

# Nano-Cathedral



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



### 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 Maria of Vitoria-Gasteiz in Spain were selected as representative of south European "Mediterranean" climate in coastal and continental regions, respectively; the Sint-Daath 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 thereof 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 IUPAC call requirements. In particular, the employment of nano-particles 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 preservation 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	VITORIA	WIEN	KOLN	GHENT	OSLO
					
<b>BUILDING PERIOD</b> Medieval Age  <b>ARCHITECTURAL STYLE</b> Pisan Romanesque  <b>MAIN LITHOTYPES CLASSES</b> Mount Pisano marble, Jurek limestone / Apuan marble / Proconnesian marble / calcarenite / granitic rocks / Serpentine	<b>BUILDING PERIOD</b> Medieval Age  <b>ARCHITECTURAL STYLE</b> 13 <sup>th</sup> -14 <sup>th</sup> Centuries Gothic  <b>MAIN LITHOTYPES CLASSES</b> Lumachella from Ajarte / sandstone from Egueta / calcarenite from Olerdu	<b>BUILDING PERIOD</b> Medieval Age (1140-1513)  <b>ARCHITECTURAL STYLE</b> Late Romanesque and Gothic  <b>MAIN LITHOTYPES CLASSES</b> Limestones from Laim mountains and Vienna, few siliceous sandstones from Lower Austria	<b>BUILDING PERIOD</b> Medieval Age (1248-ca. 1320) 19 <sup>th</sup> Century (1842 - 1850)  <b>ARCHITECTURAL STYLE</b> Gothic Neogothic  <b>MAIN LITHOTYPES CLASSES</b> Diachenes Trachyte / Schladtort Sandstone / Odenkirchener Sandstone / Senoneser Limestone / Volcanic Tuffstones / Basalt lava	<b>BUILDING PERIOD</b> Medieval Age (942-1038) 14 <sup>th</sup> -16 <sup>th</sup> Centuries (1300-ca. -1568)  <b>ARCHITECTURAL STYLE</b> Romanesque Brabantine Gothic  <b>MAIN LITHOTYPES CLASSES</b> Arenaceous limestone belonging to the Lecc Formation (Belgium) and Belgian and French limestones as replacement materials (from Goerelange, Euville, Sevonnieres and Messing)	<b>BUILDING PERIOD</b> 2000-2007  <b>ARCHITECTURAL STYLE</b> Contemporary  <b>MAIN LITHOTYPES CLASSES</b> White Carrara marble

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The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646170



Nanotech ITALY 2015  
 Grant call n. 015 / 2015  
 01/05/2015 - 31/05/2015

