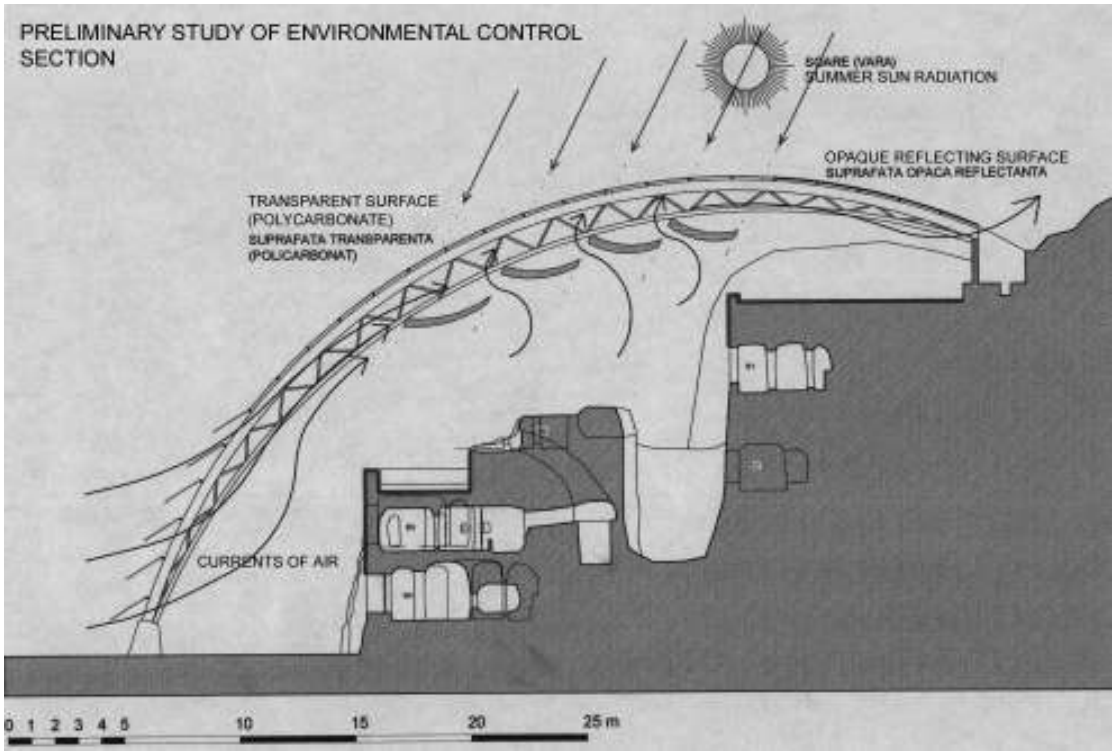
2.1. A general observation is that the use of new materials is not necessarily a good thing in itself. They should be used when traditional ones are not sufficient for the problems to be solved, and only if they are known and proven.

2.2. COMPATIBILITY :
There is the danger of rejection and secondary effects, comparable to those in medicine (for living beings, human, animals and plants).
There is a strong tendency in the last period, to compare the problematic of historic preservation to medicine. The principle of "primum non nocere" is essential. The "anamnesis", diagnosis, pathology analyse and therapy are used both in medicine (for a very long time), and in historic conservation.
In these fields, errors are not acceptable because they are not recoverable. The loss of lives or the loss of cultural heritage are definitive losses.
There are examples, mainly for the use of cement and steel in restoration works, beginning from the XIXth century.
Cement of Portland type is a material that did not exist before, and the long-term reactions of cement mortars and concretes have not always been correctly predicted or even taken into account.
Steel has been extensively employed, for example in France, In the XIXth century; although existing as such from a very log time, the developpment of industry has made it available on a new scale, in association with a certain entusiasm. The use of steel, for example in stone consolidation of fractured elements, as connection pieces in drilled holes, in association with cement mortar, has been very extended; in time, mortar ws damaged and steel has corrodated, causing fractures due to the volume increase, and rust stains. Other rejection phenomena have been caused by alcaline salts contauined in cement, differences in vapour permeability between cement and traditional materials etc.

2.3. Other criteria that can be taken into account in this brief account are the REVERSIBILITY of the intervention, the principle of THE LESSER INTERVENTION reasonably possible, avoiding "hard" interventions whenever possible.
AUTHETICITY is a key prinnciple in historic preservation; it implies, generally, that the originary substance of the building must be preserved. This imlies that a minimum of new substance should be added. The treatment by substitution should be avoided when possible, and the treatment by cicatrisation employed preferrably.
The broblem of the greater costs exists, too, but it should not be a main criterium for choosing an intervention strategy.

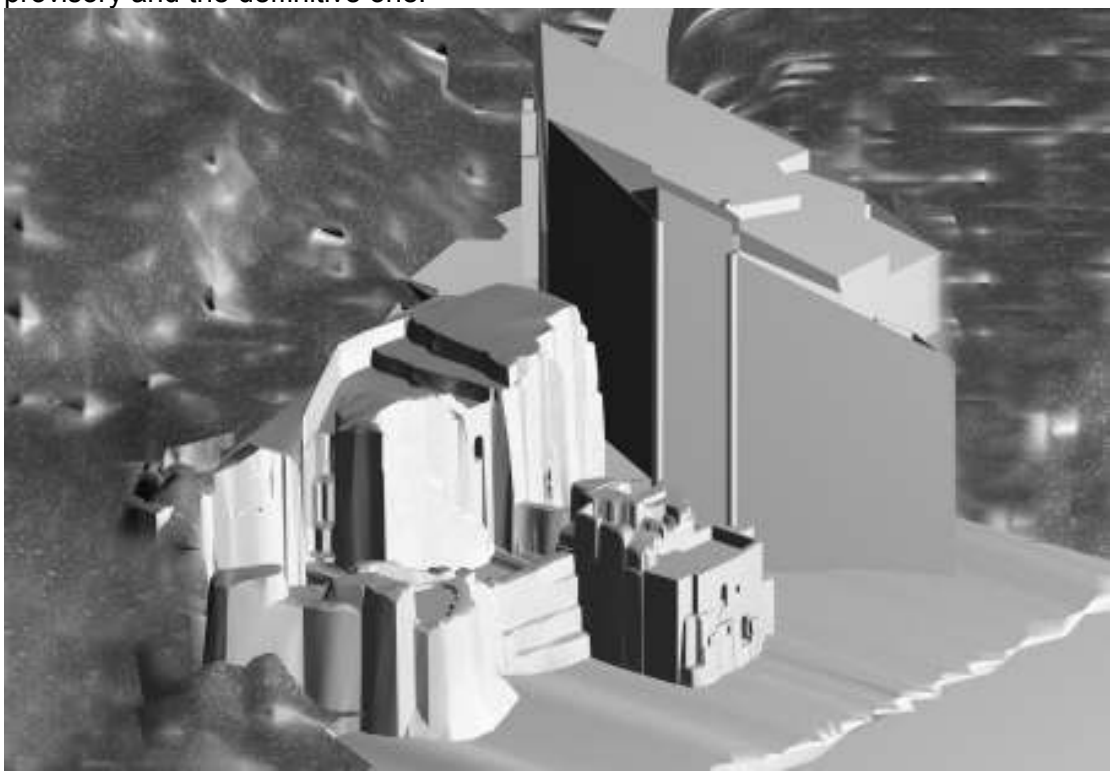
CASE PRESENTATION

BASARABI RUPESTRIAN ENSEMBLE
DEPARTMENT OF CONSTANTA, ROMANIA
IX th - X th CENTURY
Design manager : Mihai OPREANU, architect, senior lecturer
Stone restoration : Dorin DANILA, sculptor, restorer



The ensemble is situated in the cliff of a chalk stone hill, where a quarry of antique roman character had The rock is amorphous calcium carbonate, and it is very tender and sensitive to humidity, frost, salts etc.
The ensemble is composed by small churches, chapels, complex galleries, tombs, dwellings, all carved in the rock, in the remains of the former quarry.
On the surfaces of the excavations and also on some exterior surfaces, there exists a multitude of incisions made in the soft rock : many of these are inscriptions of great value, in several types of writing, in paleoslavic language, in greek, but most of the inscriptions are in an enigmatic writing, similar to the nordic *runae*, which still remains undeciphered
The physical conditions of the ensemble are critical to the highest degree. The degradations are very intense, ant their starting point is relatively recent, corresponding generally to the interruption of the works in 1977. The incised surfaces have been naturally conserved for about a thousand years, buried in the soil. The pathological phenomena are obviously caused by the extremely negative concurence of environment and micro-climatic factors, in the existing protection buildings, both the The concrete building is not thermally insulated, it is insufficiently lit and ventilated. Both buildings have the tendency of aggravating the climatic excesses, causing overheating in summer, ample and frequent frost-and-thaw cycles in winter, lack of natural light and ventilation and so on.
The project aims for a new building for climatic protection, with a lightweight structure and a translucent envelope.

Research is presently carried on for the conservation of the carved surfaces and the chalk masses. Experiments are made, with Potasium metyl-silyconate (in water), and Poli-xiloxanic olygomere (in white spirit), for avoidig capillary ascension in the rock masses and on the surfaces. The white spirit, lighter than water, rises and replaces the water, which eventually evaporates.
A horrizontal water repellent treatment is proposed, by impregnation in drilled perforations.
provisory and the deffinitive one.



Much of the chalk masse was crushed when the ensemble was discovered, in the 50s. It has been reconfigurated with concrete structures, and the salts from the cements are causing degradations to the chalk. A treatment for the chemical passivation of the existing cements will be necessary (it is now in the phase of research).

FORTIFIED CHURCH AND RURAL STRONGHOLD OF MOSNA - MESCHEN DEPARTMENTOF SIBIU, TRANSYLVANIA (SIEBENBURGEN), ROMANIA

The monumental ensemble of the stronghold of Mosna belongs to a series of fortifications built by the peasant communities of Saxon colonization in Transylvania. Together with the stronghold of Biertan – Birthaelm, some 15 km away, it is one of the largest of the series. The major element of these ensembles is the church, dating from 1485, which is a fortification in itself.

The stronghold consists of a complex fortified precinct, with towers and different buildings, and the ruin of a Romanesque chapel.

The ensemble is built on a marsh, and the humidity is excessive. A horizontal water repellent treatment is proposed, together with anti-capillar treated mortar on the lower psurfaces. A draining system and a general re-configuration of the ground surface will be realised (following the principle that the treatment strategy should aim at the pathological causes, not only at the symptoms).

A special problem exists at Mosna, and at other saxon strongholds. The communities have kept, from the times of the invasions, the tradition of the storage of lards in spaces within the stronghold. The salt accumulated for centuries caused specific and important damages. The treatments will include the passivation of the salt within the built masses, which has migrated with the water.

Such interventions of humidity control have been realised at the Church on the Hill in Sighisoara (a medieval town in Transylvania, now on the World Heritage UNESCO list) and "The house with the Stag", an important medieval building in the citadel of Sighisoara, now a romanian-german cultural centre (dr. Christoph Machat, Sandor Benczedi); the neo-gothic church of Floresti in Moldavia (M. Opreanu) and many others. Still more such intervention are in the project phase.

The facades of the University In Bucharest and of the old building of theSchool of Architecture, both historic monuments from the early 20th century, have been restored using low-pressure water and sepiolite compress cleaning, with amoniac solutions, silicate consolidation, various methods and material for visual re-integration, and silicones for water-repellent treatment (M. Opreanu, D. Danila). These are the first big-scale realisations in facades restaurations in the country, together with the Chrissovelloni palace in Bucharest, early 20th cent., (C. Rulea, arch., |D. Danila). Still others are in various phases.

The cathedral of Galati (important town on the lower Danube), dating from the early 20th century, had been seriously damaged by earthquakes and air pollution caused by the proximity of a huge steel plant. In the '70s, The etire exterior surfaces, of sculptured stone, molded artificial stone and lime mortars, has been covered by a sprayed mixtur of cement and acetate adhesive, in order to achieve a new look. In three decades, this crust (which anyway had de-figurated the decoration), has exfoliated on certain surfaces, and remained very adherent on others, where it became impregnated whith dirt and smoke particles). Some consecutive surface paintings, also on bad technical solutions, made things worse. The facades gave the unpleasant impression of a skin disease.

The crust could not be removed by chanic methodes, without damaging the surface of origin, especially the natural stone. Several experiments with solvents have been made. Finally, a composite sollution with ethyl silicate proved to attack the acetate adhesive contained in the parrasite crust and make it precipitate, at the same time consolidating the surfaces of origin.
The cleaning process needs special training and attention, but the results are very good. There is a complex intervention sucessive to the cleaning : completion of lacunae and damaged parts, visual re-integration and finally a water-repellent treatment on the entire surface. The main porch is completed for two years now, and the main facade with the bell towers for one year, and they behaved very well. The other facades are going to follow. (M. Opreanu, D. Danila)

The former medical drug-store "Tinc" in Galati, dating from the late XIXth century, is a building with an exuberant decoration of molded stucco, and brick facings. It shows a complex pathology. Substitutions have been limited as much as possible. Treatments for cicatrisation included ethyl silicate consolidation together with traditional methods, and a water repellent treatment (M. Opreanu)