SOME RECENT ACHIEVEMENTS IN HUNGARIAN MONUMENTS PRESERVATION

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Abstract

Without adequate preservation methods, monuments face perishing. Wrongly applied conservation agents are almost as damaging. Different kinds of monuments, different stones require different treatments, unthinkable without an integer approach. After two decades of trials and errors, a recent agent named ZKF seems to be a solution even in problems of weathered soft limestones, current in Hungary.

The technical-scientific research base for the technical-technological development of monuments preservation has been established some fifteen years ago at the Technical University, Budapest.

This work started initially as an interdisciplinary, personal cooperation between leading specialists of marginal sciences. Later, about a decade ago, a Laboratory for Monuments Preservation has been established at the Section of Monuments Preservation of the Institute of History and Theory of Architecture, TUB, without renouncing of relations with research workers of marginal sciences, of University departments, or even, of non-university research institutes.

Within the framework of this collaboration, solution of the worst technical problems has been attempted in the order of importance, eventually, upon cooperation constracts with, or commissions from the National Monuments Inspectorate, may be for the actual research target program of the Ministry of Building and Urban Development. In space shortage, here a single one of them will be discussed.

First, by the late sixties, the problem of damp-proofing of buildings, in particular, a method for the ulterior wall damp-proofing, has been concerned with, motivated essentially by the inherent — partly social — constraint to exempt historical monument buildings from the Act of Monuments Preservation. The procedure developed to solve this problem — an ulterior wall damp-proofing method patented under the denomination "Silicophob-Anhydro" — has been applied since fifteen years, actually by some hundred enterprises, cooperatives, and some fifty craftsmen, under the license of the Hungarian Academy of Sciences, proprietor of this employer's patent.

This problem is strictly related to up-to-date methods for the pre-reconstructional diagnostic test. This is how the KPZ wall dampness probing method — another employer's patent of the Hungarian Academy of Sciences — has come about. Another wide domain of diagnostic tests comprises tests on the deterioration of building materials and on the suitability of conserving agents, to be discussed later.

Surface protection problems have been attacked by the early seventies, again by an invisible, aerating, protective silicon coat Silicophob 7607, to conserve unplastered stone, brick and mixt-walled buildings (e.g. stone pylones of the Chain Bridge in Budapest, the "Király" bathhouse built under the Turkish rule, and ruins of historical monument walls). An experimental building has been serving since 1972 for testing the effect of the protective coat on a still unweathered "Sóskuti" limestone surface, the most extended, hence the most important stone type to be protected in this country.

In addition, a cooperation within the TUB — granting personal and material facilities of six faculties and about 100 departments for monuments preservation as needed — has been producing a succession of up-to-date conservation materials, invisible surface protections.

Another important problem in monuments reconstruction is conservation of non-weathering-resistant adobe walls of popular building monuments in this country. Our relevant method has been tested on complete buildings (such as the Bessenyei mansion in Bakonszeg).

A wide-range problem in monuments preservation is expected to be solved by WEZA-telemetry, a survey method (mainly for elevations) feasible by a single person using a simple, small-size manual device. This device, raising interest at international fairs both in Hungary and abroad is now under manufacture in this country.

This short survey of some research achievements (that could be completed with e.g. special paints and plasterings for monuments) will be followed by a somewhat detailed report on our recent method of preserving stone monuments weathered, deteriorated at a high rate, likely of international interest, with the related overall architectural and economical problems.

In view of international achievements in stone preservation under Hungarian conditions, the following problems emerge:

1. development of a system of preliminary diagnostic tests valid under Hungarian conditions for quality rating tests by the national building authority, and for practical stone consolidation problems;
2. to clear principal problems emerging internationally, and in Hungarian practice (e.g. when a preventive-type treatment by some protective agent is sufficient without consolidation, when consolidation is needed, and what are conditions to be created for these works);
3. weathered soft limestone conservation with consolidation.

Methods developed by the RILEM-ICOMOS Stone Consolidation Working Committee international recommendations are considered by us as of utmost significance, and we are sharing this work. Theoretical and practical achievements, the suggested tests are expected to be agreed and introduced in every country.

At the same time — as a theoretical instruction — let me point to the following:

— Test methods for causes and rates of stone deterioration and for the suitability of the conserving agent (as to water absorption, freezing resistance, vapour diffusion, surface hardness, strength, porosity, colour, texture, etc.) refer to different stone materials. Most of statements by museum stone restorers — but to a degree, also by research workers and institutions of research concerned with the consolidation of stone surfaces of monuments of architecture — refer to "a piece of stone". Remind, however, that in case of monument buildings, stone structures have to be consolidated, where stone elements far from being homogeneous from petrographic and weathering aspects are fastened by mortars of maybe wrong composition, and by metal ties.
Also positions of tin plates, doors and windows, or of other building materials related to the stone surfaces are of importance.

— Logically, function and position of the stone in the building much affects its resistance.

— Up-to-date, large testing laboratories, research stations adopt these aspects, they are, however, far from being internationally generalized, and most of research institutions miss technical facilities needed to bypass the limits of testing "a piece of stone".

The optimum system of preliminary diagnostic tests and the involved test methods are primarily restricted to the general testing of a stone type, to clear the condition of valuable stone carvings before conservation, or to check effectivity of conserving agents. Remind, however, that in most cases, all the working process of cleaning and consolidating the stone façade of a building to be reconstructed would fail simply from economical causes if a full range of preliminary diagnostic tests needed only in the above cases of rating is insisted on.

Thus, in conformity with Hungarian experience, just as much as every building and every building part may be different from the aspect of conservation, imposing up-to-date preliminary diagnostic tests to decide over the problem of cleaning and conservation, in fact, the system of diagnostic tests itself cannot be standardized but the tests to be imposed upon have to be decided for the given problem, taking economy aspects into consideration.

This is the principle underlying our cooperation with the Institute for Building Quality Control — specified by the minister of building — intended to develop a method of, and at the same time to perform, rating of materials and technologies for practical problems of stone conservation and cleaning, partly to advise industrial users, and partly to officially counteract harmful, wrong operations.

Protective coatings (mainly silicons) for cases needing no consolidation but only surface protection are swarming in the world market. Provided applied in the proper case, suitability depends on how requirements of water repellency, aeration and invisibility are met. These fundamentals are generally identical between countries — just as the barren debate of about two decades putting the question mostly *in general* whether silicons suit stone conservation or not?

On the other hand, some specialists (other than myself) consider only materials and methods for simultaneous stone conservation and consolidation as stone conservants. Again others discuss silicon treatment and protective coatings together with consolidating conservation procedures — a sheer nonsense.

A fundamental requirement for conserving agents with a consolidating effect is to penetrate into the weathered stone layer to full depth and beyond. The conserved weathered layer must, of course, "interact" with sound parts. A material unable to penetrate is a priori unfit to stone conservation with consolidation. This has to be joined by a consolidation procedure, in a manner to me measurable (an important, much debated item of developing the fundamental principles). Since the Hungarian soft limestone — making up most of our monuments — is of extremely poor quality, prone to weathering, our relevant research is "proficient" in that, provided this conserving agent is efficient in this case, no conservation of another stone of higher quality is likely to fail.

Our research proved no overall valid formula to exist either for stone cleaning or for stone conservation — just as for deepgoing preliminary diagnostic tests — mainly since these are composite architectural problems, furthermore, this work can only be done by the architect or stone carving restorer as an interdisciplinary teamwork involving representatives of marginal sciences. Of course, also the contrary is true: neither a chemist, nor a physicist or petrographer, or other member of a team can do effective stone conservation work in a building, without the architect directing the project. (On the contrary, in research problems each specialist of a discipline does self-contained work to solve his share of the problem — but also here, it is deemed useful to contact representants of marginal disciplines.)

Approaches different between disciplines and differentiation of problems in this respect are characterized by an actually rather frequent debate on

reversibility. According to a general principle valid to any material of museum restorers, this is an absolute requirement. One may wonder, however, how to extract from a building façade, e.g. the agent Paraloid B72, the only reversible conserving agent, penetrated to 3 or 4 cm. By the way, Paraloid B72 is actually the only reversible stone conserving agent, but only for a penetration of 1—2 cm, insufficient for stone conservation with consolidation.

Essentials of practical results of our work relying on the outlined fundamentals are, omitting stone cleaning:

Conservation without consolidation — continuously reported on since 1971 — cover a wide range from the first silicon treatment with Silicophob 7607, a Hungarian patent, across applications of Bayer and Wacker silicons (FRG) and of their Hungarian variety based on a license (Silicophob W190 and 290) to the agent Aquaphob.

For problems of *conservation with consolidation*, since the early seventies all internationally applied agents have been tried out to conserve Hungarian weathered soft limestone building façades or carvings. This is increasingly urged by current restorations of extensive public buildings (e. g. the Parliament, the Basilica in Budapest), entire streetscapes, or the recent reconstuction of the Opera House. Investigations make it clear that no material or procedure perfectly suits this problem, either by missing freeze resistance requirements (especially difficult under the climatic conditions in this country with 40 to 50 cycles of afternoon precipitation and nightly frost a year) or by an insufficient consolidating effect, or by insufficient vapour transmission (at last 85% is needed). This is of special importance in this country, since some wall moisture from rising soil dampness is likely even in buildings with ulterior wall damp-proofing (made by means of the chemical wall damp-proofing chemical Silicophob-Anhydro, a Hungarian patent, fundamentally different from other chemical wall dampproofing agents, mainly in that the material quantity can be dimensioned, and by its drying effect.)

In-situ treatment is often counteracted by the inability of known and applied materials to penetrate to 10—15 cm.

Thus, tests made with epoxy resin, barium hydroxide, silanes, siloxanes, acryl resins or their combinations, etc., showed them to be next to ineffective.

A comparison of requirements as to role and importance made the problem of colour trueness of atone surfaces, anyhow rather heterogeneous in colour, to be of secondary importance — provided one (the last) phase of the treatment work can adjust the colour felt to best approximate that of the original stone surface. A slight change of hue or colour in the treatment — that can be ulteriorly mitigated — due to a treatment otherwise meeting essential requirements crucial for the stone to subsist — is felt to be admissible. This is how the latest patent for the procedure *ZKF* has been achieved.

The procedure *ZKF* consolidates the treated material (compressive strength increase by 60%, twofold or even threefold tensile strength), increases the abrasional resistance counteracting erosion. It lends water repellency to the material and its surface; penetration to a depth of 5 to 15 cm improves frost resistance (to over 80 freezing-thawing cycles), while safeguarding vapour diffusion requirements (loss below 15%). In addition to be weatherproof, the cross-linked resin is resistant to acids, alkalis and chemicals, thereby the treated surface is protected from environmental damage (e.g. corrosion due to winter salting of roads, acid rains, etc.), reduces surface soiling.

Although this invention essentially refers to soft limestone conservation with consolidation, the involved material is applied to stone replacement and repair by combining the given stone in a proper particle grading and the agent ZKF into a reconstructed stone interacting with the original stone, and is similar to it as to colour and texture, both of them can be adjusted at will.

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