

Roman Cement – material with a history and future

Forgotten Heritage



Dr. Roman Kozłowski, associate professor at the Institute of Catalysis and Surface Chemistry of the Polish Academy of Sciences, has been coordinator and co-investigator of European research projects dealing with Baroque stuccomarle, Roman cements, the impact of global climate change on architectural heritage, and others

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Restoring historic buildings to their former splendour using materials similar or identical to those used in the past poses a great challenge to the conservation community

The 19th century was an era of rapid industrial expansion, growing wealth of societies, and extraordinary construction activity. Cities expanded on an unprecedented scale, monumental public buildings and headquarters of commercial institutions were constructed, and exclusive residential architecture was developed. The wealth and power of the new elites were expressed in sumptuous building façades, decorated with architectural and ornamental forms imitating the grand styles of past epochs. While the stylistic costume of the buildings drew upon the past, the technology used in manufacturing the decorative elements was entirely contemporary. The key material was a new cement-binder, known as Roman cement. In old technical journals and textbooks for stuccoists it is also described as 'Hydrauer,' 'Kufsteiner,' or misleadingly as 'Hydraulic lime.'

Effective natural material

What was Roman cement? The best answer to this question can be found in a historic Austrian Standard published in 1880: *Roman cements are products obtained from argillaceous marlstones by burning below the sintering temperature. They do not slake in contact with water and must therefore be ground to a floury fineness.* Roman cements were therefore natural binders and the simple technology for their synthesis at low temperatures (800–1200°C) was successful due to the natural intimate mixture of lime

and clay (a source of silica, alumina and iron oxides) in the marl, which could not be attained in any man-made mixture.

The fast setting times of Roman cement mortars, their beautiful warm yellow-to-brown colour, excellent weather-resistance, and cheap mass production made Roman cements favoured materials applied on a large scale for manufacturing stuccoes on the exterior of buildings, in particular for the mass prefabrication of cast architectural details.

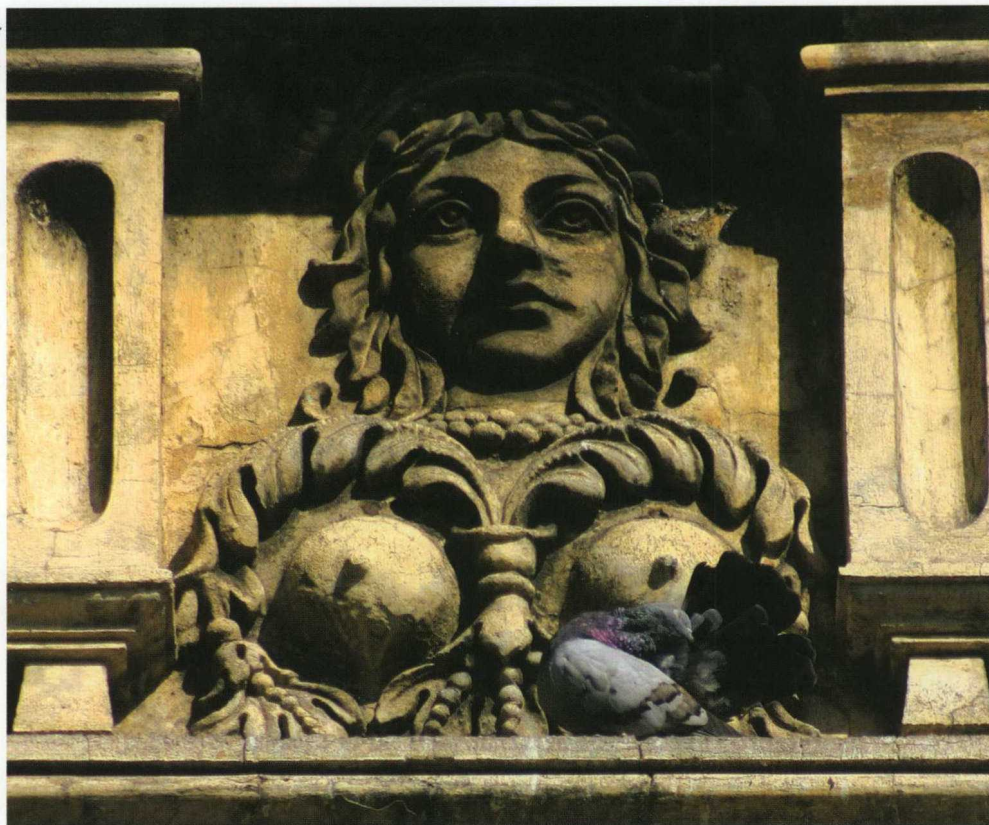
Neglected heritage

In the 20th century the use of Roman cements gradually declined, being displaced by the newer Portland cements and the dominance of modern architecture, with simple façades lacking any stucco decorations. Furthermore, the architectural heritage of the 19th century became a symbol of stylelessness, bad taste, and was regarded as purely utilitarian constructions. Few materials have been as underappreciated as Roman cement stuccoes. Accumulations of paint layers or sprayed cement coatings, damaging cleaning, the removal of renders



The missing part of this cornice is reconstructed by applying Roman cement mortar and repeatedly passing over a wooden profile

Pawel Gajbor



Warm colour, an irregular network of thin shrinkage cracks, and a good state of preservation are characteristic features of Roman cement decorations

and decorative castings when in poor condition, and patchy repairs with improper materials have adversely affected and aesthetically degraded a substantial portion of this built heritage.

Unaltered Roman cement façades, preserving their original colour and architectural surface in an undisturbed state, are rare in spite of the fact that the technique was used on a massive scale in the past. It is enough to say that in Krakow, where conservation work has been underway on a large scale for many years, only once, during the conservation of Teodor Talowski's apartment house 'Under the Spider,' built in 1889, was a conservation decision made to preserve the authentic surface of Roman cement elements - the standard measure being to coat such surfaces irreversibly with modern paint.

One important cause for such neglect was the absence of Roman cements currently on the market. Only during the past ten years have attempts been undertaken in several European countries to give this architecture the same good conservation treatment as applied to objects of earlier periods. One important step in these efforts

came with the European Commission's decision to support financially a broad research project entitled "ROCEM - Roman cement to restore built heritage effectively" (2003-2006) implemented by 10 partners from the research fields of materials manufacturing and practical conservation, coordinated by the Institute of Catalysis and Surface Chemistry of the Polish Academy of Sciences in Krakow.

Durable and universal

The principal achievement of the ROCEM project was to reestablish the manufacturing and use of Roman cements in conservation practice. Work started by investigating a large group of historic buildings rendered and decorated with Roman cement mortars, located in different European countries. Built in the 19th and early 20th centuries, they ranged from Wycombe Abbey (1804), an early example of the use of Roman cement in England, to the Trade Academy in Krakow (1904-1906), built shortly before the quick decline of the Roman cement era. Analyses of samples of historic mortars, a survey of archival materials, and also investigations of raw material samples from

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Jan Zawiejski's former Trade Academy in Krakow, built in 1904–1906. A monumental municipal school building decorated with Roman cement renders, here after conservation with the use of authentic stucco materials and techniques



Marcin Błaszczyk

quarries exploited in the past helped to identify promising sources of raw materials: a historic quarry near Lilienfeld in Lower Austria and a currently operating quarry in Folwark near Opole in Poland. After laboratory optimization of the calcination parameters of the cement stones from these deposits, cements of binding characteristics and colour very close to the historic materials were obtained. Several tons of Roman cements were produced in a specially built large electric kiln, allowing the calcination conditions to be kept under strict control. The materials enabled conservation tests to be undertaken in several countries participating in the project.

The project's investigations discovered unique properties of the Roman cement renders and many secrets of their resistance to weathering. They combine high strength with very high porosity, which ensures their resistance to the impact of rain water and entails good drying of the building. Because of their low shrinkage, they can be applied as thick single coats (up to 50 mm). Roman cements are universal binders, ideally suited both for casting of decorative architectural details in moulds and for run work or rendering. They can be used to produce interior cores of decoration but also for sur-

face finishing by laying thin, smooth finish layers. By mixing pure Roman cement with water, a cement paint is obtained which can be applied as a thin coating for textural and colour integration of a façade.

Detailed microscopic investigations have shown that the microstructure of hardened Roman cement stuccoes contains a very fine 'groundmass' encapsulating unhydrated remnants of the original cements: in castings their amount was usually more significant than the amount of the added aggregate, for example sand or gravel. These unhydrated grains have a maximum size of approximately 1 mm. They are of significant importance for the high strength and durability of the historic materials, as they act as an aggregate reacting with water, strongly bound to the surrounding hydrated cement matrix.

Compatible with the original

The materials and techniques reestablished as a consequence of the project's efforts were used in restoring the façade of Jan Zawiejski's former Trade Academy in Krakow, built in 1904–1906. Supported financially by the Citizen's Committee for the Renovation of Krakow, restoration of the Academy's façade was finished in 2007. This was the first renovation of Roman cement stuccoes in Europe carried out with the use of materials compatible with the historic substance of the original decoration. With the ready availability of Roman cements, the family of historic hydraulic binders necessary for the appropriate conservation of the built heritage of the 19th and 20th centuries is now complete; we no longer need to turn to substitutes for help. However, further conservation and information activities are needed to encourage growing acceptance of the use of Roman cements in the restoration of historic buildings of the period. ■

Further reading:

<http://www.heritage.xtd.pl>
(1887). *Österreichische Bestimmungen für die einheitliche Lieferung und Prüfung von Portland-Cement. Aufgestellt und genehmigt vom Österreichischen Ingenieur- und Architektenverein, 1880.* [In:] Tarnawski A. (1887). *Kalk, Gyps, Cementkalk und Portland-Cement in Österreich-Ungarn.* Vienna: Selbstverlag.