



Nano-Cathedral

Nanomaterials for conservation of European architectural heritage
developed by research on characteristic lithotypes

Innovation for Europe
Cultural Heritage
Protection and
Conservation

NANO-CATHEDRAL PROJECT

Cathedrals, distributed throughout Europe, are representative of the diversity of European cultural heritage. **Five different cathedrals were selected** as they may be considered as representative of both different exposure conditions and different types of stones.

In particular, the Cathedral of **Pisa**, in central Italy, and the Cathedral de Santa María of **Vitoria-Gasteiz** in Spain were selected as representative of south European "Mediterranean" climate in coastal and continental regions, respectively; the Sint-Baafs Cathedral of **Ghent**, in Belgium, the Cathedral of St. Peter and Mary in **Cologne**, Germany and the St. Stephen's Cathedral, in **Wien**, Austria, were selected as representative of North European climate in coastal and continental regions, respectively. Moreover, the **Oslo** Opera House, was considered as an example of a contemporary building coated with white Carrara marble.

They also represent different lithotypes such as *marble, sandstone, limestone*.

The objective is providing "key tools" for restoration and conservation:

- On representative lithotypes
- On European representative climatic areas
- With a time-scale/environmental approach
- With technology validated in relevant environment (industrial plant and monuments)
- Exploiting results also on modern stone made buildings

WHAT ARE THE INNOVATIONS?

The results of the project will provide both innovation in technology and rationalization of the conservation policy affording a renewed knowledge of the complex system "treatment/stone substrate", and of the durability threshold of these treatments.

Innovative materials, such as nano-particle based consolidants and proper polymer nano-composites based coatings will be developed, in agreement with the NMP-21 call requirements. In particular, the employment of nano-particle with different composition will allow to provide methods for consolidations, protection and pollutants decomposition, thus preventing part of the degradation and providing long-term conservation. An environmental impact assessment of the new materials will be included, to ensure development of sustainable and compatible materials and methods.

APPROACH

The multidisciplinary approach is granted by the presence of expertise covering the field of geology and materials science, institutions for management and preservations of the cathedrals, restoration companies and also nano-particles and coating producers. The multidisciplinary approach and the inclusion of industrial partners directly involved in the production processes and technology of restoration will allow the development of affordable methodologies, granting reliability of the developed chain.

THIS KIND OF SYNERGY IS NANO-CATHEDRAL'S KEY FOR INNOVATION.

THE SELECTED MONUMENTS



PISA

BUILDING PERIOD
Medieval Age

ARCHITECTURAL STYLE
Pisan Romanesque

MAIN LITHOTYPES CLASSES
Mount Pisano marble /black limestones /Apuan marble /Proconnesian marble /calcarenite /granitoid rocks /serpentinite



VITORIA

BUILDING PERIOD
Medieval Age

ARCHITECTURAL STYLE
13th - 16th Centuries
Gothic

MAIN LITHOTYPES CLASSES
Lumachella from Ajarte /sandstone from Elguea /calcarenite from Olarizu



WIEN

BUILDING PERIOD
Medieval Age (1140-1513)

ARCHITECTURAL STYLE
Late Romanesque and Gothic

MAIN LITHOTYPES CLASSES
Limestones from Leitha-mountains and Vienna, few siliceous sandstones from Lower Austria



KOLN

BUILDING PERIOD
Medieval Age (1248-ca. 1520)
19th Century
(1842 - 1880)

ARCHITECTURAL STYLE
Gothic
Neogothic

MAIN LITHOTYPES CLASSES
Drachenfels Trachyte / Schlaitdorf Sandstone / Obernkirchen Sandstone / Savonnières Limestone / Volcanic Tuffstones / Basalt lava



GHENT

BUILDING PERIOD
Medieval Age
(942-1038)
14th-16th Centuries
(1300-ca. - 1569)

ARCHITECTURAL STYLE
Romanesque
Brabantine Gothic

MAIN LITHOTYPES CLASSES
Arenaceous limestone belonging to the Lede Formation (Belgium), and Belgian and French limestones as replacement materials (from Gobertange, Euville, Savonnières and Massangis)



OSLO

BUILDING PERIOD
2003-2007

ARCHITECTURAL STYLE
Contemporary

MAIN LITHOTYPES CLASSES
White Carrara marble

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