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# Preserving our heritage, Improving our environment

Volume I

20 years of EU research into cultural heritage

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Directorate-General for Research  
Directorate: Environment  
Unit: Environmental Technologies and Pollution Prevention

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# Foreword

## Cultural heritage – our debt to the past, our promise to the future

Europe's cultural legacy is one of the world's most diverse. It is a beacon that draws millions every year to our churches and monuments, to our museums, libraries, as well as to concert halls and festivals. As such, it is both the accumulation of past artistic achievements and the expression of continuing tradition and creativity. It is also a very dynamic trigger of economic activities and jobs, reinforcing the social and territorial cohesion of the European Union (EU).

Culture is playing a growing role in the European integration process. This should come as no surprise as Europe has always been a cultural undertaking since its very beginning. Indeed, the attempt to bring together the peoples of the continent with their different habits, traditions and languages has clearly a cultural dimension.

In this respect, the originality – and success – of the EU is in its ability to respect Member States' varied and intertwined history, languages and cultures, while forging common understanding and rules which have guaranteed peace, stability, prosperity and solidarity – and with them, a huge richness of cultural heritage and creativity to which successive enlargements have added more and more.

This increased recognition of the cultural dimension culminated with the adoption of the *European agenda for culture* by the European Commission in May 2007, that was later also endorsed by the Council of Ministers in November 2007. This agenda is articulated around three main objectives, with a clear and vital role for cultural heritage:

- ⌘ promoting cultural diversity and intercultural dialogue
- ⌘ promoting culture as a catalyst for creativity in the framework of the Lisbon Strategy for growth and jobs
- ⌘ promoting culture as a vital element in EU external relations.

Given the importance of culture to the European integration process, the Commission has long been a strong proponent and supporter of research to preserve, conserve and enrich Europe's cultural legacy to the full, while adapting it to the demands of preventive conservation and modern life. Since 1986, its Framework Programmes (FPs) have supported some 120 cultural heritage projects. These link together more than 500 public and private research organisations across the EU and its Mediterranean partners – from universities, research centres, museums to private companies – to develop and apply the best technology and scientific know-how to our cultural heritage. Research has focused on solutions to preserve movable and immovable cultural heritage assets, such as artefacts and monuments respectively. This tangible part of our cultural heritage, together with the digital and intangible aspects, represent a valuable store of knowledge and treasure of significant historical and socio-economic importance.

The need for a policy of sustainability in this area is more pressing than ever. Much of our cultural heritage is under attack – from environmental degradation and climate change, from socio-economic pressures and the accelerating pace of urbanisation, from the strains of global tourism and from forgery or trade in stolen artworks and not least

from the mere passage of time itself. We have no choice but to achieve as high a level of cultural heritage development to ensure that this legacy is protected in particular through our technology, creativity and foresight.

Grounded in the principle of subsidiarity, this challenge demands a collective effort by local, regional, national and EU authorities. It calls for collaboration among heritage managers and urban and regional planners, the tourism and construction sectors, policy-makers and civil society groups and, above all, cooperation among researchers, conservators, industry and SMEs. Indeed, an informed policy on cultural heritage actively contributes to the European Research Area and reflects in microcosm the dynamic and innovative approach required by the Lisbon Strategy.

The breadth of EU-funded research in this field is as diverse as our cultural legacy itself, as a glance at the following chapters easily confirms. This publication, comprising two volumes, highlights 20 years of European Commission-supported research in the field of tangible cultural heritage: the first volume provides the reader with an overview of the EU's commitment to cooperation in this field and how it has developed over the years. The second volume compiles nearly 100 projects implemented since 2000, with most of them being related to FP5 and FP6 *Environment* and *International cooperation* research. There are among others cutting-edge projects to conserve and restore buildings and monuments, to preserve Europe's vast archives of historical documents, to infallibly tag paintings and other artwork with new advanced techniques or to analyse materials using non-destructive methods.

This support extends into the 2007–2013 Seventh Framework Programme with particular emphasis, for cultural heritage, on the challenges posed by the environment, including climate change. Research resolves to integrate sustainable development with cultural legacy, thus improving the quality of life for Europe's citizens. Today's generation expects no less... and so will tomorrow's.

Janez Potočnik  
European Commissioner for Science  
and Research

Ján Figel'  
European Commissioner for Education, Training,  
Culture and Youth



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European Commissioner for Science and Research  
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European Commissioner for Education, Training, Culture and Youth  
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# Saving our heritage, enriching our environment

## EU research into tangible heritage over the last 20 years

*Even before growing economic organisation, culture has long been an important component in the unification of Europe while at the same time retaining significant diversity. More specifically, the cultural heritage of the peoples of Europe is a key factor in distinctly defining their identities. Thus, it highlights the need to promote mutual awareness of each other's culture and history within the overall 'European enterprise'. Simultaneously, it plays a key role in European citizens' quality of life today, contributing to economic prosperity and creating jobs. And yet, by definition, this is a fragile and non-renewable resource – indeed during the 20th century, it is considered that nearly 50% of Europe's tangible cultural heritage was lost. The combined impact of atmospheric pollution, urbanisation, excessive tourism, negligence and inappropriate restoration measures often results in irremediable changes and, in some cases, even the complete disappearance of major examples of immovable and movable heritage. These environmental and cultural threats continue to multiply, therefore requiring that resources be pooled beyond national boundaries, organised at EU level, to combat them.*

### Culture and cultural heritage: towards a new Community competency

There has been a long tradition in and awareness of the importance of cultural heritage – especially immovable heritage – at the national level, in particular related to the protection and restoration of architectural heritage. Indeed for many centuries, there has been awareness of the importance of preserving built heritage, but this idea of restoration really crystallised in the 19th century, with these ideas being put into practice. Then the concept of cultural heritage conservation broadened to include other areas of heritage, especially related to the movable part. In the second half of the 20th century, a series of resolutions, recommendations and conventions was taken by international worldwide and European organisations especially UNESCO, and its related agencies the International Council on Monuments and Sites (ICOMOS), the International Council on Museums (ICOM), and the International Centre for the Study of the Preservation and Restoration of Cultural Heritage (ICCROM).

At the European level, it was first the Council of Europe, and then the European Union (EU) institutions – essentially the Council, Commission and Parliament together with the Economic and Social Committee and the Committee of Regions – which became aware of the role played by cultural heritage, a recognition which shines through in the various legal acts which provide the backdrop to the EU's growing undertakings in this area. While the EC Treaty initially made no reference to the protection of our cultural heritage as such, or indeed the cultural sector as a whole, for some years now this subject area has been integrated through the EU's policies and programmes. Indeed, now the EC Treaty specifically makes provisions for protecting and enhancing cultural heritage (Article 151). Moreover, the EU has recognised citizens' growing attachment to the symbols of their past and has responded by progressively acknowledging the significance of heritage, and culture in general, as part of the process of European integration.

Coming back to the past, the European Parliament passed its first Resolution calling on the Community to take action in the cultural

sphere in 1974. This focused, in particular, on the protection of our architectural heritage. Then the Parliament in the same year issued a Recommendation to Member States in which it stressed the need to take urgent measures to safeguard the architectural and natural heritage of Europe, highlighting that, in determining the quality of life of European citizens, these key factors were “seriously threatened with decay and disappearance”.<sup>1</sup>

This set the ball rolling on a joint process of analysis, involving Member States and the competent institutions, with a view to protecting cultural heritage. In accordance with existing European and international agreements, any such action would be subsidiary to the measures taken by the Member States themselves and would strive, above all, to achieve effective cooperation; promote knowledge exchange and transfer of know-how and technical data; raise the awareness of both professionals and the general public; and enhance access to heritage.

These same goals were reinforced by two 1986 Council Resolutions on the conservation of works of art and artefacts and the protection of European architectural heritage.<sup>2</sup>

### Setting a wide range of activities

As far back as 1983, the Commission launched an initial series of operational and concrete measures related to cultural heritage as part of its cultural programme, lending its support to the restoration of particularly prestigious European historical and artistic sites and monuments, such as the Acropolis in Athens and the monasteries of Mount Athos in Greece. In 1984, it broadened its horizons, launching specific ‘Support

1. Commission Recommendation of 20 December 1974 to Member States concerning the protection of the architectural and natural heritage. OJ L021 of 28/01/1975.

2. Resolution of the Ministers with responsibility for cultural affairs meeting within the Council of 13 November 1986 on the conservation of works of art and artefacts, and Resolution of the Ministers with responsibility for cultural affairs and on the protection of Europe's architectural heritage. OJ C320 of 13/12/1986.

pilot projects for the conservation of the European architectural heritage' aiming at saving heritage buildings that were of particularly exemplary cultural and technical value, right up until 1995.

In 1993, the EC Treaty placed culture firmly in the Community remit for the first time, creating an appropriate legal base for action to be taken. In fact, Article 151 created the basis for all future developments in cultural undertakings at Community level:<sup>3</sup>

1. The Community shall contribute to the flowering of the cultures of the Member States, while respecting their national and regional diversity and at the same time bringing the common cultural heritage to the fore.
2. Action by the Community shall be aimed at encouraging cooperation between Member States and, if necessary, supporting and supplementing their action in the following areas:
  - improvement of the knowledge and dissemination of the culture and history of the European peoples;
  - conservation and safeguarding of cultural heritage of European significance;
  - non-commercial cultural exchanges;
  - artistic and literary creation, including in the audiovisual sector.
3. The Community and the Member States shall foster cooperation with third countries and the competent international organisations in the sphere of culture, in particular the Council of Europe.
4. The Community shall take cultural aspects into account in its action under other provisions of this Treaty, in particular in order to respect and to promote the diversity of its cultures.
5. In order to contribute to the achievement of the objectives referred to in this Article, the Council:
  - acting in accordance with the procedure referred to in Article 151 and after consulting the Committee of the Regions, shall adopt incentive measures, excluding any harmonisation of the laws and regulations of the Member States. The Council shall act unanimously throughout the procedure referred to in Article 151;
  - acting unanimously on a proposal from the Commission, shall adopt recommendations.

As shown above, this article clarifies the scope and purpose of Community action as regards culture and heritage: it must respect both cultural diversity and the principle of subsidiarity, but in no way aims to subsume the policies pursued by Member States; rather it must support them with a view to obtaining European added value.

Under paragraph 2b, the Community is urged as a priority to encourage cooperation among Member States and, if necessary, to support and supplement their action in the “conservation and safeguarding of cultural heritage of European significance”; although this concept of “European significance” was not explained in detail given the risk of different values and interpretations in the various Member States, it allowed the European Commission to take clear initiatives in the field of cultural heritage. Significantly, under paragraph 4, the text stresses that the Community must also take cultural aspects into account when defining and implementing policy in all relevant areas.

3. The project of the Treaty, signed in Lisbon by the Heads of the Member States on 13 December 2007, while not yet ratified, foresees the adoption of decisions in the field of culture on the basis of the qualified majority; its new Article 167 does not change the other contents of Article 151

Between 1995 and 2007, a series of initiatives to protect cultural heritage was undertaken within the remit of the Directorate-General for Education and Culture. The *RAPHAEL* programme (1995–99), in particular, aimed to support and supplement the action taken by the Member States in the field of cultural heritage of European importance. In addition, one of the key goals of the cultural cooperation programme *Culture 2000* (2000–06), that replaced the *RAPHAEL* programme from 2000, was to preserve and enhance Europe’s cultural heritage, allocating 34% of its budget to this area. This programme included an initiative entitled *cultural heritage laboratories* – some of which have, for instance, played a part in the restoration of the frescoes in the Basilica of St Francis of Assisi in Italy.

In the wake of its predecessor, the current culture programme (2007– 13) backs cooperation projects in many artistic fields, including the cultural heritage fields – such as the *ART NOUVEAU NETWORK* which can cover projects involving, among other things, training, the exchange of experience and the development of cultural multimedia products, and the EU Prize for Cultural Heritage awards, which are granted to heritage restoration projects. Through these awards, the EU celebrates exemplary initiatives of the many facets of Europe’s cultural heritage in categories ranging from the restoration of buildings and their adaptation to new uses, to urban and rural landscape rehabilitation, archaeological site interpretations, and care for art collections.

In addition, the *SOCRATES* programme supported educational projects in the field of cultural heritage which involved schools and museums, while the *LEONARDO DA VINCI* programme financed, among other activities, training in traditional crafts and in the restoration and development of cultural heritage. The Council of Europe and the EU have also worked together to organise *EUROPEAN HERITAGE DAYS*, which have been held since 1991, in order to raise awareness of cultural heritage.

Worldwide, cultural diversity and intercultural dialogue have become major challenges for a global order based on peace, mutual understanding and respect for shared values, such as the protection and promotion of human rights and the protection of languages.

In this context, in May 2007 the European Commission issued a Communication to “promote a European Agenda for Culture in a Globalising World”. This agenda is founded on three common sets of objectives: promoting cultural diversity and intercultural dialogue, promoting culture as a catalyst for creativity in the framework of the Lisbon Agenda for growth and jobs, and promoting culture as a key component in international relations, with a clear and vital role for cultural heritage. The Commission therefore wants to share this agenda with all concerned stakeholders: Member States, EU institutions (especially the European Parliament) and the cultural sector, through new partnerships and methods for cooperation. The aim is to raise the profile of culture in the ‘European enterprise’ while focusing available resources on the three shared strategic objectives, which serve as general guidelines for future action by all relevant stakeholders.

Under the first set of objectives, the EU and all other relevant stakeholders should work together in order to foster *intercultural dialogue* with a view to ensuring that the EU’s *cultural diversity* is understood, respected and promoted. To do that, the idea is, for example, to enhance the cross-border mobility of *artists and workers in the cultural sector* or the cross-border dissemination of works of art. The second set of objectives focuses on the promotion of *culture*



European cities: a complex web of inherited and new construction, cultural heritage is an essential part of our living environment (Budapest) – © Stock.Xchng



Athens Acropolis, a major site which restoration has been supported by the EU Cultural Programme – © Stock.Xchng

as a catalyst for creativity in the framework of the Lisbon Strategy for growth and jobs. The cultural sector is already a very dynamic trigger of economic activities and jobs throughout the EU territory. Cultural activities also help promote an inclusive society and contribute to preventing and reducing poverty and social exclusion. As was recognised by the conclusions of the 2007 Spring European Council, creative entrepreneurs and a vibrant cultural industry are a unique source of innovation for the future. Indeed, cultural industries are an asset for Europe's technological innovation, economy and competitiveness. This potential must be recognised even more and fully tapped. **International relations** is the third set of objectives. As a party to the UNESCO Convention on the Protection and the Promotion of the Diversity of Cultural Expressions, which entered into force in March 2007 and can be seen as a fundamental step, the EU – having greatly contributed to it – is committed to integrating the cultural dimension as a vital element in Europe's dealings with partner countries and regions. The EU is, and must aspire to becoming even more, an exemplar of a 'soft power' founded on norms and values such as human dignity, solidarity, tolerance, freedom of expression, respect for diversity and intercultural dialogue, values which, provided they are upheld and promoted, can be of inspiration for the world of tomorrow.

Even if it is not directly targeted by this Communication, the contribution of cultural heritage and research in this field can be complementary and significant for the implementation of these objectives.

## Provisions on cultural heritage in other EU policies

In order to assess the true scope of Community action in the field of heritage, it is necessary to mention several other EU policies. The EC Treaty (Article 151, paragraph 4) requires the EU to take culture into account in all its actions so as to foster intercultural respect and promote diversity. Therefore, one important objective is to mainstream cultural policy into activities in other areas of EU policy. In practice, the European Commission, Directorate-General for Education and Culture, thus ensures a coordinating role over the activities

managed by other Directorate-Generals with regard to culture. In terms of regional policy, the European Regional Development Fund (ERDF) has recognised the potential of activities related to heritage in generating both employment and growth and has funded various types of project involving historical buildings and sites. It has lent its support mainly via programmes based on a partnership between the European Commission, Member States and the regions, as well as Community initiative programmes such as Interreg (cross-border cooperation programme) and Leader (development of the rural economy) and, later, 'innovation projects' through which funding was earmarked for innovative pilot projects, including some anchored in culture and heritage, such as the design and development of archaeological sites.

In addition, as regards digital heritage, which is mainly part of intangible heritage, it is worth mentioning the activities of the Directorate-General for the Information Society and Media (DG INFSO). A series of programmes, such as Esprit, ACTS and IST (Information Society Technologies) served to boost the technologies of the information society as part of the different Framework Programmes. The European Commission, through DG INFSO, has participated in the European Heritage Network (Herein), in cooperation with the Council of Europe. IST, developed under FP5 and 6, in turn involved a project entitled *DIGICULT* (Digital heritage and cultural content) which provided considerable support for the introduction of digital data libraries, archives and museum collections, and promotes electronic access to these cultural resources.

A vast range of IT and multimedia applications were developed using resources intended to promote the digital industries and information market. Particularly worthy of note are the programmes *Info 2000* and, more recently, *E-CONTENTPLUS*. Regarding research, in 2007 the Commission adopted a Communication on scientific information in the digital age to examine how new digital technologies can be better used to increase access to research publications and data as an important driver for innovation.<sup>4</sup> The overall objectives of the Commission Recommendation and the vision of the European

4. <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/190&format=HTML&aged=0&language=EN&guiLanguage=en>

## Shape memory following seismic shocks

The construction industry currently uses specialist protection techniques to reduce the seismic load placed on structures and to strengthen them in case they are subjected to tremor. But these methods are not suitable for all types of historical building and, indeed, can even prove harmful to brick and stone edifices with less robust structural links. The Basilica of St Francis of Assisi, located in Umbria, is a prime example of this. Its vaults collapsed during the earthquake of 1997, despite having been previously reinforced.

*ISTECH* (Development of innovative techniques for the improvement of stability of cultural heritage, in particular seismic protection) invented a very attractive alternative solution to this problem.

The natural joints of the ancient structures, which change over time and following each successive quake, are strengthened using a nickel–titanium shape memory alloy, or SMA. The main advantage of these materials is that they are able to dissipate energy from movement while improving the general stability of the structure concerned. After a long series of tests and simulations, this technique was implemented in the Assisi Basilica and San Martino in Rio Church, which was located close by and had also fallen victim to a seismic shock. The project was completed between 1996 and 1999 thanks to support from the ‘Environment and climate’ programme in FP4.



Underwater archaeological site of “Cala Minnola” in Levanzo

**Coordinator:**  
**FIP Industriale SpA, Selvazzano dentro Pordenone, Italy**

Digital Library received the political endorsement of the Council<sup>5</sup> in November 2006.<sup>6</sup> Between 2003 and 2006 a total budget of around €80 million was devoted to supporting research in the field of ‘Access to and preservation of cultural and scientific resources’.

In addition, it is important to note the close ties between the action undertaken by the European Commission in the field of applied heritage research and its activities as part of its *Environment and sustainable development policy*. For example, the recently adopted environment directives and new thematic strategies on air pollution and improving the European urban environment also have an impact on heritage conservation.

This list is not exhaustive. Furthermore, it is important to note that culture – and often heritage in particular – has been pinpointed as a priority for the majority of funding resources available for Community action in the fields of external relations and development cooperation. Particular focus has been placed on the Mediterranean region, especially through the *EUROMED HERITAGE* programme which supports cooperation between the EU and partner countries of the southern Mediterranean in the fields of study, conservation and promotion of tangible and intangible heritage.<sup>7</sup> One result of the programme is the defining of a strategy paper entitled *Strategy for the development of Euro-Mediterranean Cultural Heritage: priorities from Mediterranean countries (2007–2013)*, drafted in consultation with the Mediterranean partners countries. The new EU maritime policy also offers a unique opportunity to promote the maritime cultural heritage as a means to foster cultural understanding and relevant cooperation.

For some years now, the European institutions have been calling for the

gradual creation of an informal ‘European cultural area’, and the store set by cultural issues in so many of the Community’s programmes is clear proof of the EU’s commitment to this idea. But even though culture and heritage have been added quite visibly to the political agenda of the EU, coordination between the different initiatives should be further improved. This situation has nullified the leverage that could have been created in order to compensate for the limited resources allocated to this field. By promoting synergy within the European institutions alongside an interdisciplinary approach in the field, the policies concerned could be strengthened which, in turn, would help promote the development of a global and integrated EU initiative in the sphere of culture including the conservation and promotion of Europe’s cultural heritage. Over the last two decades, the Community has also progressively paid greater heed to matters relating to cultural heritage when pursuing its research policies, especially its environmental, international and social components. These research aspects will be analysed in greater detail in the following chapters. Since 2000 when the initiative of the European Research Area (ERA)<sup>8</sup> was created where all scientific and political efforts must converge for improved coordination, shared knowledge and efficiency, de facto, cultural heritage research has contributed, more or less implicitly, to the ERA.

However, even if many EU policies may now include the conservation of cultural heritage, it is worthwhile noting that the impacts on cultural heritage of the new EU legislation in other fields of activities (e.g. air, water, construction, chemicals, energy performance, tourism, etc.) are not yet systematically taken into account and assessed<sup>9</sup> to prevent eventual damage.

5. Council Conclusions 2006/C297/01

6. [http://ec.europa.eu/information\\_society/activities/digital\\_libraries/index\\_en.htm](http://ec.europa.eu/information_society/activities/digital_libraries/index_en.htm)

7. [www.euromedheritage.net](http://www.euromedheritage.net).

8. European Research Area: New Perspectives – The “Green Paper” of 04.04.2007 – EUR 22840 – European Commission COM (2007)161

9. One association entitled *European Working Group on EU Directives and Cultural Heritage* is looking over new EU legislation and directives to examine how eventual impacts on cultural heritage are taken into account in these legal acts: it issues periodic newsletters and has also issued a publication on: European legislation and cultural heritage (editors A. Ronchi & T. Nypan, 2006, Deleyva editore, Milan,

## Research into tangible cultural heritage

It was not until 1986 – subsequent to the resolution of the Council adopted on 13 November – that the European Commission began to diversify and produce responses to the many demands and challenges linked to the protection of heritage in the face of the repercussions of modern living and industrial development. Since then, a new awareness of the need to better manage the environment has emerged across Europe, coupled with recognition of the significant damage caused by the hitherto unbridled use of fossil fuels.

The knock-on effects of development – i.e. air and water pollution, the uncontrollable boom in road traffic, the spread of the road network and urban expansion – are no longer considered to be inevitable. Indeed, in 1987, the Brundtland Report issued by the World Commission on Environment and Development first touted the concept of “sustainable development” which suggested that economic growth can and must be compatible with better management of the earth’s resources for future generations. Furthermore, the international texts drafted on the subject of heritage (such as the Granada Convention, which was promulgated by the Council of Europe in 1985, assert the need to root conservation policies not only in cultural criteria, but also in environmental, urbanistic, economic and social factors.

Cultural heritage is a particularly fascinating case study in this context. It lies at the intersection between various different disciplines and combines basic research, notably into the reactions of materials when exposed to environmental attack, with the development of technologies that could, in turn, produce innovative conservation resources. This cross-over between the fields of heritage, human and social sciences, environmental research, and town and country planning helps identify the significance of heritage for society and identities. It also provides the decision-makers with valuable pointers for an integrated policy of protection and restoration. Furthermore, cooperation between the scientific world and the owners and users of our heritage is an absolute prerequisite for the sustainable management of the cultural resources concerned.



Assessing the impact of tourism on cultural heritage is essential to its preservation — © APPEAR

Last but not least, cultural heritage is inextricably linked to tourism, one of the largest sectors of Europe’s economy today. Each year, some 300 million tourists travel the globe. According to the World Tourism Organisation, this figure is set to rise to 800 million by 2025. The potential of this industry gives considerable food for thought. Furthermore, culture and cultural heritage in Europe generates, directly and indirectly, 8 million jobs, in comparison with 12 and 1.7 million in the automobile and chemicals industries respectively.

So as not to overlook any of these many factors, a joint and pragmatic approach at European level was adopted. On the one hand, the work aimed to devise common methods and instruments with a view to better protecting, restoring and safeguarding heritage for the future, by means of cooperation between research and industry. On the other hand, the parties involved were eager to promote innovation in this area in accordance with the provisions of the Treaty which seek to strengthen the scientific and technological basis of Community industry and encourage it to “become more competitive at international level”.

The causes, mechanisms and damage of environmental and human influences on heritage sites, buildings and objects were progressively studied, also promoting international cooperation in heritage research. These remained the overarching aims of successive programmes implemented through the European Commission’s research policy for just 20 years.

### Saving works of art

*SAVE ART* (To save the artistic heritage from insect pests without using toxic chemical compounds) is a highly original research project that ran between 1998 and 2000. Its aim was to develop the innovative and economical technology VELOXY® (Very Low OXYgen) with a view to protecting old books, textiles and other antiques from attacks by insects and micro-organisms, without losing sight of the health and safety of restoration specialists and the public at large.

The method developed uses an electromechanical device that can be easily transported and will create an atmosphere that is almost entirely devoid of oxygen inside plastic units that are assembled on site. The object being treated remains sealed inside the unit for 14–15 days. The anaerobic atmosphere created guarantees 100% eradication of insects, including eggs and larvae, as well as of the majority of micro-organisms. This project was supported by the ‘Environment and climate’ theme in FP4.

**Coordinator:**

**R.G.I. Resource Group Integrator Srl, Genoa, Italy**

## Successive programmes and projects covering cultural heritage research (FP1–FP6: 1986–2006)

From the very first programme, entitled *EFFECTS OF AIR POLLUTION ON HISTORIC BUILDINGS* (1986–90) to the programmes launched as part of FP5 (1999–2002) and FP6 (2003–06) as well as the *INTERNATIONAL COOPERATION PROGRAMME*, more than 100 individual projects were subsidised.

### Cultural heritage from FP1 to FP4

Over the course of the first Framework Programme for Research and Technological Development (FP1, 1984–87), the Member States agreed to an EU initiative to research the effects of acid rain and air pollution on historic buildings. It was the result of the extension of a compromise about the effect of acid rain on various types of resources from natural (such as forestry) to built environment and cultural heritage.<sup>10</sup> Backed by the European Parliament, this action comprised 10 sub-projects focusing on the effects of air pollution on stone (granite, limestone and marble) through a series of:

- ⌘ monument studies in many locations throughout the EU (Dublin, Lisbon, Padova, Rome, Pavia, Paris, Seville, etc.);
- ⌘ environmental monitoring of critical environmental conditions in Athens, Dublin, Antwerp, Padova, Rome and Pavia;
- ⌘ controlled chambers studies and computer modelling, in which the effects of controlled exposure to various pollutants was studied in Manchester, Lisbon, Paris and Patras;
- ⌘ exposure studies in Athens, Antwerp and Dublin.

Via FP1–FP4 run by the European Commission, the EU's *ENVIRONMENT RESEARCH* programme tackled a series of relevant issues between 1986 and almost 2000. It aimed to encourage cross-border, cross-disciplinary research cooperation with a view to reconciling a better environment and quality of life with industrial development. Consequently, each successive programme devoted specific provisions to heritage, to assess a wider and diversified range of cultural heritage assets and proposed new methodologies for conservation.

- ⌘ While the sub-projects undertaken in FP1 focused on air pollution on stone buildings, FP2 (1987–91) picked out eight new projects, two of which focused on the environmental deterioration of granite monuments, including megaliths.
- ⌘ Two further groups investigated how polluting particles and gases deposit on to building surfaces and how they interact with the surface.
- ⌘ A large and general project concerned the 'Environmental deterioration and protection of historic buildings', which includes 14 laboratories of nine European countries.

Apart from stone, this area of research included in this second period of development, the conservation and protection of three other kinds of materials:

- ⌘ ancient leather objects (especially book bindings)
- ⌘ stability of paper under internal and external environmental factors
- ⌘ metal objects from archaeological sites.

The initial projects under FP1 and FP2 were more fundamental studies and progressively turned (in FP5) into wider research projects carried out by universities, research centres and specialist (SMEs) from various

European countries, running for two, mostly three or sometimes four years and involving on average 7–10 different project partners. Over time, their scope has broadened, echoing the desire of the programme as a whole to cover all of the complex facets of heritage, tackling the many different problems it brings up. At the same time, the scientific teams who were working in a relatively isolated manner were obliged to work together and mix. Whether they developed methods of analysing environmental damage, devised a more effective and less aggressive treatment for different types of tangible cultural heritage, or identified best practices for the management of cultural resources, the projects concerned all made use of the latest resources in research and technology to guarantee the optimum integrity and authenticity of our cultural heritage for the future.

Running from 1990 to 1994, FP3 continued to support the objectives of all 18 of these projects selected through two calls for proposals, with the first one still focusing on the many facets of stone conservation:

- ⌘ chamber studies on standard specimens and field measurements
- ⌘ salt marine spray influence on Mediterranean monuments
- ⌘ mechanisms of damage caused by biological agents

Concerning the methods of examination used, numerical models for structural analysis were combined with a range of non-destructive techniques, including for instance:

- ⌘ X-ray tomography ultrasound techniques
- ⌘ ground-penetrating radars, etc.

With regard to materials other than stone, three new subjects were developed:

- ⌘ coating designed to protect outdoor bronze sculptures
- ⌘ environmental monitoring at cultural property sites and museums
- ⌘ standard definitions of damage for brick masonry structures 'Atlas of damages combined with an expert system for the evaluation of damage' (a video was produced presenting the results of this research project).

As to the result of the second call for proposals, projects demonstrated some continuity as regards research undertaken in previous periods concerning stone, brick masonry, archaeological iron, effects of the environment on indoor cultural property (museums and libraries), vegetable tanned leather. In addition, new materials and areas of research covered environmental research for art conservation applied to the paintings and woodcare.



*Damage to plaster due to salt, RH cycles leading to irreversible dilation*

10. The list of FP1–FP4-funded projects can be found on page 30, while the list and description of FP5 and FP6 projects is provided in Volume II of this publication.

In the context of the following FP4 (1994–98), 19 projects were carried out under the environmental research area ‘Technologies to protect and rehabilitate the European cultural heritage’. In the first call for proposals, 10 new projects were funded, including one dealing with archaeometry and providing some background on the impact and evolution of European industrial and urban pollution, as significant for future formulation of European legislation on urban air quality.

Regarding the protection and conservation of historical buildings, several projects helped to complete the scientific information of the environmental degradation of built European heritage, regarding in particular:

- ⌘ effects of marine salts on Mediterranean/Atlantic coastal monuments
- ⌘ impact of urban atmosphere pollution on modern and ancient mortars
- ⌘ improvement and conservation of wooden materials of Scandinavian cultural heritage
- ⌘ improvement of the stability of monuments, including earthquake-resistance capability, through the use of new materials (See box on ISTECH, ‘Shape memory following seismic shocks’, page 10.)
- ⌘ analysis of the environmental degradation of artificial marble and preparation of the optimum material for repairs and replacement with a very broad application.

Concerning the movable cultural property, some projects dealt with bronze sculptures, rock art (mass tourism management related to archaeological paintings on karstic caves), assessment of environmental risk related to unsound use of technologies (air conditioning, lighting, etc.) and mass tourism (targeted towards museums and galleries).

With regard to the second call, nine new projects were funded reflecting some updated priorities: these modifications stressed the cooperation with other European Commission initiatives, the involvement of end-users in research projects (SMEs, local authorities, libraries, museums and galleries, etc.) and the cost–benefit analysis of damage to cultural property in the urban environment.

Four projects dealt with the decay and treatments for historical buildings, covering issues such as salt compatibility of surface treatments, a new water-repellent biocide, the maintenance of pointing, and remediation strategies of marble structures. Another project entitled *REACH* addressed the issue of ‘Rationalised economic appraisal of cultural heritage’, in order to assess the cost/benefit of urban environmental policy changes with respect to air pollution damage and its remediation, and the introduction of management standards for the care of monuments.

Some other projects addressed the protection of silver collections from tarnishing, the treatment of wooden cultural objects from insect pests without using toxic chemical compounds (see box on *SAVE ART*, ‘Saving works of art’, page 11), or the analysis of bone objects degradation as an indicator in the deterioration of archaeological cultural property. Finally, another project developed a novel molecular tool for analysing unknown microbial communities of mural paintings and their application in the conservation/restoration practice.



Sculptures of Igor Mitoraj, Trajan Market, Rome – © Stock.Xchng

## Cultural heritage under FP5 and FP6

Nearly 80% of European citizens live in built-up areas. Europe's cities are the homes, workplaces and leisure destinations of millions. They abound with historical and artistic heritage of exceptional value which has shaped the imaginations and identities of the European people and continue to attract flocks of tourists from across the globe. For half a century, Europe's cities have been changing drastically in architectural, urbanistic and socio-economic terms. In order to protect the heritage of these cities from atmospheric pollution, and to conserve, restore and reintegrate it into the emerging new urban context, a global and more consistent approach was thought to be needed and implemented at EU level.

Under **FP5 (1999–2002)**, the key action, entitled 'The city of tomorrow and cultural heritage', aimed at responding to this challenge covered the different factors relating to sustainable urban management and development, construction, urban transport research, and the 'Protection, conservation and enhancement of European cultural heritage'. Some 29 research projects, as well as two joint initiatives and two topic-based networks, were launched and funded in this cultural heritage area between 1999 and 2002 for an overall EC contribution of about €4 million. A series of priorities were set: assessment of damage to cultural heritage; the development of innovative conservation strategies; and better integration of heritage into the urban setting. The projects implemented worked towards these priorities to conceive plans for the prevention of deterioration due to microbiological factors, safe methods for assessing damage caused to movable and immovable cultural heritage, preventive conservation measures for artefacts housed in museums and churches, and study visits aimed at improving the storage conditions and access to archaeological relics located in towns and cities.

To these environmental projects must also be added 10 cooperation projects involving third partners of the Mediterranean region.

Under **FP6 (2003–06)**, tangible cultural heritage was withdrawn from the environment programme and constituted an area funded within the programme entitled '*SCIENTIFIC SUPPORT TO POLICIES*' (*SSP*). However, it remained the responsibility for its overall management and follow-up of the environment directorate within the Directorate-General for Research. As part of *SSP*, the research carried out was tailored to the priorities and requirements of specific and 'operational' EU policies, especially those related to the cultural sector and promotion of European heritage.

Although the funds earmarked through the *SSP* programme for this sector of research into cultural heritage fell considerably during FP6 (around €13 million for four calls for proposals), the research themes chosen again offered some continuity with past projects but developed new aspects. These aspects encompassed assessment of the impact of climate change and atmospheric pollution on cultural heritage; analysis of the effects of tourism; research into protection and conservation methods and treatments; and identification of traditional materials and techniques that could enhance current approaches to conservation of the built environment of architecture and movable items taking into account, as much as possible, the aspects of authenticity, compatibility, retreatability and reversibility. The last calls for proposals within FP6 comprised a further, significant issue and opened to a wider field of research linking environment and security research issues: the methods and technologies used to verify the authenticity and traceability of cultural artefacts, in particular in cases of theft, and more generally to combat fraud and illegal trafficking of works of art.

20 or so projects were funded through to the end of FP6 within the framework of *SSP*.

In addition, 15 cooperation projects involved the Mediterranean region via the Mediterranean Partner Cooperation initiative (*FP6-MPC*). Altogether with the FP5 *INCO* programme, these *INCO-MPC* projects reflected the large variety of approaches foreseen by the calls for proposals, allowing the analysis and utilisation of ancient technologies and management systems for the restoration, conservation and valorisation of historical and archaeological objects, monuments, and sites. Of particular importance, the research initiatives concerned ancient materials ( metal alloys, ceramics, paper, mortars, mural paintings ) and their production techniques which in several cases gave rise to specific applications in modern industry

It is worthwhile noting that few complementary and focused initiatives have also been developed in other specific research programmes of FP5 and FP6 such as in the FP5 *Competitive and Sustainable Growth* programme, or *Improving the human research potential and the socio-economic knowledge base*, including aspects of networking and mobility projects. Within this last specific programme, the FP5 key action *Improving the socio-economic knowledge base* covered, for instance, the *ECHO* project *European cultural heritage online* promoting the preservation of cultural heritage and its free access and large dissemination of results on the Internet.

At the end of FP6, a series of broad networks and work fora were also set up to consider in detail and extend the work being done. One such forum and large initiative is the 'European Construction Technology Platform' (*ECTP*) which involves key participants from both the public and private sectors, mainly led by industry and SMEs, which are also required to provide a larger share of the research funding. As for all European Technology Platforms, the *ECTP* is led by the private sector especially the construction industry. The *ECTP* platform encompasses a 'Focus Area' on looking into cultural heritage (*FACH*), mainly built heritage. The *ECTP* drafted a long-term plan of action entitled *Vision 2030* and the *Strategic Research Agenda (SRA) and implementation plan* which aims to pinpoint the priorities to be dealt with in the construction field as a whole, and includes cultural heritage. This implementation plan covers the period 2007–13, corresponding to the time frame of FP7. Furthermore, a Joint Technology Initiative (*JTI*) in the field of construction and energy is under preparation in 2008, which may also include appropriate aspects of built heritage. The proposed *JTI* would be submitted for approval by the EU institutions in the next few years subject to the main industrial participants. Linked with the *ECTP*, nearly 30 national construction platforms have also been set up to stimulate scientific and political efforts for construction in the Member States, many of which also include a 'focus area' on cultural heritage.

# Implementing research strategies and networking for European cultural heritage

## Focusing on FP5 and FP6

*The development of innovative approaches and technologies for conservation, and the identification of best practices in the management of urban and cultural property, the impact of environmental factors on our cultural heritage are just some of the priorities of the FP5 and FP6 implemented by the European Commission between 1999 and 2007. The specific activities undertaken within these two Framework Programmes have offered the research centres and decision-makers concerned across Europe an unprecedented opportunity for the creation of innovative methods for protecting and managing our heritage, both immovable and movable, based on cross-border, cross-disciplinary cooperation.*

### FP5: Europe's cities as living laboratories

The architecture, in particular the historical buildings, and quality of life of the inhabitants of Europe's cities are constantly under threat from both environmental and human influences. In 1998, the European Commission launched a key action entitled 'The city of tomorrow and cultural heritage', placing urban issues at the core of an ambitious research programme for the first time. Granted a budget of €170 million for the period 1998–2002, this initiative hoped to produce tangible results via targeted, innovative and integrated actions. The challenges faced are by no means negligible – to improve the quality of life of urban communities and related regions, and to enhance the competitiveness of Europe's cities by encouraging sustainable development that is measurable in economic, architectural, environmental, social and cultural terms.

When choosing which projects to fund, the Commission looked for those that would be likely to produce significant, sustainable results, involve real participation of the end-users, and help create transnational networks of cooperation. The projects were required to improve the technologies, resources and methodologies used via research and development work, and enhance forecasting, monitoring and assessment of interaction between the many facets of Europe's cities and their natural and human environments. In particular, these concerns were set out in concrete terms in the 29 cultural heritage projects finally selected under Theme 4.2 of the key action entitled 'Protection, conservation and enhancement of European cultural heritage', with an EU contribution totalling €40 million, in response to three calls for proposals in 1999, 2000 and 2001 (the third call with two deadlines).

The projects funded were divided across the following three research areas:

- ⌘ assessing damage to cultural heritage
- ⌘ innovative conservation strategies
- ⌘ fostering integration of heritage into the urban setting.

### Assessing damage to cultural heritage

The various research projects carried out under this heading covered a wide range of different categories of heritage and associated problems. Some were based on a global approach aiming to suggest models and guidelines that could be applied to various types of cultural

property. As an example, *MULTIASSESS* (Model for multi-pollutant impact and assessment of threshold levels for cultural heritage) aimed to devise a methodology that would enable assessment of the risk of deterioration of cultural heritage as a result of the impact of gas particulates emitted by road traffic. *IMPACT* (Innovative modelling of museum pollution and conservation thresholds) and *MIMIC* (Microclimate indoor monitoring in cultural heritage preservation) are two further examples of such projects; they analysed the effect of air pollution inside buildings and museums with a view to developing models and drafting guidelines to assess the damage done to collections.

Other research projects carried out under this same priority heading focused on more specific issues: *IDAP* (Improved damage assessment of parchment) endeavoured to develop and implement a methodology enabling better assessment of damage with more accuracy and protection of ancient parchments. *MODHT* (Monitoring of damage in historic tapestries) carried out some similar work on old tapestries. A further example is *LIDO* (A light dosimeter for monitoring cultural heritage: development, testing and transfer to market), which aimed to facilitate measurement of light with a view to preventing deterioration of artefacts within museums, galleries, etc., and has given rise to a patent. (See box on *LIDO*, 'Taming light', on page 16.)

### Innovative conservation strategies

The projects selected as part of the second priority area within this key action, i.e. 'Development of innovative conservation strategies', tackled issues related to the preservation of the physical integrity of objects of historical value. This type of project also had to take into account the assessment of damage but went further by proposing remediation strategies for improving conservation. They developed strategies, products, methods and technologies for both preventive conservation and restoration. Several of the projects carried out also focused on microbiology and molecular biology techniques for the protection of heritage. They strove to improve diagnosis and analysis of bio-deterioration and especially to find solutions to improve conservation. The projects *COALITION* (Concerted action on molecular microbiology as an innovative conservation strategy for indoor and outdoor cultural assets), *CATS* (Cyanobacteria attack rocks: control and preventive strategies to avoid damage caused by cyanobacteria and associated micro-organisms in Roman hypogean monuments),

*BIODAM* (Inhibitors of biofilm damage on mineral materials) and *BACPOLES* (Preserving cultural heritage by preventing bacterial decay of wood in foundation piles and archaeological sites) all worked towards similar but differentiated objectives.

*DIAS* (Integrated tool for *in situ* characterisation of effectiveness and durability of conservation techniques in historical structures: drilling, indentation, acoustics of stones) developed new portable prototypes and complementary technologies and associated software to assess, *in situ* and laboratory, the mechanical properties of building stones and damage in a non-destructive manner for an effective strategy for stone replacement in damaged parts of historic buildings and monuments. Also *LASERACT* (Laser multitask non-destructive technology in conservation diagnostic procedures) developed a 'non-contact' portable prototype associating laser and optical techniques and software for structural assessment in art conservation (e.g. detecting voids, cracks, detachments, holes, in different categories of materials, wall paintings, wooden structure etc.). *ONSITEFORMASONRY* (On-site investigation techniques for the structural evaluation of historic masonry buildings) aimed to improve methodologies for inspection and assessment of ancient and often in homogeneous masonry mainly consisting of brick, stone and mortar. The project looked at a range of measurement techniques known as non-destructive testing (NDT) and investigated another test method referred to as minimally destructive. The partners classified the different types of damage and the challenges they pose to structural investigation, and they identified which techniques worked best in which situations.

Other projects such as *ASSET* (Assessment of suitable products for the conservative treatment of sea-salt decay) and *COMPASS* (Compatibility of plasters and renders with salt-loaded substrates in

historical buildings) dealt with damage to architectural structures caused by salt, either from sea water or humidity and produced an expert system designed for end-users. This is a problem often faced by old buildings. The *ROCEM* project (Roman cement to restore built heritage effectively) carried out research with a view to relaunching the standard Roman cement used during the 19th and at the start of the 20th century to decorate façades, which gradually went out of use.

A final group of projects focused more specifically on historically valuable movable items. One project entitled *MASTER* (Preventive conservation strategies for protection of organic objects in museums, historical buildings and archives) promoted preventive conservation strategies and developed appropriate sensors and prototypes to protect movable assets housed inside museums and galleries. At the same time, other projects came up successfully with new methods for conserving ancient papers and documents. These include *PAPYLUM* (Chemiluminescence, a novel tool in paper conservation studies), *INKCOR* (Stabilisation of iron gall ink containing paper) and *MIP* (Transitional metals in paper). *COLLAPSE* (Corrosion of lead and lead-tin alloys of organ pipes in Europe), meanwhile, endeavoured to analyse and combat the problems related to corrosion of historical organ piping.

## Integration of heritage into the urban context

The objective of the third research priority of the key action 'The city of tomorrow and cultural heritage' was to foster the integration of cultural heritage into the urban context. Two projects received funding under this heading: *SUIT* (Sustainable development of urban

## Taming light

Light, whether natural or artificial, is well known as one of the greatest enemies of the works of arts housed in museums and historical buildings. Prolonged exposure can fade colours and even erode the ancient materials used. In order to prevent such damage, conservationists are striving to limit exposure times or the intensity of the lighting used for the most sensitive works. Ideally, ongoing monitoring is needed, but this is very costly and can only be achieved in a restricted number of cases.

To facilitate assessment of the impact of light on works of art and to identify optimum lighting conditions, a European team was set up to work on the *LIDO* project (A light dosimeter for monitoring cultural heritage: development, testing and transfer to market). The objective of this project was to design a dosimeter that would be easy to use and robust, offer good value for money and meet with the very specific day-to-day needs of experts working in cultural heritage. Following both laboratory and fieldwork, for which measurements and analyses were carried out in museums in London, Paris, Berlin, Florence and Prague, two dosimeters were produced: LightCheck® Ultra (LCU), which is used to monitor highly light-sensitive objects, and LightCheck® Sensitive (LCS), which is applicable for more durable objects (and longer exposure times). These devices are now available on the market. This project, which was carried out from February 2001 to January 2004, was supported under the key action of FP5 – 'The city of tomorrow and cultural heritage'.



A LightCheck strip placed next to carpet (photograph: V&A, London) – © LIDO

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**Website:**  
[www.lightcheck.co.uk](http://www.lightcheck.co.uk)

## Fragments of urban history: from heritage to development

Alongside the prestigious buildings and monuments which form the core of our urban heritage, Europe's cities are also home to less visible historical quarters which house more ordinary buildings that nonetheless exemplify styles of architecture that were in fashion at different periods of our history. This urban heritage is part of the living and breathing fabric of our towns and cities.



Antwerp Cathedral at night – © Stock.Xchnng

It helps safeguard their great social and cultural diversity and calls for a different approach to conservation than that applied to historical monuments. The long-term conservation of these fragments of urban history must go hand in hand with measures to promote socioeconomic development and enhance citizens' quality of life.

The *SUIT* project (Sustainable development of urban historical areas through an active integration within towns) set out a series of guidelines in a manual entitled '*Guidance for the environmental assessment of the impact of certain plans, programmes or projects upon the heritage value of historical areas, in order to contribute to their long-term sustainability*'. On the one hand, this project endeavoured to assist the relevant authorities in decision-making and forward planning for urban areas. On the other, it aimed to provide developers, heritage and town planning professionals, environment management experts and the general public with new ideas and suggestions based on the results of an in-depth critical study carried out at European level. This project was implemented between 2000 and 2004 and was supported by FP5's key action, '*The city of tomorrow and cultural heritage*'.

### Coordinator:

**University of Liège, Department of Architecture and Town Planning, Laboratory for Architectural and Urban Methodological Study, Liège, Belgium**

**Website: [www.suitproject.net/](http://www.suitproject.net/)**

historical areas through an active integration within towns) and *APPEAR* (Accessibility projects for the sustainable preservation and enhancement of urban subsoil archaeological remains). (See boxes on *SUIT* 'Fragments of urban history: from heritage to development' and *APPEAR* 'Archaeology at the heart of the city', pages 18.) They endeavoured to develop tools, methods and models that would promote sustainable use and integration into the urban context of the cultural heritage of European cities, including archaeological relics, without hampering efforts undertaken to maintain their integrity and in conformity with European directives on environmental impact assessment. This is achieved by pinpointing the constraints placed by urban development around historical sites, drafting guidelines which aim to facilitate urban planning and enhance the access and security to historical buildings or archeological remains, and reconciling the criteria for protecting them with the current regulatory framework.

To provide a complete overview of this aspect, it is necessary to mention the results of those projects that were co-financed by the *CRAFT* 'programme' (Cooperative research action for technology). Although this programme did not cover protection of heritage as an explicit priority, the *CRAFT* system enabled groups of SMEs with insufficient resources to outsource research tasks to external organisations (universities, research centres, other SMEs) while keeping ownership of the applications. Four of these projects – *ITER* (Isotopic technologies applied to the analysis of ancient Roman mortars), *HISTOCLEAN* (Intelligent measurement technology for the cleaning of historic buildings and monuments), *PARELA* (Paper restoration using laser technology) and *LICONS* (Low-intrusion conservation systems for timber structures) – aimed to develop technologies and tools to be used to analyse ancient Roman mortars, clean with higher precision historical monuments,

restore paper using laser technologies and undertake cost-effective repair of structural timber.

This rough sketch also demonstrates the interdependence of the European operators who often invested heavily in the research being carried out. The support from the Commission – while limited – and its role as a catalyst in some cases enabled the results to far exceed the available resources. Although the projects being funded seemed initially disparate, they did focus on same broad categories of heritage and pursued comparable objectives. It is for this reason that the Commission encouraged the creation of project 'clusters' during both FP5 and FP6 to promote exchanges and transfer of experiences and highlighted the extensive interaction between the different research groups. As such, groups of projects could be brought together under the same headings:

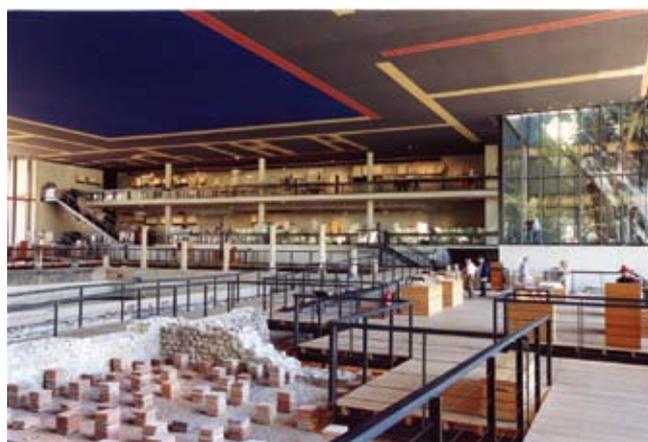
- ⌘ the impact of climate change and air pollution on cultural heritage;
- ⌘ damage to and protection of historical buildings;
- ⌘ the indoor environment (inside museums, galleries, libraries, churches, archives and historical buildings);
- ⌘ new microbiological tools used for the conservation of cultural property;
- ⌘ the integration of cultural heritage into the urban context;
- ⌘ miscellaneous.

The complementary nature of the projects implemented under the heading 'Protection, conservation and enhancement of European cultural heritage' was echoed across various other initiatives taken within the other topic areas of the key action 'The city of tomorrow and cultural heritage'. Some of these related to the built environment, such as the *RUFUS* project (Re-use of foundation on urban sites),

## Archaeology at the heart of the city

Urban archaeology brings to light issues that are particularly complex. In addition to the difficulties in carrying out digs and placing relics located in what can be very dense urban areas, it is not always easy to see how uncovered objects can be conserved, successfully integrated into the living context of the city as it is today, and made accessible to the general public. All of Europe's historical cities face these same problems and countless examples illustrate the variety of approaches tried out in this field.

The *APPEAR* project (Accessibility projects – sustainable preservation and enhancement of urban subsoil archaeological remains) aimed to provide both decision-makers and professionals responsible for the management of archaeological heritage with a set of best practices drafted on the basis of a detailed inventory of case studies. As such, the *APPEAR* guide enables those involved in urban archaeology to plan out and implement the measures needed to enable public access to and awareness of relics, while guaranteeing optimum protection of the latter. This project ran for three years (2003–05) and was supported under FP5's key action – ‘*The city of tomorrow and cultural heritage*’.



Vesunna archaeological site, Périgueux, France – © APPEAR

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while others, such as *ISHTAR* (Integrated software for health, transport efficiency and artistic heritage recovery), covered urban transport systems. These projects contributed to ensuring the conditions for sustainability, thereby including, at least in part, the safeguard of our cultural heritage in the urban environment.

## FP6 research priorities

Although with less financial means and visible space allocated to cultural heritage, FP6, launched in 2003, progressively spread into new directions. The protection of cultural heritage was moved from the remit of the environment to the heading ‘*Scientific support to policies*’ (*SSP*). In concrete terms, the repercussions of this as regards the support provided by the Commission brought about a substantial drop in the opportunities available for joint research. However, in the context of the European Research Area, in particular of EU enlargement, there was an intention to strengthen cooperation between the different Community policies and directives involved, directly and indirectly, in the cultural heritage sector, and to assess the impact on Europe's cultural heritage of specific Community policies and directives, based on horizontal links between the different sectors.

In accordance with the *SSP* work programme applied to the cultural heritage area, this objective was expected to be applied in particular to several initiatives being subsidised within ‘Culture 2000’, and to EU regulations, in particular the Structural Funds, the Water Framework Directive and the measures to be adopted for the protection of cultural heritage, the ‘Clean Air for Europe’ (CAFE) Directive, which includes the effects of air pollution on historical buildings, the Directive on the return of cultural property removed from any Member State illegally, and the Regulation governing exports of cultural property to third countries.

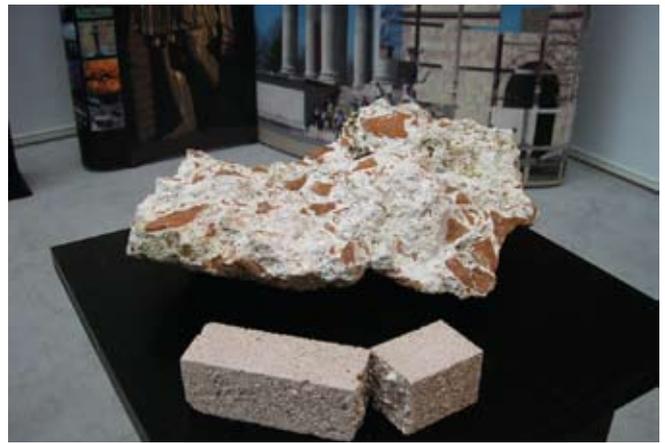


Different investigation methods performed (radar, impact-echo, ultrasound)  
– © FP5 ONSITEFORMASONRY project

The FP6 calls for proposals in cultural heritage required a multi-disciplinary approach to the research issues raised with a view to providing a multi-parametrical analysis of relevant data regarding history, cultural values, architecture, structures and materials, as well as environmental factors in deteriorating cultural herit-

## A mortar built to last

Very often, the masonry work of ancient Roman sites is astonishingly well preserved and the mortars used would appear not to have suffered with the passing of the centuries. The *Iter* project (Isotopic technologies applied to the analysis of ancient Roman mortars) sought to discover why these Roman mortars were more durable than those we use today. Mineralogical and isotopic analyses were carried out on samples taken from the Xanten site in Germany, Villa Traiana in Italy, and Caesarea Marittima in Israel. These tests identified the unique characteristics of the materials used and provided the scientists involved with fresh knowledge of the construction techniques of the time. All of the data gathered, whether historical, mineralogical or isotopic, were entered into a single database. The ingredients and preparation method of the ancient mortar were modelled, leading to the creation of a prototype 'Roman' mortar which was then tested for future use in the heritage conservation and construction sectors. This project ran for 28 months (1 April 2002–31 July 2004) and was funded by the EU's *CRAFT* programme.



Ancient mortars and new prototypes – © ITER

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age, understanding materials, monitoring changes, modelling and predicting behaviour, managing cultural heritage, and preventing damage and fraud.

At the same time, all projects undertaken were required to work towards the Lisbon objectives within their specific sector, by encouraging innovation, competitiveness and job creation within the EU. However, overall in practice these ambitious objectives could only be achieved to a limited extent.

From 2003, the European Commission issued one call for proposals each year as part of *SSP*. This resulted in a series of nearly 20 projects for which total funding of approximately €13 million was provided. These projects were grouped into five major categories which reflected the priorities set out in the detailed description of tasks of the work programme.

The first category dealt with assessing the impact of climate change and atmospheric pollution on cultural heritage, as well as drafting appropriate measures for prevention and protection. The *CULT-STRAT* project (Assessment of air pollution effects on cultural heritage) looked at establishing pollution thresholds for the materials used in historical buildings, providing definitions of damage observed and drafting prevention strategies. Meanwhile, *NOAH'S ARK* (Global climate change impact on built heritage and cultural landscapes, see box 'Culture under climatic threat' on page 26) focused on the impact of meteorological factors on heritage, forecasting climate change for the coming 100 years, and designing models and methods that could minimise the effects of climate change on historical buildings and sites.

The second category related to improving the efficiency and reversibility of protection and conservation treatments, including using traditional materials and artisan techniques. For example, the *CONSIST* project (Conserving Europe's industrial heritage) compared traditional materials and methods with modern processes used for the maintenance of metallic, industrial structures with a view to developing new cleaning and conservation methods that will last longer together with improved specific management practices applied to industrial heritage.

With respect to movable heritage, a research priority was supported to deal with the increasingly sensitive issues of theft and illegal trafficking of cultural goods and the counterfeiting of works of art. The aims of the work achieved under this heading include developing effective measures for verifying the authenticity of items of cultural heritage as well as better methods for traceability. In addition to the traditional methods of critical analysis of the style and techniques used to create an artwork, a variety of scientific measures can be used to check authenticity, some of which rely on optics, molecular biology, digital and nanotechnologies. The project *FING-ART-PRINT* (Fingerprinting art and cultural heritage – *in situ* 3D non-contact microscale documentation and identification of paintings and polychrome objects) is one such example, which combined 3D surface scanning with multi-spectral imaging. In addition, *COINS* (Combat online illegal numismatic sales) aimed to fight online and auction sales of stolen ancient coins using image-recognition techniques, and *AUTHENTICO* (Authentication methodologies for metal artefacts based on material composition and manufacturing techniques) is researching the innovative integration of non-invasive techniques for objective authentication of metal artefacts.

The final two research areas offered to European operators covered, on the one hand, best practices for long-term management of archaeological sites, and on the other cultural heritage and tourism. The *PICTURE* project (Proactive management of the impact of cultural tourism upon urban resources and economies), for example, proposed a model of urban governance anchored in sustainable management of cultural tourism in small and medium-sized towns in Europe. (See box 'A resource to be channelled', on page 22.) *ARCHAEO MAP* (Archaeological management policies) is a 'coordination project' aiming to develop innovative solutions for the sustainable and integrated management of archaeological underwater and coastal sites in the Mediterranean, including several World Heritage Sites.

## From enlargement to international cooperation

During the course of recent Framework Programmes until FP6, and beyond the Associated States and European Free Trade Association

## Beating graffiti

The *GRAFFITAGE* project (Development of a new anti-graffiti system, based on traditional concepts, preventing damage to architectural heritage materials) tackle a phenomenon that preys indiscriminately on all types of urban building. Sometimes considered as art – several major contemporary artists first began expressing themselves through graffiti – it is nonetheless a major factor in the physical and visual destruction of architecture, in particular where it is applied to historical buildings made from porous stonework, bricks and lime. What is more, the products currently available for protecting buildings against graffiti are not suited to these types of material. Therefore, the overarching goal of this project was to develop a new generation of anti-graffiti coatings that will provide permanent protection in outdoor conditions, are water- and vapour-proof, and can be harmlessly removed using specially designed cleaning systems. Before marketing these products, the project partners conducted a series of comparative analyses between the new coatings and those used currently, and assessed their technical and socioeconomic impact on our cultural heritage. This project fell within the ‘Specific support for policies’ programme of FP6.



Grffiti: sometimes considered as art is nonetheless a major factor in the physical and visual destruction of architecture – © Stock.Xchng

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(EFTA) countries<sup>11</sup>, the EU's partner countries especially from Central and Eastern Europe have been repeatedly invited to ‘get on-board’. Without a doubt, this has been a striking development, including in applied research into cultural heritage. A number of organisations located in the 10 countries which joined the EU in 2004<sup>12</sup> and the two that became Member States in 2007<sup>13</sup> as well as in the current candidate countries and other related third countries, have been progressively involved in the relevant European networks and projects. They brought their long-standing experience in the field of heritage conservation and their rich patrimony and, in turn, were able to access the very latest research and technological developments in this field. During FP4, just three projects involved cooperation with partners from Central and Eastern Europe. This number increased significantly under FP5 to include 29 participations in the various projects funded in the environment programme only, and the scientific community in these related countries became progressively more involved in projects. Since the 2004 and 2007 enlargements and the further agreements concluded in the context of FP6 and now FP7, organisations from new candidate countries and the Western Balkan are also encouraged to participate in, and be integrated into, EU-funded projects.<sup>14</sup>

Indeed, the impact and contribution of the European Research Area is not limited solely to Europe. Since FP5 and FP6, considerable efforts have been undertaken to open it up to the rest of the world and these Framework Programmes devoted significant resources to international cooperation. The FP5 *INCO 2* programme (Specific

measures in support of international cooperation) was to support the Community's external relations with the developing countries, the EU's partner countries in the Mediterranean, Russia and the newly independent states (NIS) as well as the Western Balkan States. In FP5 and FP6, one of the main facets of this international cooperation programme focused on cooperation with the Mediterranean Partner Countries specifically on cultural heritage research<sup>15</sup> as this large region constitutes a main component of our civilisation.

Taking only a few examples from FP5 whose scope in cultural heritage research was vast, the goal of the *HERCOMANES* project was to devise a model for conserving and managing 19th and 20th century heritage located in Egypt and Syria. The *EC-FORTMED* project, meanwhile, aimed to protect and restore castles and medieval fortresses situated in the eastern Mediterranean regions and to rehabilitate the sites on which they are located.<sup>16</sup> Other, more specialised projects have also been carried out, such as also *CAHRISMA* and *ERATO* which aimed to protect the acoustic heritage respectively in ancient mosques, and ancient theatres and odea, or *JEWELMED* which made a comparative analysis of manufacturing technologies in goldsmithing from 7th to 1st century BC.

In the context of FP6, the scope covered three priorities: the first, entitled ‘Materials, artefacts, monuments and sites: new technologies and characterisation’, aimed specifically to test and implement measures in the field by identifying the causes of the damage and setting up approaches for heritage conservation and restoration, as well as documenting and displaying objects of heritage. The second priority ‘Simulation – recreation – comparative preservation methodology’ aimed to bring back Mediterranean techniques, lifestyles and environments and to suggest consolidation methods and hypotheses for the re-use of historical buildings. The third facet looked at ‘Risk assessment and preventive conservation’ and aimed to promote

11. Switzerland, Norway, Iceland, Liechtenstein and Israel.

12. Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

13. Bulgaria and Romania.

14. As regards FP7, legal entities established in Switzerland, Israel, Norway, Iceland, Liechtenstein, Turkey, Croatia, the Former Yugoslav Republic of Macedonia (FYROM) and Serbia, respectively, are able to receive Community contributions for contracts/grand agreements signed after 1 January 2007. The Memoranda of Understanding associating Albania and Montenegro to FP7 also authorise legal entities established in these countries to receive Community contributions from 1 January 2008.

15. Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestinian-administered areas, Syrian Arab Republic, Tunisia and Turkey

16. In connection with this project, the conservation study of the castle of Servia in Greece was awarded by Europa Nostra in 2005.

an integrated and sustainable approach to management of cultural property in the Mediterranean. It considered the methods used for risk assessment and the many social, cultural, educational and economic parameters. As only a few examples which illustrate the diversity of subjects, the *OPERHA* project dealt with the ‘next generation of strengthening systems for the rehabilitation of Mediterranean building heritage,’ *PROMET* aimed to develop new analytical techniques and materials for protecting metal and alloys; *DESERT PATINA* intended to interpret and re-create the patina of engraved SAHARAN sandstones bearing climatic changes; *SHADUF* studied traditional water techniques; and *HAMMAM* assessed the central and social place of traditional hammams that it has occupied during the history and the possibilities of reuse or revival. *MED-COLOUR-TECH* studied the optimisation and possible revival of traditional dyeing materials, whereas *PROHITECH* analysed reversible methodologies for the seismic protection of historical buildings.

Overall for the period of FP5–FP6 (2000–2007), EC funding support amounted to about €20 million for more than 20 international cooperation projects involving Mediterranean Partner Countries (FP5 *INCO-MED* and FP6 *MPC*). This cooperation in FP5 and FP6 provided a wealth of important additional data from various sectors of heritage and was clearly much appreciated by heritage scientists and end-users in this large Mediterranean geographical area (see further examples of FP5–FP6 projects in Volume II).<sup>17</sup>

Lastly, it is worthwhile noting the support provided by the International Association for the promotion of cooperation with scientists from the New Independent States (NIS) of the former Soviet Union (INTAS) to several heritage research projects carried out in the NIS, this activity being supported by the European Commission during about 15 years, FP4–FP6.<sup>18</sup> This international association, created by the EU Member States and the NIS, has supported scientific cooperation among research institutes, universities and some SMEs in these two geographical areas. It has covered research projects in the field of archaeological heritage together with initiatives related to intangible heritage anchored more deeply in identity through local languages, cultures and traditions.

As regards international research cooperation implemented with organisations located in other countries and geographical areas in the world than those mentioned previously, it should be recognised that it has been very limited so far. For example, some tentative actions were encouraged at policy level with organisations from Latin America, but did not ultimately materialise at research level both due to the limited Commission funding for tangible heritage and also the competitive aspect of the cooperation based on calls for proposals.

## Communication and training

Over recent years, some initiatives have been taken to ensure that the results of the projects carried out are communicated to as broad a public as possible. Given the often highly specialised nature of the work done and topics considered, the main target groups for such

information initiatives have tended to be research professionals and experts working in the conservation and management of cultural heritage, territorial planning authorities and SMEs. Seminars and other meetings have been held, documents and websites have been published, and conferences for a more general audience have been organised with the support of the European Commission. An initial series of EU-supported seminars and workshops were held during the period 1989–96 (see the list of events page 29); between 1997 and 2000, four conferences were held in Rome, Aachen, Santiago de Compostela and Strasbourg, focusing on the opportunities offered by cultural heritage for European enterprises.

Then, in 2002, the city of Krakow played host to the 5th European Commission conference, entitled ‘*Cultural heritage research: a pan-European challenge*’, which focused on the next EU enlargement and the key role to be played in this respect by the protection and integration of our shared cultural heritage. The following event, held in London in 2004, focused on ‘Sustaining Europe’s cultural heritage: from research to policy’. It aimed to demonstrate the intrinsically interdisciplinary nature of research into cultural heritage. It stressed the contribution such research could make to boosting the economic competitiveness of Europe through its work on issues that are of key importance to society (environment, regional policy, education, tourism, construction, etc.). Participants from 26 countries inside and outside Europe attended and approved a declaration highlighting the importance of cultural heritage research in the context of the Lisbon Agenda and the next research Framework Programme. This text called on the Member States to multiply their efforts in complementarity to those made by the EU.

The Commission supported a seventh conference in Prague in spring 2006, looking at ‘*Safeguarded cultural heritage: understanding and viability for the enlarged Europe*’ (*SAUVEUR*). Against the background of the preparations for FP7, this conference concentrated on analysing the impact of the projects funded by the European Commission and new opportunities that are currently available. It looked in particular at projects that focused on infrastructure and international cooperation and set particular store by the implementation of the project results and feedback from the users.

In addition, it issued a concluding message by which the EU institutions were asked to:

- ⌘ support the incorporation of cultural heritage themes into relevant priorities and tasks of FP7 and to intensify their support for cultural heritage research within FP7;
- ⌘ facilitate ways of overcoming the fragmentation of research for the cultural heritage community;
- ⌘ ensure that the revision of the EU Sustainability Strategy in 2009 includes explicit mention of the value of cultural heritage research;
- ⌘ mitigate unintentional negative effects on cultural heritage of EU legislation by carefully applying Article 151.4 in all legal documents that are issued.

Moreover, the European Research Council was asked to consider the importance of basic research for cultural heritage, while national and regional governments and relevant authorities were asked to integrate scope for cultural heritage research and support for related research infrastructure into their research programmes. Finally public–private partnerships were requested to be established with the cultural heritage research community, to respond to the new and complex challenges, and non-governmental organisations were asked to promote public participation in cultural heritage research, namely related to environment, energy, sustainability and quality of life.

17. However, this support has not been pursued in FP7 as it is expected that organisations from the Mediterranean (or from other parts of the world) can participate in EU-funded projects in the context of the various themes of the FP7 Cooperation Programme.

18. The support allocated to INTAS by the European Commission has not been renewed in FP7 and INTAS will have to end entirely its activity in 2009.

After the Prague event, the next eighth EU-supported conference entitled 'Cultural heritage research meets practice' is foreseen in Ljubljana, Slovenia, 10–14 November 2008 (website: [www.eu.chresp](http://www.eu.chresp)).

In addition to the above, the Commission undertook various initiatives in the fields of training as part of FP5 and FP6. These tackled issues that are of general interest to specific target groups, such as 'Science and technology of the environment for the sustainable protection of cultural heritage' (London 2002), 'Cultural Heritage Protection in a Sustainable Society' (London 2003), and 'Innovative technologies and materials for the conservation of cultural heritage' (Athens 2004). Over 2007–08, *ARCHAIA* (training seminars on research planning, characterisation, conservation and management in archaeological sites) is looking at the conservation and management of archaeological sites and *SPRECOMAH* (Seminars on preventive conservation, monitoring and maintenance of architectural heritage) is focusing on preventive conservation of the immovable built heritage. These international training modules placed the results of the projects funded as part of the Community programme directly at the fingertips of large groups of professionals and advanced students working in the field of heritage across Europe.

Last but not least, several project publications in the series "*Protection and Conservation of European Cultural Heritage*" (see list of selected bibliography and references in annex pages 27–28) have helped raise awareness of the action undertaken in specialist circles, as have the websites and information leaflets systematically published for each and every project funded.

## Other European initiatives for exchanging best practices and experiences

The European Commission lends its support to complementary European activities that focus on coordination, networking and exchanges across Europe. Beyond EU coordination projects, it does this for instance via *COST*<sup>19</sup>, an intergovernmental body that has been promoting European cooperation for research in science and technology since 1971. Although research into cultural heritage is not one of the *COST* programme's top priorities, several initiatives have been initiated in this area since the beginning of the 1990s. At present, *COST* has facilitated the implementation of various projects (entitled 'COST actions') that are looking into quite specific issues, such as the analysis of museum collections vis-à-vis indoor environmental conditions, or the laser restoration of works of art, the restoration of paintings, or the protection of heritage against the dangers of fire, as well as the protection of ancient landscapes and archaeology. Among the last *COST* actions approved, they include the understanding of pre-industrial structures in rural and mining landscapes, the chemical interactions between cultural artefacts and indoor environment, and wood science for conservation of cultural heritage.

The programme encouraged those working in cultural heritage to consider these issues and exchange experiences and knowledge through *COST* actions and events such as the strategic seminar on 'COST and cultural heritage: crossing borders', held in Florence in 2005, or the other event on 'Past-present-Prediction-about simulation

19. In French: *Coopération européenne dans le domaine de la science et de la technologie*

## A universe of iron and steel

The industrial revolution and economic upswing witnessed in Europe during the 19th and at the start of the 20th century left in their wake countless industrial buildings and other structures made from iron and steel. Today, many of these vestiges of this illustrious period in our history have either been closed down, are seriously dilapidated, or could even disappear altogether. As this problem affects all European countries, the partners in the *CONSIST* project (Comparison of conservation materials and strategies for sustainable exploitation of immovable industrial cultural heritage made of iron and steel) are acutely aware of the urgent need for a cross-border approach. They are keen to devise innovative products and strategies that will guarantee the long-term conservation of this heritage – an important element in our identity. The three-year project (1 July 2005–30 June 2008) compared the materials and technologies traditionally used to maintain industrial buildings with more modern conservation and restoration methods. A set of new and improved conservation products and techniques will then be marketed with a view to protecting our metallic industrial heritage for the long term. The research carried out will also aim to conceive management models that take account of the opinions and needs of the different parties involved – owners, conservationists, architects, decision-makers – and promote access for the public after the restoration campaign.

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## A resource to be channelled

Over recent years, cultural tourism has risen to unprecedented levels of popularity, casting the capital cities of Europe, as well as some of its smaller and medium-sized towns and cities, into the limelight, thanks to their ideal combination of charm and rich heritage. Cultural tourism has the decisive potential to breathe fresh life into historical centres and improve the quality of life of town and city dwellers, providing that the right planning and management measures are taken. The objective of *PICTURE* (Proactive management of the impact of cultural tourism on urban resources and economies) was to develop a framework for the sustainable management of tourism in small and medium-sized towns and cities. The project partners focused on the conservation and enhancement of historical buildings, assessment of the impact of tourism on the social, environmental and economic context of towns and cities, and identification of innovative models for sustainable development of tourism, to be used by local authorities and decision-makers. It ran for three years (2004–07) as part of FP6's 'Specific support for policies' programme.

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**Website: [www.pictureproject.net](http://www.pictureproject.net)**

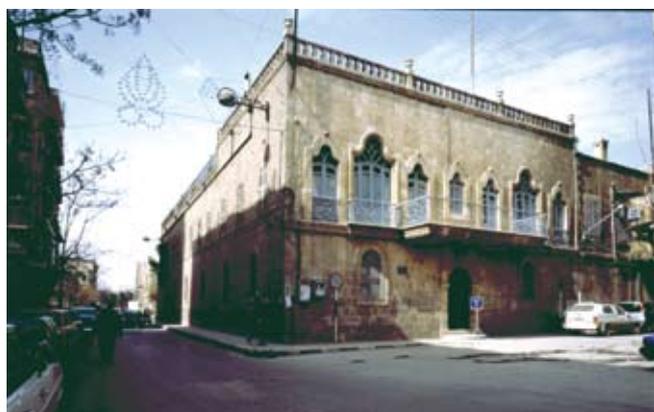
techniques, dosimeters, sensors in conservation research and application' held in Ohrid, the Former Yugoslav Republic of Macedonia in 2007.

Yet more European projects which also touch on heritage are supported by the *EUREKA* network, another intergovernmental initiative first set up in 1985, which aims to encourage innovation and competitiveness in Europe. With respect to cultural heritage, it has endeavoured to stimulate cooperation between companies, research centres and universities which are keen to develop innovative and marketable products, procedures and services at European level. One such umbrella for cultural heritage activities under *EUREKA* is *EUROCARE* (Europe's cultural heritage and building stock), which aims to develop new industrial products and technologies as well as craft skills for conservation and restoration work. It has helped define technical standards and guidelines for examination and treatment of objects and monuments.

It is without doubt necessary to ensure that the action undertaken actually relates to the needs of the public and private sectors and, more generally, of society. It is for this reason that the European Commission decided to encourage the set-up of a series of European Technology Platforms involving a wide range of stakeholders including industrial public and private partners to fund research and technology. These platforms ensure that the research priorities chosen are better aligned to needs and market demand. One such platform, the 'European Construction Technology Platform' (*ECTP*), has among its priorities cultural heritage, based on the link between cultural heritage and the construction and renovation sector. This specific priority, the 'Focus Area Cultural Heritage'

(*FACH*), aims to promote the conservation and enhancement of cultural heritage with a view to improving the quality of life of Europe's citizens by rendering its cities and the built environment in general more attractive. To this end, it is promoting conservation and renovation strategies, concepts and techniques which are innovative and sustainable and give preference to prevention and minimum destructive intervention. Within the *ECTP* which has delivered a *Strategic Research Agenda*, *FACH* also drafted a specific plan of action, *Strategic Research Agenda for cultural heritage*, contemplating immovable cultural heritage which also could be a 'driver' for the movable heritage. It considers all of the many dimensions of heritage protection, from diagnosis, monitoring, maintenance and management to intervention and restoration, and even aspects related to improved access to and integration of heritage for citizens and tourists, as well as the impact of natural disasters, education and training, socio-economic issues, information and communication in this field.

Today, with the experience gleaned from the previous research Framework Programmes, which included research into 'physical' heritage, it is possible to take stock of progress and of the major impact made by the European Commission in this area of applied research. The 120 or so projects backed – of which a number related to FP6 are still being implemented during the first years of FP7 - brought together more than 500 institutional players across Europe and beyond. These included a large number of organisations working in research and technology development (universities, research centres, SMEs, etc.) as well as the direct users of the results obtained, such as museums, institutes, galleries, archives responsible for the protection and management of heritage as well as private-sector bodies.



Building in Alep, Syria – © HERCOMANES



The permanent exhibition, concerning the Castle of Servia (Greece), studied by the EC-FORTMED project, which is located inside this archaeological site – @ FORTMED

# Novelties of FP7 (2007–13)

## Strengthening and furthering Community action

*The action taken by the Community over the last two decades in the field of applied research into cultural heritage has revealed the great richness and potential of this area to become a significant driving force in European integration, an obvious component for sustainable development within a knowledge-based society, and helping to maintain our cultural and social identity. In addition, the past research activities have demonstrated the benefits of policies which encourage an inter- and multi-disciplinary approach in this sector while stressing the importance of preventive conservation. But they have also highlighted the complex issues on how to convert the results of these research initiatives to end-users to the benefit of citizens in an ever-changing socio-economic context, and the need for the Community to continue to provide unfaltering support and incentives in this area in years to come.*

*The broad objectives of FP7 – which will last a longer period than the previous Framework Programmes – have been structured into four ‘categories’ of programmes: Cooperation, Ideas, People, Capacities. Although cultural heritage is mainly embedded in the Cooperation programme, some aspects can also be inserted in those on People (mobility and networks), Ideas (implementing the priorities of the newly established European Research Council) and Capacities (SMEs, infrastructure projects).*

### 20 years: the time for reasoned and synergistic support

Significant progress has indeed been made in science and technology, contributing to greater awareness of the impact of environmental factors on heritage and of the mechanisms by which different materials decay. This, in turn, has enabled new, safe analysis techniques to be developed alongside highly effective treatment processes for the different categories of heritage, as well as a series of innovative documentation, inspection and conservation tools in general. Drafting joint strategies and measures at European level to deal with the challenges shared by all European countries, such as climate change, city and territorial planning, pollution, loss of traditional skills and human negligence, have started to be beneficial, without impinging on the principle of subsidiarity.

However, these encouraging results must not be allowed to overshadow the fact that a great deal has to be done, especially concrete application of project results to face all negative impacts and halt further degradations. Many facets of heritage conservation should be integrated into a global approach to the management of our environment and set out in effective national and regional policies.

Those who oppose far-reaching involvement of the Community in issues related to culture and heritage often suggest that European support in these areas should be decreased or even replaced by national funds. However, in view of the inadequate resources provided by the Member States for such work and the low budget reserved for the protection of cultural property at national level in relation to gross national product, this is simply not feasible. The importance of the protection of cultural heritage was highly stressed during the consultation procedures carried out while preparing the groundwork for FP7. Community action with respect to heritage should take account of both immovable and movable heritage, the cultural landscape and archaeology, both the human, social sciences including art history and get all of the parties involved on board. These parties are universities, research bodies, museums and galleries, archives, academies of fine art, owners, managers, curators and

conservators of cultural heritage assets, national and local authorities as decision-makers, foundations and associations working in heritage conservation and restoration, industry and SMEs.

It falls to FP7 to provide an optimum response to these ambitious challenges. In contrast to FP6, the latest programme no longer provides ‘transversal research support’ for Community policy. As has been the case almost continuously since 1986, in FP7 tangible cultural heritage has been embedded in the EU environmental research. This corresponds to the initial approach adopted by the first Framework Programmes, which considers heritage to be an integral part of the human environment, going hand in hand with the natural environment, and also recognising that the environmental change represents one main threat to the sustainability of European cultural heritage. It is based on the idea that ecological technologies are needed to guarantee the sustainable management and preservation of the many facets of our environment, including cultural heritage.

At a time where the cultural sector turns more towards digitalisation, creative industries and the media in relation to the information and communication society, it is of paramount importance that, with research and beyond, the coordination of all actors and their activities are made complementary in a more effective way to maintain the conservation of the cultural heritage at a high-quality level.

### New approaches and first steps

The research programme on tangible cultural heritage has been placed mainly within the ‘Environmental Technologies’ sub-theme, in which the aspects of cultural heritage are organised separately from but are possibly complementary to other aspects of environmental technologies related to water, soil, air, sea, waste and especially built environment. FP7’s environmental Theme specifically seeks “to protect, conserve and enhance cultural heritage including human habitat”, aiming to improve damage assessment, innovative conservation strategies, and integration of



Laser cleaning of gilded bronze is today a well-established technique: the first demonstration has been the cleaning of the renaissance masterpiece by Lorenzo Ghiberti Gates of Paradise



Laser cleaning where pigments are present is still an open issue: here laser cleaning of deteriorated frescoes was demonstrated at the S. Maria della Scala in Siena using the photo-thermal effect called 'laser spallation'

cultural heritage in the urban setting.<sup>20</sup> In addition, the specific *Cooperation* programme targets:

Technologies for the environmentally sound and sustainable management of the human environment including the built environment, urban areas, landscape, as well as for the protection, conservation and restoration of cultural heritage from environmental pollution, including environment impact assessment, models and tools for risk evaluation, advanced and non-destructive techniques for damage diagnosis, new products and methodologies for restoration, mitigation and adaptation strategies for the sustainable management of both movable and immovable cultural assets.<sup>21</sup>

In fact, the initial work programme of cultural heritage in FP7 stressed the excessive fragmentation of this activity and the need for further integration and cross-fertilisation among different sectors. Thus, the overarching objective for FP7 is expected to:

- ⌘ focus on complex assemblies and not only on individual materials. Cultural heritage objects are complex, and are not made of a single type – e.g. masonry, glass or stone. They are heterogeneous assemblies consisting of a number of elements.
- ⌘ recognise that damage functions, assessment and monitoring for conservation cannot be divided down and separated out.
- ⌘ note the importance of context in research on movable and immovable heritage. The movable heritage belongs to the immovable assets, and vice-versa. They cannot be considered separate, so a better integration between these two aspects is needed although they have frequently been considered separately in the previous Framework programmes.

In this context, the two first open calls for proposals of FP7 were especially related to diagnosis, assessment and monitoring technologies and tools, including, for the second call, the development and application of monitoring and modeling tools adapted to the near- and long-

term impacts related to climate change (excluding extreme events). A following foreseen area of research is the development of technologies and tools applied to the prevention of damage resulting from natural extreme events, especially earthquakes, fires and storms. At the same time, the programme should support the coordination of European and national research programmes through an *ERA-NET* project, which was negotiated in the context of the first FP7 call 2007, together with four other projects. As in 2007, in 2008, five projects were retained for proposed negotiation following the second call for proposals. It is worthwhile noting that the first two calls of FP7 have shown a high number of cultural heritage proposals, illustrating the significant interest of the scientific community as well as end-users for this field.

From 2009, and each following year of FP7, it has been proposed that one main topic would be linked if possible with an 'overarching theme' identified for the whole 'Environmental Technology' sub-theme (e.g. extreme natural events in 2009, and later urban context) while keeping some flexibility for other topics more specific to cultural heritage. In continuity with previous FP6 projects, and also due to growing political sensitivity, it has also been envisaged that another topic on technology and tools could, in a future FP7 call for proposals, enable the authentication and traceability of movable assets: this would link environment and security aspects for a more sustainable and integrated approach in the management of movable assets.<sup>22</sup>

For the second period of FP7 from 2010 until 2013, an indicative 'roadmap'<sup>23</sup> for this programme would suggest that support might

20. Official Journal L412, 30.12.2006.

21. Official Journal L54, 22.2.2007.

22. As for any annual work programme which describes the various topics covered and call conditions for application, this is subject to agreement of the EC after consultation of the FP7 Advisory Committee (composed of high-level experts) and the FP7 Environment 'Programme Committee' (composed of the Member State representatives).

23. Such a roadmap can only be tentatively issued and may be subject to changes on research topics; the roadmap is updated every year according to the priorities given to the annual work programme which specifies the contents and boundaries of the topics, and the call conditions of application.

be given in successive calls to new technologies and tools applicable to the integration of cultural heritage in the urban and rural setting and the rational management of heritage sites, to the field of archaeology and cultural landscapes, as well as to the protection of submerged cultural heritage including maritime and coastal heritage. All projects are expected to take into account the cultural tourism and quality of life, complementing research on the built environment. A high transferability of results especially to sensitive cultural heritage sites, including to those beyond Europe (e.g. Mediterranean countries and others) may also be foreseen for most of these issues.

Also increased complementarity and synergies are sought with EU research activities supported under Theme 3 of FP7 including the 'Digitalisation of cultural assets', Theme 4 on 'Nanosciences, nanotechnologies, materials and new production technologies' (the latter in connection with the *ECTP*), and Theme 7 on 'Socio-economic science and humanities' dealing with intangible heritage, cultural

### Culture under climatic threat

Given Europe's rich cultural heritage and the threats posed by climate change, *NOAH'S ARK* – funded through FP6 – took as its premise that changes in the European climate over the coming century will have a range of effects on historic buildings. The project therefore pinpointed a number of climate change factors that were likely to impact on various building materials. While conventional climate change focuses on rising temperatures, for example, these are expected to have only a relatively small impact on buildings. Instead it is the changing water cycle that may prove most critical. The project also focused on non-climate variables like pollution and biodiversity.

To present the project's results to its primary audience – policy-makers and cultural heritage managers – the consortium created the Vulnerability Atlas. Maps were created of the recent past (1961–90), near future (2010–30) and far future (2070–99), outlining the prevalence of each risk factor across Europe, and additional maps show the predicted change. The maps provide a stark illustration of the dangers posed by climate change. In addition, the consortium provided guidelines for adaptation, addressing each threat and suggesting what should be done. The end-users can therefore plan their conservation efforts based on which risk factors threaten their area.

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**National Research Council**

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identity, traditions etc.

FP7 should also consolidate links with other Community programmes in the cultural sector. It will have the delicate task of linking the European Research Area with a European 'cultural area' as part of a more effective and integrated policy. FP7 must strive towards meeting the innovation and competitiveness criteria set out in the Lisbon Strategy, without losing sight of the specific values and characteristics that make Europe's cultural heritage one of its most valuable resources. In addition, it must be kept in mind that what is now well built or created is the heritage of tomorrow. Much care is therefore needed, notably in terms of construction, especially for retrofitting and rehabilitation,

about resources and energy considerations (e.g. sparing and re-using) also to ensure the sustainability and transmission of the cultural legacy in the best conditions to the next generations.

Tangible heritage assets have considerably diversified in nature in recent decades (as shown by, for example, the use of synthetic materials in works of art) – a tendency which is expected to continue into the near future. This, together with the increased awareness for our cultural legacy, indicates that the support to be given to research by the EU may also have to follow this evolution and therefore extend the field of intervention. It is significant that tangible heritage research in FP7 has been initially mostly supported by the European Parliament and some active Member States in this field, even before the European Commission.

Moreover, the resources allocated to the conservation of European cultural heritage, through environmental research and other relevant EU programmes, as well as in the Member States, should preserve Europe's rich patrimony and reinforce its world-leading position.

All this calls for an increased involvement of the EU institutions in this field, including further participation of/and coordination with the Member States and all stakeholders.

Ultimately, the preservation of cultural heritage brings together the art of building and of creation, culture and beauty, history, memory and identity on one side, and the latest conservation science and technology on the other. In an evolving world, well-preserved works of art that citizens can see and experience represent sources of dreams and innovation, to the benefit of everyone. Conserving such works of art thus implies active research and investigation, illustrating the efforts of all its actors to contribute to a more harmonious, sustainable and human environment. Who could argue with such an enterprise?



*Ruins of the mediaeval church in Trzesacz, at the Baltic Sea, Poland, destroyed by the shift of the coastline*

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*Cultural heritage research: a pan-European challenge, proceedings of the 5th EC Conference*, Cracow, Kozłowski, R., Chapuis, M., Dradcky, M., Drewello, R., Leissner, J., Redol, P and Vallet, J. (eds), 16–18 May 2002 , Brussels, European Commission, OPOCE, 2003.

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*Technological requirements for solutions in the conservation and protection of historic monuments and archaeological remains*, European Parliament , STOA Report and Annex, May Cassar (Ed) 2001 .  
*Conclusions of the Council of Ministers of 17/06/94* related to the setting up of a Community Action Plan in the field of cultural heritage OJ n°C235 of 23/08/1994.

*Resolution of the Council of Ministers* in charge of cultural affairs of 13/11/1986 regarding the conservation of artistic and cultural assets and *Resolution of the Council of Ministers* regarding the protection of the European architectural heritage, OJ C320 of 13/12/1986.

*Recommendation from the Commission* to the Member States of 20 December 1974, related to the protection of the natural and architectural heritage, OJ n°L021 of 28/01/1975.

## Other specialised documentation<sup>24</sup>

A research report series on the issue of the ‘Protection and conservation of the European cultural heritage’ presents information and conclusions of some of the most relevant research projects funded by the European Commission Research Programme.

### Report n°1

*Step leather project*

*Evaluation of the correlation between natural and artificial ageing of vegetable tanned leather and determination of parameters for standardisation of an artificial ageing method*

Larsen, R. (ed), 1994

### Report n°2

*Interactive physical weathering and bioreceptivity study on building stones, monitored by computerised X-Ray tomography (CT) as a potential non-destructive research tool*

De Cleene, M. (ed), 1995

### Report n°3

*New conservation methods for outdoor bronze sculptures*

Römich, H. (ed), 1996

### Report n°4

*Origin, mechanisms and effects of salts on degradation of monuments in marine and continental environments*

Zezza, F. (ed), 1996

### Report n°5

*Degradation and conservation of granitic rocks in monuments*

Vicente, M.A., Delgado-Rodrigues, J. and Acevedo, J. (eds), 1996

24. *European Cultural Heritage*: a periodic newsletter on research in this field – supported by the European Commission – was published during the period 1991–94

**Report n°6**

*Environment leather project - deterioration and conservation of vegetable tanned leather*

Larsen, R. (ed), 1996

**Report n°7**

*Evaluation of the performance of surface treatments for the conservation of historic brick masonry*

van Hees, R.P.J. (ed), 1998

**Report n°8**

*Expert system for the evaluation of the deterioration of ancient brick structures*

Koen Van Balen, K. (ed), 1997

**Report n°9**

*Baroque Artificial Marble – environmental Impacts, degradation and protection (ENVIART)*

Wittenburg, C. (ed), 1999

**Report n°10**

*Development of a new non-destructive method for analysis of the atmospheric corrosion and corrosion protection of copper and copper alloys (CONTACTLESS CORROSION ANALYSIS)*

Klewe-Nebenius, H. (ed), 1999

**Report n°11**

*An expert chemical model for determining the environmental conditions needed to prevent salt damage in porous materials*

Price, C. (ed), 2000

**Report n°12**

*System and methods for assessing conservation state and environmental risks for outer wooden parts of cultural buildings (WOOD-ASSESS)*

Haagenrd, S., Veit, J., Eriksson, B., Henriksen, J.F. and Krigsvoll, G. (eds), 2001

**Report n°13**

*Development of innovative techniques for the improvement of stability of cultural heritage, in particular seismic protection (ISTECH)*

Chirarotto, D. (ed), 2001

**Report n°14**

*Advanced study course, 7–18 September 1998, Paris – Sciences and technologies of the materials of environment for the protection of stained-glasses and stone monuments*

Lefèvre, R. (ed), 2001

**Report n°15**

*Deterioration of ancient and modern hydraulic mortars (EDAMM)*

van Balen, K., Toumbakari, E. E., Blanco-Varela, M.T., Aguilera, J., Puertas, F., Palomo, A., Sabbioni, C., Riontino, C. and Zappia, G. (eds), 2002

**Report n°16**

*Sustainable development of urban historical areas through an active integration within towns (SUIT)*

OPOCE, Luxembourg, 2004, EUR n. 21148, ISBN 92-894-7819-5

**Report n° 17**

*On-site investigation techniques for the structural evaluation of historic masonry buildings (ONSITEFORMASONRY)*, OPOCE,

Luxembourg, 2006, EUR 21696 EN, ISBN 92-894-9601-0

**Report n°18**

*Improved damage assessment of parchment (IDAP)*, OPOCE,

Luxembourg, 2007,

EUR 22838, ISBN 978-92-79-05378-8

**Report n°19**

*Global climate change impact on built heritage and cultural landscapes (NOAH's ARK)* EUR 23590 (foreseen in 2008)

# Annex

## Events

### Major symposia, conferences, workshops, advanced study courses and seminars

- ⌘ European symposium, *Science, technology and European cultural heritage*, Bologna (IT), 13–16 June 1989, co-organised with the European Commission (DG XII – Environment Programme) as part of University of Bologna Ninth Centenary Celebrations.
  - ⌘ European Commission conference, *Research and policy issues related to the conservation of paper and leather*, Delft (NL), 27–28 June 1994, organised by European Commission (jointly DG XII – Environment Programme and DG X – Culture Unit). The conclusions of two STEP research projects (analyses of the effects of air pollutants on paper and on leather) were presented at this event.
  - ⌘ European Commission workshop, *Research on the conservation of brick masonry monuments*, Leuven (Belgium), 24–26 October 1994, organised by the European Commission in order to promote the establishment of a European network between the EC core-group of projects dealing with environmental research on brick masonry monuments and other initiatives in the same field (EUREKA - Eurocare, NATO, and some national programmes).
  - ⌘ European Commission workshop, *Environmental degradation and conservation of granitic rocks in monuments*, Santiago de Compostela (Spain), 28–30 November 1994. The results of two STEP research projects dealing with granite were presented. The five coordinators of the most important EU projects related to stone degradation were invited by the European Commission to participate and contribute to the establishment of synergies and exchange of research information in this field (see Research Report n°5 from the series for the Protection and Conservation of Cultural Heritage).
  - ⌘ European Commission workshop, *Research on effects of the environment in indoor cultural property*, Würzburg (Germany), 11–13 December 1995. This workshop presented the research results to date of an EC core-group of five research projects funded under the Environment Programme dealing with this matter (see European Cultural Heritage Newsletter on Research n° 10).
  - ⌘ European Commission workshop, *Non-destructive testing to evaluate damage due to environmental effects on historical monuments*, Trieste (Italy), 15–17 February 1996.
  - ⌘ European Commission workshop, *Effects of salts on degradation of monuments in marine & continental environment*, Bari (Italy), 25–27 March 1996 (see Research Report n°4 from the series for the Protection and Conservation of Cultural Heritage).
  - ⌘ European Commission seminar, *Environmental effects and conservation of archaeological metal artefacts*, Brussels (Belgium), October 1996.
  - ⌘ European Commission seminar, *Treatments and re-treatments of historic buildings*, Brussels (Belgium), November 1996.
  - ⌘ European Commission conference, *Research for the protection of cultural heritage: opportunities for European enterprises*, Rome (Italy), 18–19 December 1997.
  - ⌘ European Commission advanced study course, *Sciences and technologies of the materials and of the environment for the protection of stained-glasses and stone monuments*, Paris (France), 7–18 September 1998.
  - ⌘ European Commission seminar, *The Assisi frescoes case*, Assisi (Italy), 24–26 September 1998, jointly organised with the Italian Ministry of Culture in the commemoration of the seismic events that partially destroyed the St. Francis Basilica frescoes.
  - ⌘ 2nd European Commission conference, *Research for the protection of cultural heritage: opportunities for European enterprises*, Aachen (Germany), 19–20 November 1998.
  - ⌘ 3rd European Commission conference, *Research for protection, conservation and enhancement of cultural heritage: opportunities for European enterprises*, Santiago de Compostela (Spain), 23–24 September 1999.
  - ⌘ 4th European Commission conference, *Research for protection, conservation and enhancement of cultural heritage: opportunities for European enterprises*, Strasbourg (France), 22–24 November 2000.
  - ⌘ 5th European Commission conference, *Cultural heritage research: a pan-European challenge*, Krakow (Poland), 16–18 May 2002
  - ⌘ *Clustering workshop on cultural heritage*, Brussels, 22–23 April 2004
  - ⌘ 6th European Commission conference, *Sustaining Europe's cultural heritage: from research to policy*, London (UK), 1–3 September 2004
  - ⌘ 7th European Commission conference, *Safeguarded cultural heritage: understanding & viability for the enlarged Europe*, Prague (Czech Republic) 31 May–3 June 2006
  - ⌘ 8th European Commission conference, *Cultural heritage meets practice*, foreseen 10–14 November 08 in Ljubljana (Slovenia)
- More information on EC research on environmental protection and conservation of European cultural heritage can be found on the Internet:
- FP5: <http://www.cordis.lu/eesd/ka4/home.html>
  - FP6: [http://europa.eu.int/comm/research/fp6/ssp/index\\_en.htm](http://europa.eu.int/comm/research/fp6/ssp/index_en.htm)
  - FP7: [http://ec.europa.eu/research/fp7/index\\_en.cfm](http://ec.europa.eu/research/fp7/index_en.cfm)

# Cultural heritage projects funded under the successive Framework Programmes (FPs)

(from FP1 to FP4: 1986–98)<sup>27</sup>

## Effects of air pollution on historic buildings (1986–90)

1.1	The inter-relationship of air pollution levels on stone decay rates at historic monuments
1.2	Kinetic studies of SO <sub>2</sub> , reactions with marble
1.3	Reactions of nitric acid and nitrates with pentelic marble
1.4	Case studies in the deterioration of stone monuments in Italy
1.5	Application of advanced methods of chemical analysis to stone conservation
1.6	Chamber studies on air pollution damage to stone conservation
1.7	Ultrasounds applied to the non-destructive examination of stone structures
1.8	Biodeterioration studies on stone monuments
1.9	Environmental deterioration and the Monastery of Jeronimos: a case study
1.10	Non-destructive evaluation of stone monuments in Pavia: a case study

## STEP programme: Protection and conservation of the European cultural heritage (1989–92)

2.1	Effects of airborne particulate matter on building surfaces
2.2	The effects of air pollutants on the accelerated ageing of cellulose containing materials
2.3	Granitic materials and historical monuments: study of weathering and application conservation
2.4	Evaluation of the correlation between natural and artificial ageing of vegetable tanned leather and determination of parameters for standardisation of an artificial ageing method
2.5	Protection and conservation of historic buildings, monuments and associated cultural property
2.6	Physicochemical parameters, including pollutants interaction, affecting the rates of dry deposition on stone surfaces
2.7	Conservation of granitic rocks and application to megalithic monuments
2.8	Criteria for the stability of archaeological and historical artefacts and standards for the assessment of conservation procedures

## Environmental programme (1991–94) – 1st and 2nd phases

### Environmental protection and conservation of the European cultural heritage

3.1	Marine spray and polluted atmosphere as factors of damage to monuments in the Mediterranean coastal environment
3.2	Non-destructive testing and system identification to evaluate diagnostics methods and reinforcement techniques applied to historical buildings
3.3	New conservation methods for outdoor bronze sculptures
3.4	Expert system for evaluation of deterioration of ancient brick masonry structures
3.5	Interactive physical weathering and bioreceptivity study on building stones, monitoring by computerised X-ray tomography (CT) as a potential non-destructive research tool
3.6	Rôles des apports atmosphériques solides et gazeux, et de la nature du substrat dans les altérations superficielles des monuments – approche expérimentale et modélisation
3.7	Assessment and monitoring the environment of cultural property
3.8	Microstructural decay of lithoid monuments, caused by environmental factors, studied using a newly developed, radar-aided methodology
3.9	Deterioration and conservation of vegetable tanned leather
3.10	Performance of surface treatments for the conservation of brickmasonry
3.11	Soil archive classification at European excavation sites in terms of environmental impacts and conservability of cultural heritage
3.12	Wood care : understanding the relationships between death watch beetle wood decay fungi and timber ageing in European historic building in order to develop alternatives to current harmful and ineffective treatments
3.13	Re-treatment of consolidated stone faces
3.14	Particulate pollution and stone damage
3.15	Deposition of gases and particles and their corrosive effect on surfaces of cultural and artistic value inside museums
3.16	Environmental research for art conservation – ERA
3.17	Development of improved conservation procedures for archaeological iron
3.18	Atmospheric eutrophication and secular organic pollution (biological and mineralogical reactions of Mediterranean monuments)

27. The projects funded under FP5 and FP6 are listed and described in the Volume II of this publication

## Environment and climate programme (1994–98) - 1st phase

### Technologies to protect and rehabilitate the European cultural heritage

4.1	Assessment of environmental risk related to unsound, use of technologies and mass tourism – AER
4.2	Archaeometric study to reconstruct the pollution and the climate of the past and their effects on cultural heritage - ARCHEO
4.3	Environmental deterioration of ancient and modern hydraulic mortars - EDAMM
4.4	Development of new non-destructive method for analysis of the atmospheric corrosion and corrosion protection of copper and copper alloys - CONTACTLESS CORROSION ANALYSIS
4.5	Development of evaluation criteria, prediction and control methods concerning sea-salt effects on monument stones – SEA-SALT CONTROL IN MONUMENTS
4.6	Baroque artificial marble : environmental impacts, degradation and protection - ENVIART
4.7	Deterioration of prehistoric rock art in karstic caves by mass tourism : integrated study (Environment, geology, geochemistry and microbiology) for their conservation - ROCK ART
4.8	Development of innovative techniques for the improvement of stability of cultural heritage, in particular seismic protection - ISTECH
4.9	System and methods for assessing the conservation state and environmental risks for outer wooden parts of cultural buildings - WOOD-ASSESS
4.10	An expert chemical model for determining the environmental conditions needed to prevent salt damage in porous materials – CONTROL OF SALT DAMAGE

## Environment and climate programme (1994–98) – 2nd phase

### Technologies to protect and rehabilitate the European cultural heritage

4.11	Novel Remediation strategies for preservation of marble structures endangered from environmental damages - HERMES
4.12	Novel molecular tools for the analysis of unknown microbial communities of mural paintings and their implementation into the conservation/restoration practice - MICROCORE
4.13	Maintenance of pointing in historic buildings, decay and replacement - POINTING
4.14	Development of an innovative water repellent biocide surface treatment for mortars : assessment of their performance by using modern analytical tools and surface analysis - NEW SURFACE
4.15	Rationalised economic appraisal of cultural heritage - REACH
4.16	The protection of silver collections from tarnishing – SILPROT
4.17	Salt compatibility of surface treatments - SCOST
4.18	To save the artistic heritage from insect pests without using toxic chemical compounds – SAVE ART
4.19	The microbial and physico-chemical degradation of bone as an indicator in the deterioration of the European archaeological property - DETERIORATION

## Environment and climate programme (1994–98) CRAFT

5.1	Wood exploitation by using starch impregnation and DIC technology - WEST
5.2	Optimalisation of mineral repair mortars for historic buildings – Lithos Arte Mortars
5.3	Advanced workstation for controlled laser cleaning of artworks - LASER
5.4	System for the maintenance of historic (wooden) buildings - MMWOOD

# Cultural heritage projects under FP5<sup>27</sup>

Programme 'Environment and Sustainable Development' (ESD: 1999–2002): Key action City of tomorrow and cultural heritage

(projects in acronym alphabetical order)

Accessibility projects sustainable preservation and enhancement of urban subsoil archaeological remains – APPEAR	Isotopic Technologies applied to the analysis of ancient mortars – ITER ( <i>CRAFT project</i> )
Assessment of suitable products for the conservation treatments of sea-salt decay – ASSET	Laser multitask non-destructive technology: in conservation diagnostic procedures – LASERACT
Preserving cultural heritage by preventing bacterial decay of wood in foundation poles and shipwrecks – BACPOLES	Low intrusion conservation systems for timber structures – LICONS ( <i>CRAFT project</i> )
Novel approaches to conserve our European heritage: Bioremediation for Building Restoration of the Urban Stone Heritage in European States – BIOBRUSH	A light dosimeter for monitoring cultural heritage: development, testing and transfer to market – LIDO
Inhibitors of biofilm damage on mineral materials – BIODAM	Preventative Conservation Strategies for Protection of Organic Objects in Museums, Historic Buildings and Archive – MASTER
Biomediated calcite precipitation for monumental stones reinforcement – BIOREINFORCE	Microclimate indoor monitoring in cultural heritage preservation – MIMIC
Carbon content and origin of damage layers in European monuments – CARMEL	Transitional Metals in Paper – MIP
Cyanobacteria and associated micro-organisms in roman hypogeal monuments – CATS	Monitoring of damage in historic tapestries – MODHT
Advanced study course 'Cultural Heritage Protection in a Sustainable Society' – CHEPRISS	Model for multi-pollutant impact and assessment of threshold levels for cultural heritage – MULTI-ASSESS
Concerted action on molecular microbiology as an innovative conservation strategy for indoor and outdoor cultural assts – COALITION	On-site investigation techniques for the structural evaluation of historic masonry buildings – ONSITEFORMASONRY
Corrosion of lead and lead-tin alloys of organ pipes in Europe – COLLAPSE	Conference 'Cultural heritage research: a pan-European challenge' – PANEURO
Compatibility of plasters and renders with salt loaded substrates in historic buildings – COMPASS	Chemiluminescence: a novel tool in paper conservation studies – PAPYLUM
Development of a monitoring system for cultural heritage through European Co-operation – DEMOTEC	Paper restoration using laser technology – PARELA ( <i>CRAFT Project</i> )
Integrated tool for in-situ characterization of effectiveness and durability of conservation techniques in historical structures – DIAS	Roman cement to restore built heritage effectively – ROCEM
Fire risk evaluation to European cultural heritage – Quantification of priorities and optimisation of fire protection strategies – FIRE-TECH	Sustainable development of urban historical areas through an active integration within towns – SUIT
Friendly heating: comfortable to people and compatible with conservation of art works preserved in churches – FRIENDLY HEATING	Determination of conditions to prevent weathering due to condensation, particle deposition and micro-organism growth on ancient stained glass windows with protective glazing – VIDRIO
Intelligent measurement technology for laser cleaning of historic buildings and monuments – HISTO-CLEAN ( <i>CRAFT project</i> )	
Improved damage assessments of parchments – IDAP	
Innovative modelling of museum pollution and conservation thresholds – IMPACT	
Stabilisation of iron gall ink containing paper – INKCOR	
Advanced study course 'Innovative technologies and materials for the conservation of monuments' – ITECOM	

27. FP5 cultural heritage projects related to international cooperation as well as other complementary research projects are listed and summarised in Volume 2 of this publication

# Cultural heritage projects under FP6<sup>28</sup> managed by the Environment Directorate of EC-DG Research

Programme 'Specific Support to Policy'  
(SSP: 2003–07)

(projects in acronym alphabetical order)

Training seminars on research planning, conservation, characterisation and management in archaeological sites – ARCHAIA	Sensor system for detection of harmful environments for pipe organs – SENSORGAN
Archaeological management policies – ARCHEOMAP	Seminars preventive conservation and monitoring of the architectural heritage – SPRECOMAH
Authentication methodologies for metal artefacts based on material composition and manufacturing techniques – AUTHENTICO	Near infrared spectroscopy tool for collection surveying – SurveNIR
Cultural heritage protection against flood – CHEF	Conference 'Sustaining Europe's Cultural Heritage: From Research to Policy' – Sustaining Heritage
Priorities and strategies to support Cultural Heritage Research Activities within <i>ECTP</i> and future FP7 activities – CHRAF	
Combat Online Illicit Numismatic Sales – Preventing illicit coin trade through unsupervised retrieval e-services – COINS	
Comparison of conservation materials and strategies for sustainable exploitation of immovable industrial cultural heritage made of iron and steel – CONSIST	
Conservation materials for stained glass windows – assessment of treatments, studies on reversibility, and performance of innovative restoration strategies and products – CONSTGLASS	
Assessment of air pollution effects on cultural heritage – CULT-STRAT	
Assessment of desalination mortars and poultices for historic masonry- DESALINATION	
Fingerprinting art and cultural heritage – in situ 3d non-contact microscale documentation and identification of paintings and polychrome objects – FING-ART-PRINT	
Development of a new anti-graffiti system, based on traditional concepts, preventing damage of architectural heritage materials –GRAFFITAGE	
Multifunctional encoding system for assessment of movable cultural heritage – MULTI-ENCODE	
Global climate change impact on built heritage and cultural landscapes – NOAH'S ARK	
Evaluation of mass deacidification processes – PAPERTREAT	
Pro-active management of the impact of cultural tourism upon urban resources and economies – PICTURE	
Improved protection of paintings during exhibition, storage and transit – PROPAINT	
Prevention of salt damage to the built cultural heritage by the use of crystallisation inhibitors – SALTCONTROL	
Conference 'Safeguard Cultural Heritage – Understanding and viability for enlarged Europe' – SAUVEUR	

28. FP6 cultural heritage projects related to international cooperation as well as other complementary research projects are listed and summarised in Volume 2 of this publication



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## Preserving our heritage, Improving our environment

The first volume of this publication highlights nearly 20 years of European Commission-supported research in the field of ‘tangible’ or physical cultural heritage. This cooperation has helped reinforce Europe’s research and technological foundations for protecting and renovating our movable and immovable cultural heritage through new scientific methodologies, tools, materials and processes. In particular Volume 1 provides the reader with an overview of the EU’s commitment to research in cultural heritage, the different forms of scientific and research cooperation and how they have developed over the years. The impact of such cooperative efforts also includes their economic contribution to the Lisbon Strategy and affects a wide range of related EU policies embracing the environment, tourism, the construction sector, regional policy, culture, etc.

From its beginning in 1986, EC research in cultural heritage has been supported or managed within the framework of the Commission’s environmental research policy. Since then, about 120 projects have been supported involving more than 500 stakeholder organisations from all European countries.

The second volume provides readers with an overview of nearly 100 cooperative projects in cultural heritage since 2000 in eight different ‘clusters’. These include the outcome of completed projects, as well as partial results of ongoing projects under FP6. All projects are grouped according to their discipline or most related programme. They also include some projects that illustrate the close objectives and links between European research programmes and operational programmes in cultural heritage.

Together, these two volumes offer a useful reference for all cultural heritage stakeholders: scientists, heritage managers, conservators and curators, architects, SMEs, and the ultimate beneficiaries of culture: Europe’s citizens.

As the EU has now begun the implementation of the Seventh Framework Programme on Research, this publication should boost awareness of the key results that span the full gamut of cultural research disciplines. It will also serve as a reference document for the European conference on cultural heritage research in Ljubljana (Slovenia), 10-14 November 2008, and offers a basis for eventual recommendations, policy orientations and decisions to further develop Europe’s world leadership in this field.

