

# SIXTH FRAMEWORK PROGRAMME



Contract for:

## **SPECIFIC TARGETED RESEARCH OR INNOVATION PROJECT**

*Extract of Annex1 - "Description of Work"*

Project acronym: **QuarryScapes**

Project full title: **Conservation of Ancient Stone Quarry Landscapes in the  
Eastern Mediterranean**

Proposal/Contract no.: **015416**

## Contents

1. Project summary.....	3
2. Project objectives .....	3
Scientific and technological objectives .....	3
3. Participant list.....	5
4. Relevance to the objectives of the programme and thematic priority.....	5
Ancient quarry landscapes: Research history, significance and current threats .....	5
The contribution of QuarryScapes to the state of the art.....	7
Region addressed in the proposal.....	7
5. Potential impact.....	8
Realism in Contribution to solving problems at Third Country Level .....	8
Strategic impact - an original approach to studies of ancient quarry landscapes.....	9
Innovation-related activities .....	10
Added value in carrying out the work at a European level .....	10
Relationship with other national or international research activities .....	10
Impact of Community support .....	10
6. Implementation plan.....	11
Introduction .....	11
List of work plans and deliverables; work plan descriptions .....	13
References .....	25

## 1. Project summary

The cultural heritage of the Eastern Mediterranean is predominantly made from stone, and throughout antiquity thousands of smaller and larger quarries were opened. The archaeological record in the quarries comprises rare evidence of stone extraction sites, roads, harbours, settlements, ceramics and inscriptions, which collectively constitute an ‘ancient quarry landscape’. Such landscapes are of crucial importance, not only to our understanding of the lives of the non-elite, but of the political and ideological ambitions of an elite that drove resource exploitation to such heights. Yet, as heritage sites of such enormous historical importance these have largely gone unrecognised, mainly due to poor documentation, which has consequently led to their current indiscriminate destruction from actions such as modern development and quarrying.

The QuarryScapes project will enhance cultural heritage management of ancient quarry landscapes through the development of methodology and conservation models that can be effectively implemented in a range of cultural contexts. ‘Quarryscapes’ will develop scientific and practical methodologies for documentation, characterisation and conservation of ancient quarry landscapes, raise awareness of the significance and vulnerability of such sites and contribute to legal protection measures and sustainable management of ancient quarry landscapes. Through case studies in Egypt, Jordan and Turkey, the project will address development of theoretical and practical methods pertaining to the major steps in the process of conservation: from recognition, investigation and assessment of significance, to understanding the risks, developing sound conservation and monitoring concepts, and suggesting mechanisms for sustainable management. QuarryScapes will also organise open workshops and disseminate project results through the development of practical guidelines for conservation of ancient quarry landscapes.

## 2. Project objectives

### Strategic objectives:

1. Develop scientific and practical methodologies for documentation, characterisation and conservation of ancient quarry landscapes
2. Raise the awareness of the significance and vulnerability of ancient stone quarry landscapes
3. In the long term contribute to legal protection measures and sustainable management of ancient quarry landscapes

### Scientific and technological objectives

Following the strategic objectives, the project can be broken down to a set of scientific and technological objectives, all measurable achievements. These are:

#### *Recognition of ancient quarry landscapes:*

- Develop a primary inventory system based on existing systems in related fields and case studies in Jordan and Turkey (*WP1 and 2, month 24*)

#### *Investigation of ancient quarry landscapes:*

- Develop archaeological and geological field survey methodologies based on GPS (Global Positioning System) and GIS (Geographical Information Systems) technology for detailed characterisation and interpretation of the features of the sites based on case studies in complex quarry landscapes in Egypt and Turkey. (*WP 3 and 4, month 19 and 24*)

*The significance of ancient quarry landscapes:*

- Explore means to assess values and significance through a combination of the results from all case studies, as well as three theoretical avenues of research: 1) Traditional and recent value assessment systems within cultural heritage, including socio-cultural aspects; 2) Contemporary landscape value assessment methodologies, 3) International conventions and declarations in cultural heritage. From this research the aim is to discuss the multitude of values of ancient quarry landscapes and show how these values govern the conservation process. (WP 8, Month 32)

*Risk assessment and monitoring of ancient quarry landscapes:*

- Develop tools for risk analysis and monitoring applicable to ancient quarry sites, primarily based on case studies in Egypt. (WP 5, Month 24)

*Conservation concepts*

- Establish a practical, conceptual model for the conservation and management of a quarry landscape (in the form of a management plan for Widan el-Faras, Faiyum, Egypt), and explore the applicability of similar conceptual models for quarry landscapes in general. (WP 6, Month 29)

*Sustainable management*

- Design and produce thematic site maps and overview maps for practical use in site and landscape management, and general land use planning. (WP 7, Month 29)

*Conservation and management guidelines*

- Establish a scientific foundation for practical conservation and management of ancient quarry landscapes through critical evaluation of the case studies in the light of recent developments in related fields. (WP 8, Month 32)
- Produce and publish a set of practical guidelines for conservation and sustainable management of ancient stone quarry landscapes. (WP 8, Month 32)

*Workshops, network and dissemination*

- Organise three open workshops on different aspects of ancient quarry landscapes and build the foundation of a sustainable professional network. (WP 9, Months 12, 24, 35)
- Produce a series of printed and digital publications, promoting the conservation of quarry landscapes, aimed at a) the scientific community, b) heritage managers at various levels, c) NGOs and d) the general audience. (WP 9, Month 36)

*Review and assessment*

- Secure the continuous review of deliverables/products and the assessment of these within WP8. The work package leaders share responsibility for this activity. (WP 8, continuous)

The most important general outcome of the project will be general guidelines for investigation, value assessment, risk assessment, monitoring, conservation and sustainable management of ancient quarry landscapes that can be used in a range of cultural and historical contexts.

### 3. Participant list

<b>List of Participants</b>
-----------------------------

Partic.R ole*	Partic. no.	Participant name	Participant short name	Country	Date enter project**	Date exit project**
CO	1	The Geological Survey of Norway	NGU	Norway	1	36
CR	2	Katholieke Universiteit Leuven	KUL	Belgium	1	36
CR	3	University College London	UCL	United Kingdom	1	36
CR	4	Middle East Technical University	METU	Turkey	1	36
CR	5	Yarmouk University	YU	Jordan	1	36
CR	6	North South Consultant Exchange	NSCE	Egypt	1	36
CR	7	Supreme Council of Antiquities	SCA	Egypt	1	36
CR	8	Università IUAV di Venezia	IUAV	Italy	1	36

\*CO = Coordinator

CR = Contractor

### 4. Relevance to the objectives of the programme and thematic priority

#### **Ancient quarry landscapes: Research history, significance and current threats**

The cultural heritage of the Eastern Mediterranean is predominantly made from stone\*. Campaigns to acquire stone in antiquity, from thousands of local, regional and distant quarries

---

\* Within the scope of QuarryScapes, the following definitions are applied:

- Stone: rocks used in their primary state, left in their original condition or worked into building and decorative stone or items such as statues and utilitarian products (e.g. stone vessels and stone tools).
- Quarry: any open cast or underground extraction site designated for the exploitation of stone products.
- Quarry site: one or several stone quarries and related infrastructure (roads, buildings, ruins, smithies, waste heaps etc.)
- Quarry landscape: a context-dependent term meaning: 1) An industrial landscape dominated by one or several interconnected stone quarry sites, in some cases also connected with the sites where the stone was transported to and used; 2) A term related to landscape archaeology, ranging from the understanding of

were, in essence, prestige statements of an elite to key places of primary production. The archaeological record at quarry sites comprises rare evidence of extraction areas, roads, harbours, settlements, tool marks, ceramics and inscriptions, which collectively constitute an "ancient quarry landscape". These landscapes can not only enhance our understanding of technological development and the lives of the non-elite in antiquity, but also provide rare insights into the political and ideological ambitions of an elite that drove resource exploitation to such heights<sup>3,4,5</sup>. In some instances, these landscapes have significantly contributed to physically and aesthetically shaping the modern landscape and may comprise important landmarks, for example impressive quarry faces such as the gallery quarries along the Nile Valley<sup>6,7</sup>. Moreover, they may be important in local and regional contexts as places for e.g. cultural tourism.

Research of ancient quarry sites, from both a geological and archaeological perspective, is still a relatively new area of study, in the project region pioneered and furthered by scientists such as Engelbach<sup>8,9,10,11</sup>; Clarke & Engelbach<sup>12</sup>; Lucas<sup>13</sup>; Röder<sup>14</sup>; Ward Perkins<sup>15</sup>; Asgari (see refs. in Waelkens<sup>16</sup>); Waelkens<sup>16</sup>; Klemm & Klemm<sup>17</sup>; Harell<sup>18,19</sup>, Lazzarini<sup>20</sup> and Aston et al.<sup>21</sup>. Since the late 1980s ASMOSIA (Association for the Study of Marble and Other Stones used in Antiquity) has been the main forum for "quarry scientists", particularly in the study of stone characterisation, provenance, trade and craftsmanship<sup>22</sup>.

Archaeological surveys and excavations have been carried out at some major quarry sites, including two of the large Roman quarry landscapes in the Eastern Desert in Egypt<sup>23,24</sup>, and the Early Dynastic quarry sites of Widan el-Faras (Central Egypt<sup>25</sup> and Chephren's Quarry, South Egypt<sup>26,27,28,29</sup>). Several of the studies of the quarry sites have concentrated on the scientific analysis of micro-level quarry data with little emphasis being placed on the macro-level, such as the broader conceptualisation of raw material acquisition as reflecting social organisational change in antiquity. Recent work<sup>4</sup> has now begun to address these issues, but for the majority of lay people such landscapes largely remain visually and conceptually obscure.

The failure to recognise ancient quarry landscapes as constituting major heritage sites has also made them invisible to local authorities. Hence the majority still remain undocumented, unregistered and, with a few exceptions, legally unprotected as archaeological sites. As a consequence, these landscapes are disappearing at an alarming rate, from actions such as modern development projects and urban expansion, modern quarrying operations, looting, vandalism and tourist pressure, natural hazards weathering. Misguided archaeological excavation activities may also present a significant risk.

This situation is not unique to ancient quarry landscapes, neither in the project region<sup>31</sup>, nor in other parts of the world. In Europe the rapid transformation of traditional landscapes has been addressed in the "European Landscape Convention" (2000) and the following declaration made at the 7th International Symposium of US/ICOMOS (2004) neatly sums up the current global situation:

*"...threats to globally important landscapes include loss of character, degradation, intense use, unregulated tourism, population shifts, economic factors, encroachment pollution and that our inability to fully fathom heritage landscapes is the largest*

---

physical landscape and its evolution over time to "mental" landscapes and intangible heritage (cf. the wide definition by Shanks<sup>1</sup>)

- Ancient: in this project from the Palaeolithic Period to 4th century AD; with the exception of WP1, the primary focus in the project is on Antiquity
- Conservation: a context-dependent term, meaning 1) the process from recognition of a site/landscape to its sustainable management, and 2) the practise of preserving the existing state of a cultural heritage resource<sup>2</sup>

*threat...*” (Adopted at the US/ICOMOS 7th International Symposium at Natchitoches, USA, 27 March 2004)

Although ancient quarry landscapes share destiny with many other cultural landscapes, it is probably fair to state that they have been treated with more ignorance and neglect than few other fields of cultural heritage. Recent statistics gathered from Jordan in the GIS-based "Jordan Antiquities Information System"<sup>32,33</sup> on the status of 145 registered ancient quarries demonstrate this fact, with over 97% remaining legally unprotected. From recent observations in Egypt<sup>7</sup> and Turkey, similar statistics also apply here.

### **The contribution of QuarryScapes to the state of the art**

Following from the introduction above, the consortium has defined the most important areas in which there are crucial needs of further research related to ancient quarry landscapes:

- Non-destructive survey and investigation methods specifically adapted to such landscapes
- Definition of criteria for assessing significance and values, taking broad historical, landscape- and socio-cultural perspectives
- Methods for risk analysis and long-term monitoring
- Concepts for integrated conservation and management

Through in-depth case studies and theoretical research, QuarryScape's most important contributions to state-of-the-art within these areas are expected to be:

- Bringing the *overall* understanding and conceptualisation, as well conservation and management of such landscapes a major step forward, as well as putting them on the international conservation agenda.
- Increasing the understanding of a *selection of quarry landscapes in the region* and practically contribute to their protection, conservation and sustainable management
- Development of modern, efficient survey methods, specifically adapted to quarry landscapes, and to be used in other contexts as well.
- Making the first international contribution to setting criteria of significance and values for such landscapes
- Making the first international contribution to development of specific methods for assessing threats, hazards and long-term monitoring for such landscapes
- Making the first set of research-based, practical guidelines for the whole process of conservation of ancient quarry landscapes
- Broaden future research perspectives, showing that investigation and conservation of heritage resources are two agendas reinforcing each other.

### **Region addressed in the proposal**

The project particularly addresses the Eastern Mediterranean, but expected results will be transferable to other regions as well. Theoretically and case study based, the project comprises fieldwork and research in several ancient stone quarry landscapes in Turkey (e.g. the Sagalassos area), Jordan (Stone Age quarries and the Petra area) and Egypt (Chephren's Quarry in Lower Nubia, silicified sandstone quarries in Aswan and basalt quarries at Widan el-Faras in the Faiyum). Except for Petra, which is a World Heritage Site (WHS) and a small part of the Aswan quarries (the famous "Obelisk quarry"), none of the quarry landscapes are legally protected, despite the fact that some of them (Aswan and Chephren's Quarry) are situated at the border of a World Heritage Site (Lower Nubia) or are included on national tentative WHS lists (Faiyum).

## 5. Potential impact

The potential impact of QuarryScapes are expected to follow on three levels:

- In the case study areas in Jordan, Turkey and Egypt
- In the project region (the Eastern Mediterranean)
- In other areas and also related to other archaeological sites and landscapes, by setting an agenda for research and conservation related to quarry landscapes

This potential impact will be discussed with reference to the specific questions posed in the INCO guide for proposers.

### **Realism in Contribution to solving problems at Third Country Level**

The threats to ancient quarry landscapes and other archaeological resources in the case study areas and the project region as a whole are overwhelming. Moreover, the human, economic and other resources available to tackle the problems are limited, whereas the number of stakeholders having an interest in the resources is large and often representing conflicting views. Since QuarryScapes is based on fieldwork in selected case study areas involving multidisciplinary teams of local, national and international experts on quarry landscapes, it is believed that the practical day-to-day work and exchange of scientific and innovative ideas and knowledge in the field will be of great importance. This may generate similar studies and conservation programmes at other sites and in other landscapes and thus secure a positive, long-term impact.

Representatives of local, national and international heritage authorities and NGOs will take part in the open project workshops (including fieldtrips), and they will also follow and monitor the fieldwork through the normal national procedures for concession granting and progress reporting. In Egypt representatives of the authorities are also part of the project. Thus, it is believed that in the case study areas, some of them formerly unknown as large heritage sites to authorities, there is a high potential for actually reducing the risks facing the quarry landscapes and putting legal protection and practical management measures at work at the end of the project period (2008) or shortly after. This is especially true for two case studies (Widan el-Faras in Faiyum and Sagalassos), which are dedicated to developing practical conservation concepts and because there is some previous work to base on<sup>34,35,36</sup>. Moreover, a very important aspect in several case study areas where haphazard modern quarrying is going on (especially Faiyum), is to address the balance between conservation and modern exploitation of the resources. In several cases, a simple approach for guiding modern quarrying operators to nearby deposits of similar-quality stone where there is no conflict with conservation interests is sufficient for bringing the sustainable management of the sites a huge step forward.

It is an aim of the project to develop a primary inventory system for quarry landscapes. Such a system will include basic guidelines for characterisation, but also give information on conservation status, threats and monitoring of the state/change over time, using simple indicators such as the legal protection status and whether a management plan has been developed and/or enforced. The system will be co-ordinated with already existing, *official* and nation-wide GIS/database systems for cultural heritage in the region, such as the "Egyptian Antiquities Information System" (EAIS<sup>37</sup>). Moreover, the compilation of an atlas/map of all known quarry landscapes in Egypt (c. 200) based on former studies<sup>19</sup> and QuarryScapes work accompanied by information on conservation, legal protection status and threats must be regarded as major tools in land-use planning.



On the basis of indicators derived from the inventories and atlas (e.g. the number of quarry landscapes legally protected) it should be possible to formulate a testable hypothesis for the potential long-term effect (5-10 years and more) the project may have in the region:

*QuarryScapes will contribute to a significant increase in the number of legal protection measures and conservation and management plans for ancient quarry landscapes in the project region.*

It will of course be difficult to determine whether QuarryScapes *alone* will generate such effects, but a "baseline" for future comparison through field checks and other means will be achieved. The use of simple indicators for monitoring the state of cultural heritage resources has been derived from the EU-project "DEMOTEC-A"<sup>38</sup> and associated field-related work on heritage landscapes in Italy<sup>39</sup>. Through practical monitoring programmes in Norway, the usefulness of such systems have been verified, and in Norway monitoring of heritage resources have even been developed into a national standard "Automatically protected cultural heritage sites and monuments - Registration of loss and damage" (Norwegian Standard no. prNS 9450). The long-term challenge in the project region is to adapt such systems to ancient quarry landscapes.

### **Strategic impact - an original approach to studies of ancient quarry landscapes**

The strategic impact of QuarryScapes inside and outside the project region is expected to follow from the actual design of the project: Considering all the steps from recognition, characterisation, value and risk assessment, to development of conservation concepts and sustainable management, QuarryScapes does not follow the traditional "exploitative" models for heritage resources (especially archaeological sites<sup>40</sup>) but has two agendas reinforcing each other: on the one hand the aim is to learn more about ancient quarry landscapes, their significance and values, and on the other, this aim can in the long run only be achieved by a firm commitment to integrated conservation strategies of the resource, balancing the needs of various stakeholders.

By using modern research methods for characterisation of material culture and the potential values of ancient quarry landscapes, it is expected that the project will broaden perspectives inside and outside the scientific community in regard to such landscapes: they are not only resources for scientific knowledge of technological developments in antiquity, but also have significance to the humanities on a macro-level in determining social organisational change, trade networks and as landscape forming elements constituting a multitude of histories/narratives. They may also be of economic (not restricted to financial) value for local communities (e.g. cultural tourism) and have a potential as sources of raw material. The challenge is to prioritise such values and explore the consequences in the development of practical conservation concepts. In many cases it may well be that small-scale modern quarrying with traditional methods (excluding heavy machinery) may enhance a site's significance because of its contribution to keeping craft traditions alive - generally considered of utmost importance in heritage conservation.

This integrated approach and the research results obtained will be communicated to the scientific community, heritage authorities and NGOs. It is expected that the scientific community (e.g. through ASMOSIA) will benefit in that the research perspective for subsequent studies and conservation programmes can be widened. Moreover, it may significantly aid e.g. UNESCO in work related to present and future World Heritage Sites including ancient quarry landscapes.

The most important general outcome of the project will be a booklet with general guidelines for investigation, value assessment, risk assessment, monitoring, conservation and sustainable management of ancient quarry landscapes that can be used in a range of cultural and historical contexts, given that such sites share a range of basic features. However, it is

expected that it will be of value also for other types of cultural landscapes, especially industrial landscapes such as ancient mining sites.

### **Innovation-related activities**

QuarryScapes combines research and innovation-related activities. The research component is especially related to characterisation, detailed site survey, value assessment methodologies, as well as risk assessment and monitoring methodologies. The innovation component draws from these studies, as well as from other studies in related fields, and is particularly related to development of practical conservation concepts for specific sites/landscapes and sustainable management through inventory and GIS-based maps/atlasses, as described above under the heading "Realism in contribution to solving problems at Third Country Level"

### **Added value in carrying out the work at a European level**

At a European level various research and conservation activities related to cultural landscapes are presently very high on the agenda - generally higher than in the project region. By drawing from such activities there is a significant added value to the research and innovation activities planned by QuarryScapes in the project region. On the other hand, ancient and historical quarry landscapes in Europe are facing similar threats as in the project region, and very little has been undertaken in order to reduce such threats (e.g. in Norway<sup>7</sup>). Therefore, QuarryScapes will also contribute to awareness-raising in Europe. A specific aspect is the recent developments in a related area in Europe; the promotion of geo-sites, geotopes and geo-parks, which was given much attention at the "World Geological Congress" in Florence (August 2004). Such sites very often incorporate ancient mines and quarries, and thus they are very relevant in the context of QuarryScapes.

### **Relationship with other national or international research activities**

In addition to drawing on research, conservation and other activities mentioned above, QuarryScapes has made informal cooperation agreements with two research projects in the project region: 1) The Sagalassos Archaeological Project, run by the University of Leuven.

QuarryScapes studies will thus particularly contribute to the understanding, conservation and promotion of the "wider Sagalassos ancient town landscape" 2) The Aswan Archaeological Project, run by the Swiss Institute of Architectural and Archaeological Research on Ancient Egypt in cooperation with the Supreme Council of Antiquities. The agreement concerns mutual scientific and practical help. QuarryScapes will also make agreements with other research projects and programmes, for instance in the Petra area in Jordan.

### **Impact of Community support**

QuarryScapes is an ambitious project aiming at having an impact on several levels, from widening research perspectives to concrete management measures. Two of the work packages are designed to strengthen the capabilities of government agencies and SME's in developing practical tools in the conservation and management of ancient quarry landscapes, thus actually implementing the research on specific sites. An important part of these two WPs is the active collaboration and communications with different government agencies, stakeholders and other parties having interests in the case study areas, as well as developing products specifically adapted to important target groups. It is expected that these WP's will leave durable and sustainable capacities within heritage authorities and private enterprises for in the future dealing with such sites professionally.

### **Contributions to standards**

The project does not aim at developing international standards. However, the inventory-related work, as well as the booklet on guidelines can be viewed as a contribution to future standards, especially in the field of monitoring of cultural heritage resources. Monitoring is one of the keys to sustainable management of cultural heritage, and also an area in which it is practically possible to develop standards.

## 6. Implementation plan

### Introduction

Conservation of heritage sites and landscapes in general can be described as a process involving several steps, from the initial discovery or recognition towards sustainable management. Within the context of QuarryScapes, these steps can be listed as follows:

1. Recognition: Registration and simplified description, e.g. based on a general or targeted regional or national (or international) inventory
2. Investigation: Detailed surveys and research (e.g. archaeological excavations), delineation of important features, understanding the context.
3. Significance: Assessment of values for various stakeholders, e.g. for science and the humanities, residents and local interest groups.
4. Risks and monitoring: Analysis of threats and deterioration, as well as selecting methods for diagnostic and systematic long-term observation as preventive conservation tools.
5. Conservation concept: Development of strategies and practical measures for reducing risks, considering the significance and balancing the needs of the various stakeholders.
6. Sustainable management: Practical steps to ensure the implementation of a validated conservation concept.

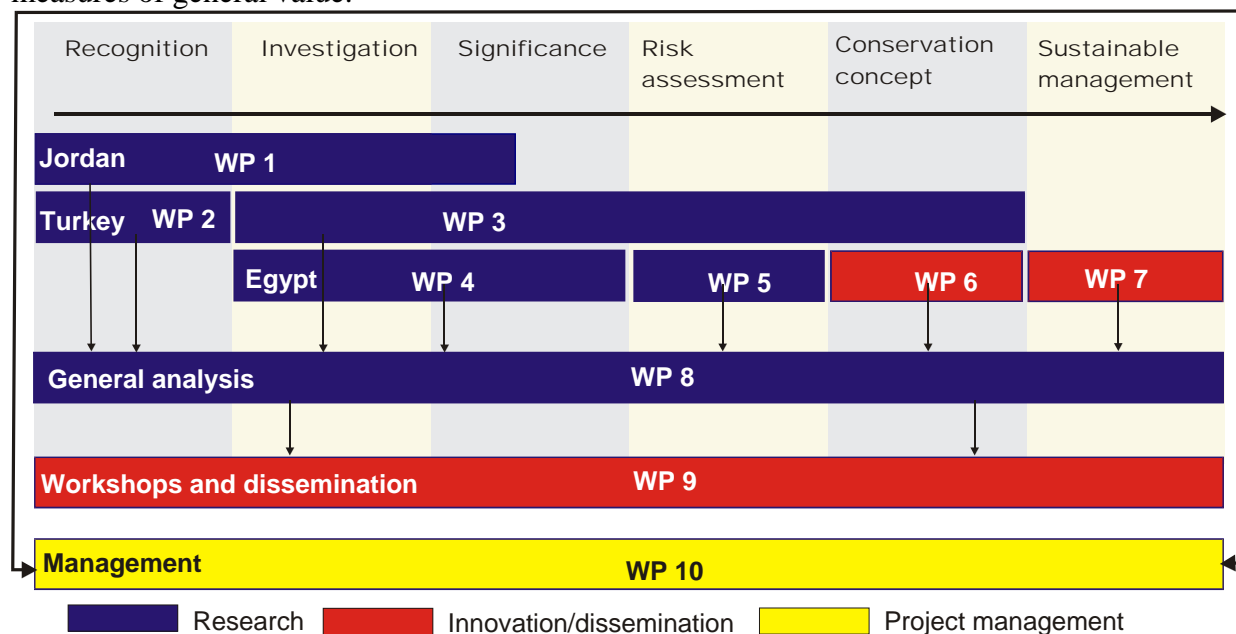
Although these steps follow a timeline from the recognition to the implementation of practical management, there are interdependencies between them, e.g. significance models can generate needs for further investigations and reassessment of the conservation concept.

QuarryScapes is composed of ten individual work packages (WPs). These are designed to explore the different steps in the process of conservation as mentioned above, and to ensure the dissemination of the results. To some degree, the number and content of the WPs are also designed for facilitating administration of the project and securing a clear and practical distribution of responsibilities between the partners – e.g. to create a genuine ownership to the WPs. This is necessary due to the complexity of the project. Therefore, some case studies with similar content appear in different WPs due to practical project management reasons. The necessity of liaisons between the WPs and the general dissemination of knowledge within the consortium will be secured through workshops, common fieldwork and meetings.

WPs are divided in 3 groups: research, innovation/dissemination and project management:

The research activities essentially contain a series of WPs involving case studies of quarry landscapes. WPs 1 and 2 in Jordan and Turkey respectively, address making a general inventory of quarries and quarry landscapes and putting the sites onto the map (recognition and introductory investigation). WP 3 in Turkey explores the quarries around the ancient town of Sagalassos and their integration within the town - quarries as part of an ancient town landscape. WPs 4 and 5 in Egypt takes the investigation part further, including detailed archaeological and geological survey of a complex quarry landscape, and also addressing the assessment of significance. WP 6 aims at exploring risk assessment and monitoring methodologies, based on one major ancient quarry landscape in Egypt and several minor case studies. WP 8 involves the interpretation and analysis of the empirical data from the case studies, putting them in a general perspective through theoretical approaches, and exploring

the value of designing general measures for each step in the conservation process. This analysis, is carried out in a separate WP in order to ensure a post-case study teamwork for both strengthening the consortium network and increasing the potential of generating measures of general value.



*QuarryScapes – Work package interdependencies*

The innovation activities also include two case studies; these are designed to promote "take-up" actions from the research activity part of QuarryScapes, particularly for developing practical approaches to conservation and management; one WP will address the development of a conceptual conservation model for a site and explore the general applicability of such models. Another WP focuses on the design of maps for sustainable management of ancient quarry landscapes and general land-use management.

The consortium has decided to collect workshops and dissemination activities, including publications, in one separate WP. This is in order to facilitate and secure the collective involvement of the partners in this activity, and to bring all published materials under one umbrella. Of great importance is the proposed guidelines for conservation of ancient stone quarry landscapes.

QuarryScapes puts much weight on the empirical case studies. This is crucial due to the necessity of carrying out in-depth studies of the specific aspects to be explored, and because of the lack of existing studies addressing conservation of such sites and landscapes. The case studies are carefully selected based on the following criteria:

- Each of them will address one or several of the steps in the process of conservation
- Together they address the whole process of conservation
- With the exception of the inventories, they are well known among members of the consortium

### List of work plans and deliverables; work plan descriptions

Work-package No.	Workpackage title	Lead contractor No	Person-months	Start month	End month	Deliverable No
1	Jordan inventory and provenance	5	30	1	24	1
2	Turkey inventory	4	66	1	24	2
3	Sagalassos quarry landscape	2	24	1	24	3
4	Aswan quarry landscape	3	37	1	19	4,5
5	Egypt risk and monitoring	1	17	13	24	6
6	Egypt conservation concept	6	21	10	29	7
7	Quarry landscape GIS	7	14	5	29	8
8	Integrated scientific analysis	1	32	5	34	9
9	Workshops and dissemination	1	25	4/12	36	10,11, 12,13, 14
10	Project management	1	4	1	36	15,16, 17
	<b>TOTAL</b>		<b>270</b>			

<b>Deliverable No</b>	<b>Deliverable title</b>	<b>Delivery date</b>	<b>Nature</b>	<b>Dissemination level</b>
1	Primary inventory and provenance of stone sources for a selection of archaeological sites and artefacts in Jordan	24	R	PU
2	Inventory of Ancient quarry landscapes in Turkey: their characteristics, production and state of conservation	24	R	PU
3	The Sagalassos archaeological site – example of an ancient integrated quarry landscape	24	R	PU
4	Characterisation of complex quarry landscapes; example from West Bank sandstone quarries, Aswan	19	R	PU
5	The assessment of significance of ancient quarry landscapes – problems and possible solutions	19	R	PU
6	Risk assessment and monitoring measures in ancient quarry landscapes at risk: Case studies in Egypt	24	R	PU
7	Conservation concept for the Widan el-Faras ancient quarry landscape, Egypt, and the possible applicability to other sites	29	R	PU
8	GIS products for management of ancient stone quarry landscapes – three Egyptian site maps	24	O	PU
9	Map of ancient Egyptian stone quarries	29	O	PU
10	Scientific baseline for conservation guidelines for ancient quarry landscapes	32	R	PU
11	Practical conservation guidelines for ancient quarry landscapes – from recognition to sustainable management	35	O	PU
12	QuarryScapes workshop proceedings – extended abstracts	36	O	PU
13	QuarryScapes Ancient quarry landscapes atlas	35	O	PU
14	QuarryScapes web	4	O	PU
15	Progress report 1	13	R	PP
16	Progress report 2	25	R	PP
17	Progress report 3	36	R	PP

**Workpackage Title:** Jordan inventory and provenance

**Workpackage number 1**                      **Start date or starting event:**      Month 1

**Work Package leader:**                      Yarmouk University

### **Objectives**

- Perform a study of a selection of ancient quarry landscapes and stone types, suggesting methods to generally improve primary inventory systems.
- Explore methodologies for establishing provenance criteria and technical characteristics of Jordanian and imported stone types

### **Description of work**

The study will contain field surveys of selected ancient quarry landscapes (sandstone in the Petra area, limestone in Jerash, Palaeolithic/Neolithic sources of stone tools in Jordan valley and Serga river basin) and archaeological sites, addressing delineation of the quarry landscapes, description of their features and characterisation of production-consumption patterns. Petrographic, mineralogical and geochemical analysis will be performed on samples in order to establish provenance criteria and physical properties of importance to the use of the stones. The choice of characterisation technique largely will depend on the types of stone examined. Whereas some techniques are universal for all stones examined, others are suited for only certain types. The following techniques will be used for all samples: Mineralogical and textural analysis, using thin sections/polarising microscopy and XRD. In addition to mineral identification, the study will particularly focus on textures and fabrics in the rocks and their value for provenancing. Mechanical properties and water absorption studies: Studies of physical properties of rocks can be of value regarding provenance, but particularly for understanding the pattern of use of stone – e.g. stone quality assessment in Antiquity and its significance to choice of sources. In specific cases, other tools will be employed to enhance the understanding of the provenance of a particular stone, including the following: Trace element studies: This method is especially applicable to rocks extending over wide areas showing little variation in their petrological characteristics. Correlating trace and minor elements between quarries and artefacts will be applied on some stone types, particularly for provenancing Neolithic and Palaeolithic stone tools. Stable isotopes: Stable isotopic studies are particularly useful in the study of marble provenance. A database integrating stable isotopic and petrographic data of Mediterranean marble already exists, and can be expanded through the work in this project.

WP1 will conclude with 1) the design and construction of a database on the characteristics of ancient stone types in Jordan and 2) a report (with maps) describing the investigated stone quarry landscapes and suggesting improvements with regard to primary inventories.

### **Deliverables**

1) Report: Primary inventory and provenance of stone sources for a selection of archaeological sites and artefacts in Jordan

### **Milestones and expected result**

Month 6: Selection of quarry areas and archaeological sites completed

Month 18: Field surveys completed

Month 24: Report

**Workpackage Title:** Turkey Inventory

**Workpackage number 2**

**Start date or starting event:** Month 1

**Work Package leader:**

Middle East Technical University

### **Objectives**

- Create an inventory for recognising and characterising a selection of non-protected ancient quarry landscapes in Turkey

### **Description of work**

The work package will focus on a selection of quarry landscapes in Turkey, all of which are not protected and poorly documented. These quarry landscapes are purposefully selected for representing a great span in time (Hittites to the Seljuks), in consumption (local building stone to attractive, widely distributed marble), in location (within and near cities to rural landscapes) and in appearance (spectacular sites to non-spectacular). The selected sites are:

- Limestone quarries of the Hittites (Sapinuwa-Ortakoy, near Corum)
- Andesites of Ankara (quarries used since Roman times or earlier)
- Tuffs of Capadocia (durable types were exploited by Seljuks)
- Eagean Marbles around Manisa

The study aims at establishing initial characterisation of the quarries and quarry landscapes, their archaeological and geological characteristics and a general review of production-consumption patterns. To achieve this, the WP will include general archaeological and geological surveys and geoarchaeological characterisation of stone materials. The WP will also include brief evaluations of the state of preservation of these sites and risks facing them. Moreover, the results will be discussed in the context of more general primary inventory systems.

### **Deliverables**

2) Report: Inventory of Ancient quarry landscapes in Turkey: their characteristics, production and state of conservation

### **Milestones and expected result**

Month 20: survey completed

Month 28: report



**Workpackage Title:** Sagalassos quarry landscape

**Workpackage number 3**

**Start date or starting event:** Month 1

**Work Package leader:**

Katholieke Universiteit Leuven

### **Objectives**

- Compile a complete overview of the Sagalassos quarry landscape regarding site characterisation, production and consumption patterns and potential risks
- Explore the quarry landscape as being a part of the extended "town landscape" of Sagalassos and discuss the consequences for conservation and promotion to the general public

### **Description of work**

The Sagalassos Project has provided extensive knowledge of the architectural heritage and use of stone in Sagalassos; QuarryScapes will take this research further by undertaking an in-depth study of the ancient quarry landscape surrounding the town by establishing its relationship with the various periods of construction.

The WP will focus on both the geographical dimension as well as the development of quarrying through time and the chronological link between stone extraction and construction periods. It will also explore the unique opportunity of the area to view the quarry landscape as the "larger Sagalassos landscape", adding new dimensions to the quarry landscape itself and to the ancient town of Sagalassos. It will address conservation measures in the light of an integrated landscape, risks and the potential of the quarry sites for adding value to cultural tourism.

The methodology will include:

- Archaeological and geological field surveys
- Provenance studies to fulfil the already extensive work carried out in this field
- Relative dating of quarrying with the development of the quarry landscape
- Contextualising the quarry landscape in the "larger Sagalassos cultural landscape"
- Designing an integrated GIS for visualisation and "baselining" the management of the landscape

The Sagalassos Work Package will serve as a showcase on how a prodigious quarry landscape can be interpreted, in particular its relationship with stone consumption in the nearby Sagalassos town.

### **Deliverables**

3) Report: The Sagalassos site – example of an ancient, integrated quarry landscape

### **Milestones and expected result**

Month 18: field surveys undertaken

Month 24: Report

<b>Workpackage Title:</b> Aswan quarry landscape	
<b>Workpackage number 4</b>	<b>Start date or starting event:</b> Month 1
<b>Work Package leader:</b>	University College London

### **Objectives**

- Develop archaeological and geological characterisation and documentation methods for the West Bank ancient quarry landscape in Aswan, applicable for large and complex quarry landscapes in general
- Develop tools for assessing the significance and values of ancient quarry landscapes

### **Description of work**

The first objective of this case study (West Bank ancient quarry landscape in Aswan) is to devise methodologies for the documentation and characterisation of such an intricate quarry landscape, using non-destructive field surveying techniques, to understand the synchronic development of the site in its totality and to delineate the extent of the site. This case study will then form the foundation for the development of a multidisciplinary field surveying methodology, usable in a range of cultural contexts, in how to characterise and document empirical data in ancient quarry landscapes using non-destructive field surveying techniques. From analysis of this data it is then possible to develop hypotheses relating to the social context and logistics of ancient stone quarrying. The case study will comprise the following work: mapping, characterisation of material culture, documentation and registration of extraction technologies and epigraphic data, scientific dating, transportation of stone, provenance study, consumption analysis.

The second objective is to produce criteria for assessment of significance and values within this complex network of material culture, given its vulnerability to urban development and need for conservation and sustainable management, and to explore the applicability of such criteria for quarry landscapes in general. Since Aswan, with its rapidly expanding population and urban infrastructure, is practically completely surrounded by an ancient quarry landscape (predominantly granite and silicified sandstone), it is important to take a broad view in the studies of significance. Thus, the tools for assessment of values and significance will be developed by exploring three avenues of research: traditional cultural heritage value systems, landscape values, how international conventions and declarations relate to ancient quarry landscapes

### **Deliverables**

- 4) Report: Characterisation of complex quarry landscapes; example from West Bank sandstone quarries, Aswan
- 5) Report: The assessment of significance of ancient quarry landscapes – problems and possible solutions

### **Milestones and expected result**

Month 14: Fields surveys completed  
Month 19: Reports

**Workpackage Title:** Egypt Risk and monitoring

**Workpackage number 5**

**Start date or starting event:**

Month 4

**Work Package leader:**

Geological Survey of Norway

### Objectives

Develop practical tools for:

- The analysis of human threats, natural hazards and weathering applicable to ancient quarry landscapes.
- Long-term systematic monitoring based development of indicators and through field checks and satellite imagery

### Description of work

The main case study area is Chephren's Quarry, an ancient quarry landscape covering some 120 km<sup>2</sup> of flat, hyper-arid desert in the south of Egypt. The main risks and vulnerability having been recently identified, and protective measures underway, the landscape is well suited for research pertaining to long-term monitoring concepts. Three avenues of research will be explored:

- Indicator development: "Hard" or quantitative indicators, e.g. percentage of "pristine" quarry landscape affected by modern development, state of legal protection measures; "soft" or qualitative indicators, e.g. related to condition, quality of management plans.
- Systematic field checks: Development of tools, especially GPS-based mapping, for aiding heritage authorities in undertaking future monitoring/comparison with earlier states.
- Satellite image analysis: Exploring the practicality and usefulness, especially in terms of cost-efficiency as compared to field checks and the spatial resolution needed to detect important features and changes, of US declassified images from the 1960s, Landsat images, IKONOS and Quickbird images. Data will be analysed using Access databases and ArcView GIS. Since GPS based maps of the quarry landscape have already been produced, these will be used for retrospective monitoring and thus enable validation of the final concept developed.

Chephren's Quarry is "simple" in terms of topography and risks. Therefore, case studies in more complex quarry landscapes (Aswan, Widan el-Faras, Sagalassos) will be undertaken, following the methodologies and concepts worked out at Chephren's Quarry. A main goal is to develop *field checklists*, enabling heritage authorities to look for relevant features in terms of threat identification and vulnerability. Moreover, site records based on old maps, photos, descriptions, satellite imagery, interviews etc. will be built in order to analyse historical changes and thereby enable better evaluation of risks. Analysis of natural hazards will follow from geological, geomorphological, geotechnical and climatic studies, as well as from available historical records and interviews. Assessing the risk of weathering of quarry faces, artifacts and ancient infrastructure will be based on traditional research related to both geomorphology and building stone weathering.

### Deliverables

6) Report: Risk assessment and monitoring measures in ancient quarry landscapes at risk: Case studies in Egypt

### Milestones and expected result

Month 22: Field survey completed

Month 24: Report

**Workpackage Title:** Egypt conservation concepts

**Workpackage number 6**                      **Start date or starting event:**    Month 4

**Work Package leader:**                      North South Consultants Exchange

### **Objectives**

- Develop an integrated plan for the conservation and management of the Widan el-Faras basalt quarry landscape, Egypt
- Explore the general usefulness of similar management plans in conservation of ancient quarry landscapes, especially by testing their application to other QuarryScapes case study areas

### **Description of work**

WP6 is concerned the Widan el-Faras ancient basalt quarry landscape in the Northern Faiyum Desert, Egypt. The work will be related to both this landscape and associated archaeological and natural sites in order to develop an integrated model for conservation and sustainable management:

Stakeholder coordination: Improve the political environment for management of the area. Identify authorities and organisations with long-term interest in the conservation of the area, as well as public and private sector entities involved in quarrying, tourism, road development and agricultural activities. Set up a coordination committee with representatives of key stakeholders and experts.

Fresh field survey: Aided by GPS/GIS and available satellite images to produce thematic maps, compilation of data using database/GIS technology.

Literature review: Assemble site data from earlier and current excavations and surveys.

Value assessment: Explore which values the features of the area have for different stakeholders (science and the humanities, different authorities, residents/local people, agriculture, raw material producers, cultural tourist operators etc).

Risk analysis: Analyse man-made and natural risks from production of GIS-based thematic risk maps and development of indicators (cf. WP5).

Management plan: Develop a management plan for the area together with stakeholders and authorities to set up goals, including themes such as practical conservation requirements, halting or relocation of destructive activities, potential for cultural tourism, visitor management, a monitoring concept (see WP 5).

Sustainability network: Mobilise committed institutions for ensuring sustainable development of the area. Contribute to the development of follow up proposals for submission to donors/funding agencies for tasks identified in the management plan. Maintain communication, suggesting mechanisms for the sustainability.

Through QuarryScapes workshops, communication across the various WPs, literature surveys and interviews with professionals and actual stakeholders, this WP will also explore the applicability of similar plans to the other quarry landscapes, with the aim of providing heritage authorities with ideas and models for their regions.

### **Deliverables**

7) Report: Conservation concept for the Widan el-Faras ancient quarry landscape, Egypt, and the possible applicability to other sites

### **Milestones and expected result**

Month 24: field survey completed

Month 29: report

**Workpackage Title:** Quarry landscape GIS

**Workpackage number 7**                      **Start date or starting event:**    Month 4

**Work Package leader:**                      Supreme Council of Antiquities/Egypt Antiquity Information Systems

### **Objectives**

- Design and produce thematic site maps for the use in conservation and management plans
- Design and produce a complete map of ancient Egyptian quarry landscapes for the purpose of general land-use management and awareness raising

### **Description of work**

The work package will explore practical methods for optimising design and production of GIS products specially suited for the management of ancient quarry landscapes. Hence, the WP will address the design and layout for GIS tables/databases specifically applicable for visualising features of quarry landscapes. This includes the design and testing of different hierarchical database structures, grouping data sets for different visualisation purposes, and selection of thematic map types for approaching these landscapes. The WP will also explore the visualisation of significance (WP4), threats and hazards, and monitoring of sites.

The WP will use the case studies in Egypt and design GIS systems covering site characterisation and significance (Aswan West Bank case study), threats, hazards and monitoring (Chephren's Quarry and Widan el-Faras). In addition, based on previous research, especially by Harrell (URL), the WP will include design and construction of a national map of ancient stone quarry landscapes in Egypt.

### **Deliverables**

8) Maps: GIS products for management of ancient stone quarry landscapes – three Egyptian site maps

9) Map: Map of ancient Egyptian stone quarries

### **Milestones and expected result**

Month 24: Site maps completed

Month 29: Egypt map completed

**Workpackage Title:**Integrated scientific analysis

**Workpackage number 8**

**Start date or starting event:**

Month 10

**Work Package leader:**

Geological Survey of Norway

### **Objectives**

- Perform a critical evaluation of the empirical results from the case studies in the light of recent development in associated fields and with a view to conservation
- Establish typologies of quarry landscapes
- Establish the scientific foundation for practical conservation and management of ancient quarry landscapes
- Produce a set of practical guidelines for conservation and sustainable management of ancient stone quarry landscapes
- Secure review and assessment of the deliverables and scientific progress of the project

### **Description of work**

The analytical phase of the project is complex, given that the empirical data will have been collected from quarries exploited in a range of environmental, cultural, historical and social contexts. The aim is to synthesise this data to produce straightforward guidelines for heritage authorities. In essence, the analytical phase has to generate models that set baseline priorities of recognition, significance, values and risks, which can be used as decision-aiding tools in the process of conservation and management by such authorities. To make these guidelines ‘state of the art’ and also relevant globally, model building has to be developed within recent developments in landscape theory, conservation and with adherence to international conventions.

In order to fulfil these objectives, datasets need to be generated from which typologies can be produced that can aid in the recognition of the basic characteristics which all ancient quarry sites, to a greater or lesser extent, share. Moreover, producing typologies, which can be compared across the range of empirical data collected, is an analytical tool that can aid in characterising the archaeological record and for developing chronologies. This is specifically valid in the context of ancient quarries where the data is often fragmentary. Developing such a comparative analytical methodology can further demonstrate that quarry sites can be interpreted using non-destructive surveying techniques. Risk analysis and monitoring is a redline through several case studies. QuarryScapes aims to prioritise these risks and to provide local cultural heritage authorities with the necessary tools to identify and counter them. The original approach to this is to produce a conceptual conservation model, *specifically* for ancient quarry landscapes. In practical terms, it is not possible to protect and conserve all ancient quarry landscapes, given their large amount and sizes. However, without setting up a criteria of significance and values specific to ancient quarry landscapes, it is impossible for cultural heritage authorities to make informed decisions about which elements should be specifically earmarked for protection. Therefore, guidelines need to be drawn up from the analytical steps taken above, to create a criteria of significance and values so that cultural heritage authorities can make informed decisions, when faced with local developmental needs, as to which elements of an ancient quarry landscape take precedence for protection over others.

### **Deliverables**

10) Scientific baseline for conservation guidelines for ancient quarry landscapes

### **Milestones and expected result**

Month 29: Joint meeting

Month 32: Report

**Workpackage Title:** Workshops and dissemination

**Workpackage number 9**

**Start date or starting event:** Month 1

**Work Package leader:**

Geological Survey of Norway

### Objectives

- Arrange three open workshops addressing ancient quarry landscapes
- Publish QuarryScapes workshop proceedings with extended abstracts
- Publish and develop a regularly updated web-site containing all public project information
- Publish an atlas of ancient stone quarry landscapes (printed booklet)
- Publish guidelines for conservation of ancient quarry landscapes (printed booklet)

### Description of work

The dissemination products address three main target groups:

- *The "interested public"*: popular science focusing showcases for illustrating various aspects of ancient quarry landscapes. Also promotion of the project through the websites and newsletters of NGOs, such as WHC, ICOMOS, ICCROM etc.
- *Local and regional conservation authorities, international NGO's*: guidelines for conservation measures for quarry landscapes and sites
- *The scientific community*: scientific publications during or after the project period

Proceedings for the three planned workshops will be compiled and published after the last workshop, either as a printed publication or a web-publication. The proceedings will address a scientific audience.

A project web-site will be launched latest month 4, and will be regularly updated during the project progress with news and all open reports available for downloading. The Web-site will be designed for the "interested general public" but contain links to scientific material.

The atlas of ancient stone quarry landscapes in Egypt will be addressed to the general public, containing reviews of important aspects of such landscapes and sites with examples from case studies, and illustrate typologies of such landscapes.

The guidelines for conservation of ancient quarry landscapes will be published in the shape of a booklet, addressing cultural heritage authorities and managers.

Due to the production time of scientific journals, one cannot guarantee publication within the project period. However, each WP will generate at least one scientific publication. Moreover, it is an aim to promote a session on the topic at the ASMOSIA 2006 congress and a special issue of a major scientific journal.

### Deliverables

- 11) Booklet: Practical conservation guidelines for ancient quarry landscapes – from recognition to sustainable management
- 12) Booklet or web-publication: QuarryScapes workshop proceedings – extended abstracts
- 13) Booklet: QuarryScapes Ancient quarry landscapes atlas
- 14) Web-site: QuarryScapes web

### Milestones and expected result

Month 4: web site launched

Month 35: booklets

**Workpackage Title:** Project management

**Workpackage number 10**

**Start date or starting event:**

Month 1

**Work Package leader:**

Geological Survey of Norway

### **Objectives**

- Secure a professional and efficient management of the project activities

### **Description of work**

QuarryScapes is a large and complex project, involving many case studies and partners. The project is designed to make the first major initiative in the understanding of quarry landscapes by outlining the important steps necessary for taking action for their improved conservation and management. The major part of the project is composed of seven work packages with local/regional content, but it aims to bring forward aspects of general value. The work in these seven WPs will be carried out by small groups within the consortium, supervised by the co-ordinator. The co-ordinator is also responsible for the liaison between the WPs and the intra-consortium communication. The seven WPs each have a responsible person/institution, distributing the "ownership" of the project elements to all consortium members. They are all achievable and have a simple deliverable profile - predominantly reports. WP8 is designed for tying together the results from the other WPs and establish the scientific baseline for the dissemination products. This will involve all the partners, and secure a collective responsibility for compilation and interpretation of the results. Likewise, the dissemination activities in WP9 seek to secure the involvement of all partners, creating collective ownership of the products generated by the project, and to ensure the future life of a sustainable professional network on the subject. The practical elements in WP10 include one "kick-off" meeting in the beginning of the project period, and regular consortium meetings connected to the workshops. Each year, a progress report will be sent to the Commission. The co-ordinator will assign an administrative officer to secure the practical day-by-day communication in the consortium, with the Commission and keeping control on deliverables and economic reporting.

### **Deliverables**

15) Progress report 1

16) Progress report 2

17) Progress report 3

### **Milestones and expected result**

Month 1: Kick-off meeting

Month 13: Progress report 1

Month 25: Progress report 2

Month 36: Progress report 3 (final report)



## References

- 1) Shanks, M. (2001). Culture/archaeology. The dispersion of a discipline and its objects. In Hodder, I. (ed.), *Archaeological Theory Today*, Cambridge, UK, pp. 284–306.
- 2) Feilden, B.M. & Jokilehto, J. (1998): *Management Guidelines for World Cultural Heritage Sites*. ICCROM, Rome.
- 3) Peacock, D.P.S. (1992): *Rome in the Desert: A Symbol of Power*. Inaugural Lecture, University of Southampton
- 4) Bloxam, E. G., 2003, *The Organisation, Transportation and Logistics of Hard Stone Quarrying in the Egyptian Old Kingdom: A Comparative Study*, PhD., Institute of Archaeology, University College London.
- 5) Bloxam, E., Storemyr, P. & Heldal, T. in press. Hard Stone Quarrying in the Egyptian Old Kingdom (3<sup>rd</sup> Millennium BC): Rethinking the Social Organisation. *Proceedings ASMOSIA 2003*, Greece
- 6) Stanier, P., 2000, *Stone Quarry Landscapes*, Tempus, Stroud, UK
- 7) Storemyr, P. & Heldal, T. (in press): Ancient stone quarries: vulnerable archaeological sites threatened by modern development. *Proceedings ASMOSIA 2003*, Greece
- 8) Engelbach, R. 1922, *The Aswan Obelisk*. Cairo: Impr. De l'Institut Français d'Archeologie Orientale
- 9) Engelbach, R. 1923, *The Problem of the Obelisks*. London: T. Fisher Unwin Ltd
- 10) Engelbach, R. 1933 'The Quarries of the Western Nubian Desert. A Preliminary Report'. *Annales du Service des Antiquités de l'Égypte* 33: 65-80
- 11) Engelbach, R. 1938 'The Quarries of the Western Nubian Desert and the Ancient Road to Tushka' *Annales du Service des Antiquités de l'Égypte* 38: 369-390
- 12) Clarke, S. and R. Englebach 1930, *Ancient Egyptian Masonry: the building craft*. London: Humphrey Milford, Oxford University Press
- 13) Lucas, A. 1962, *Ancient Egyptian Materials and Industries*. 4<sup>th</sup> edition rev. J.R. Harris London: Edward Arnold
- 14) Røder, J., 1965, Zur Steinbruchgeschichte des Rosengranits von Assuan. *Archäologischer Anzeiger*, pp. 467-552
- 15) Ward-Perkins, J.B. 1971. Quarrying in Antiquity: Technology, Tradition and Social Change. *Proceedings of the British Academy*. London: Oxford University Press
- 16) Waelkens, M., Paepe, P. & Moens, L. (1988): Patterns of extraction and production in the white marble quarries of the mediterranean: In: Fant, J.C. (ed.): *History, present problems and prospects. Ancient Marble Quarrying and Trade. Papers from a Colloquium held at the Annual Meeting of the Archaeological Institute of America, San Antonio, Texas, December 1986. BAR International Series 453*.
- 17) Klemm, R. & Klemm, D. D., 1993, *Steine und Steinbrüche im Alten Ägypten*. Springer-Verlag
- 18) Harrell, J.A., V.M. Brown and M.S. Masoud, 1996, Survey of ancient Egyptian quarries: Egyptian Geological Survey and Mining Authority, Paper No. 72, 31 p.
- 19) Harrell, J.A., URL, *Archaeological Geology in Ancient Egypt*, [www.eeescience.utoledo.edu/Faculty/Harrell/Egypt/AGRG\\_Home.html](http://www.eeescience.utoledo.edu/Faculty/Harrell/Egypt/AGRG_Home.html)
- 20) Lazzarini, L. (in press): The Mediterranean distribution of the most important stones of Roman and Medieval antiquity. *Proceedings ASMOSIA 2003*, Greece
- 21) Aston, B., Harrell, J.A., Shaw, I.M.E., 2000, Stones (Chap. 2); in P.T. Nicholson and I. Shaw (eds), *Ancient Egyptian Materials and Technology*, University of Cambridge Press, Cambridge, pp. 5-77
- 22) [www.eeescience.utoledo.edu/ASMOSIA](http://www.eeescience.utoledo.edu/ASMOSIA).
- 23) Peacock, D.P.S. & Maxfield, V.A., 1997, *Survey and Excavation Mons Claudianus 1987-1993, 1, Topography & Quarries*. FIFAO 37
- 24) Maxfield, V.A. & Peacock, D.P.S., 2001, *The Roman Imperial Quarries, Survey and Excavation at Mons Porphyrites 1994-1998, 1, Topography and Quarries*. Egypt Exploration Society
- 25) Bloxam, E. & Storemyr, P., 2002, Old Kingdom basalt quarrying activities at Widan el-Faras, Northern Faiyum Desert, *Journal of Egyptian Archaeology*, 88, pp. 23-36
- 26) Shaw, I. M. E. and E. G. Bloxam 1999 'Survey and Excavation at the Ancient Pharaonic Gneiss Quarrying Site of Gebel el-Asr, Lower Nubia'. *Sudan and Nubia Bulletin* No.3: 13-20

- 27) Storemyr, P., Bloxam, E., Heldal, T. & Salem, A., 2002, Survey at Chephren's Quarry, Gebel el-Asr, Lower Nubia 2002. *Sudan and Nubia*, 6, pp. 25-29 + Plates
- 28) Shaw, I.M. & Heldal, T. 2003: Rescue work in the Khafra Quarries at Gebel el-Asr. *Egyptian Archaeology* No. 23, 14-16
- 29) Heldal, T., Storemyr, P., Bloxam, E., Shaw, I. & Salem, A. in press: GPS and GIS methodology in the mapping of Chephren's Quarry, Upper Egypt: a significant tool for documentation and interpretation of the site. *Proceedings ASMOSIA 2003*, Greece
- 31) Palumbo, G. & Teutonico, J.M. (eds.) (2002): Management Planning for Archaeological Sites. *The Getty Conservation Institute, Los Angeles, CA*
- 32) [www.esri.com/news/arcnews/spring04articles/jordan-department.html](http://www.esri.com/news/arcnews/spring04articles/jordan-department.html)
- 33) [www.nis.gov.jo/pls/anti/sitetype](http://www.nis.gov.jo/pls/anti/sitetype)
- 34) Dolson, J. et al. 2002. The Eocene and Oligocene Paleo-Ecology and Paleo-Geography of Whale Valley and the Fayoum Basins: Implications for Hydrocarbon Exploration in the Nile Delta and Eco-Tourism in the Greater Fayoum Basin. Field Trip Guidebook for Field Trip No. 7, Cairo 2002, the International Conference and Exhibition, sponsored by AAPG, EPEX, SEG, EPS, and EAGE, October 27-30. [www.searchanddiscovery.com/documents/cairo/index.htm](http://www.searchanddiscovery.com/documents/cairo/index.htm)
- 35) Storemyr, P., Heldal, T., Bloxam, E. & Harrell, J.A., 2003, Widan el-Faras Ancient Quarry Landscape, Northern Faiyum Desert, Egypt: Site Description, Historical Significance and Current Destruction. *Report*, No. 2002.062, Expert-Center for Conservation of Monuments and Sites, Zurich
- 36) Degryse, P., Ph. Muchez, L. Loots, L. Vandeput and M. Waelkens (2003) The building stones of Roman Sagalassos (SW Turkey): facies analysis and provenance. *Facies* 48: 9-22.
- 37) [www.eais.org.eg](http://www.eais.org.eg)
- 38) [www.niku.no/demotec](http://www.niku.no/demotec)
- 39) Storemyr, P., Küng, A. & Bionda, D. (2004): EU-Project DEMOTEC-A, Work package 2, Pilot GIS development Nemi: Monitoring and risk assessment of monuments and archaeological sites in the Nemi basin, Colli Albani, Italy. Vol. 1: Report (80 p.), Vol. 2: Catalogue. *Report no. 2004.039*, Expert-Center for Conservation of Monuments and Sites, Zürich. Vol. 1 Downloadable from: [www.niku.no/demotec](http://www.niku.no/demotec)
- 40) Demas, M. (2004): "Site unseen": the case for reburial of archaeological sites. *Conservation and Management of Archaeological Sites*, 6, 137-154
- 41) Ward-Perkins, J. B. 1980, Nicomedia and the marble trade, *Papers of the British School at Rome* 48: 23-69.
- 42) Greenhalgh, J. 1987, *Roman Pisidia. A Study of Development and Change*, Newcastle upon Tyne (unpublished PhD dissertation).
- 43) Waelkens, M., Ph. Muchez, L. Loots, P. Degryse, L. Moens and P. De Paepe 2002, Marble and the marble trade at Sagalassos (Turkey), in: *Asmosia V. Proceedings of the Fifth International Conference of ASMOSIA*. Boston. Museum of Fine Arts: 370-380.
- 44) Waelkens, M. and the Sagalassos Team 1997, Interdisciplinarity in classical archaeology. A case study: the Sagalassos Archaeological Research Project (Southwest Turkey), in M. Waelkens and J. Poblome (eds) *Sagalassos IV. Report on the Survey and Excavation Campaigns of 1994 and 1995 (Acta Archaeologica Lovaniensia Monographiae 9)* Leuven University Press: 225-252.
- 45) Waelkens, M., E. Paulissen, H. Van Haverbeke, Öztürk, B. De Cupere, H.A. Ekinici, P-M. Vermeersch, J. Poblome and R. Degeest 1997, The 1994 and 1995 Surveys on the Territory of Sagalassos, in M. Waelkens and J. Poblome (eds) *Sagalassos IV. Report on the Survey and Excavation Campaigns of 1994 and 1995 (Acta Archaeologica Lovaniensia Monographiae 9)* Leuven University Press: 11-102.
- 46) Bloxam, E. Heldal, T., Storemyr, P. And A. Kelany 2004 'The Gebel Gulab and Gebel Tingar Archaeological and Geological Survey March 2004'. Unpublished Final Report to the Supreme Council of Antiquities.
- 47) Avrami, E., Mason, R. & de la Torre, M. (eds.) (2000): Values and Heritage Conservation Research Report. The Getty Conservation Institute, Los Angeles
- 48) Torre, M. de la (ed.) (2002): Assessing the Values of Cultural Heritage. Research Report. The Getty Conservation Institute, Los Angeles
- 49) Grzyski, K. (2004): Landscape Archaeology of Nubia and Central Sudan. *African Archaeological Review*, Vol. 21, No. 1
- 50) Murray, G. W. 1939 'The Road to Chephren's Quarries' *The Geographical Journal* XCIV No.2: 97-114

- 51) Harrell, J. A. and V. M. Brown 1994 'Chephren's Quarry in the Nubian Desert of Egypt'. *Nubica* 3/1: 43-57
- 52) Bloxam, E. G. 2000 'Transportation of Quarried Hard Stone from Lower Nubia to Giza during the Egyptain Old Kingdom'. *Current Research in Egyptology 2000*. A. McDonald and C. Riggs (eds) BAR International Series 909 2000 Oxford: Archaeopress, pp.19-27
- 53) Larsen, K. & Sinding Larsen, A. (2001): *The Lhasa Atlas*. Traditional Tibetan Architecture and Townscape. London: Serinda Publications, 179 p.
- 54) McLane, J. & Wüst, R. (2000): Flood Hazards and Protection Measures in the Valley of the Kings, *CRM*, 6, 35-38
- 55) Zehnder, K. (1982): Verwitterung von Molassesandsteinen an Bauwerken und in Naturaufschlüssen. *Beiträge zur Geologie der Schweiz, Geotechnische Serie*. Bern.
- 56) Storemyr, P. (1997): *The Stones of Nidaros. An Applied Weathering Study of Europe's Northernmost Medieval Cathedral*. Ph.d-thesis, no. 1997:92, Norwegian University of Science and Technology, Trondheim.
- 57) Degryse, P., Vandavelde, P., Muchez, Ph., Viaene, W. & Waelkens, M., in press. Weathering of limestone in the historical buildings of Sagalassos. In : M. Waelkens & J. Poblome (eds.), Sagalassos 6. *Acta Archaeologica Lovaniensia Monographiae*, Universitaire Pers Leuven
- 58) Heinrichs, K. & Fitzner, B. (2000): Deterioration of rock monuments in Petra/Jordan.- *Proceedings of the 9th International Congress on the Deterioration and Conservation of Stone*, 19-24 June 2000, Venice - Italy, Volume 2: 53-61, Elsevier, Amsterdam.
- 59) Zehnder, K., Arnold, A. & Küng, A. (2000): Weathering of painted marly limestones in the temple ruin of Merenptah, Qurna/Luxor, Egypt. *Proceedings: 9th Int. Congr. on Deterioration and Conservation of Stone*, Venice, 749-757
- 60) Harrell, J. A. and T. M. Bown 1995, 'An Old Kingdom Basalt Quarry at Widan el-Faras and the Quarry Road to Lake Moeris in the Faiyum'. *Journal of the American Research Center in Egypt* 32: 71-91
- 61) Caton-Thompson, G and E. W. Gardner 1934, *The Desert Fayum*. Vols I and II London: The Royal Anthropological Institute
- 62) Wendorf, F. and R. Schild (eds) 1976. Prehistory of the Nile Valley. New York: Academic Press.
- 63) Arnold, D. and D. Arnold 1979, *Der Temple Qasr el-Sagha*. Mainz: German Archaeological Institute
- 64) Wenke, R. and M. E. Lane 1983, 'The Fayyum Archaeological Project: Preliminary Report of the 1981 Sesaon'. *Newsletter of the American Research Center in Egypt* 122: 25-40
- 65) Cwiek, A. 1997, 'Fayum in the Old Kingdom'. *Göttinger Miscellen* 160: 17-22
- 66) Bown, T. M. and M. J. Kraus 1988, 'Geology and Paleoenvironment of the Oligocene Jebel Qatrani Formation and Adjacent Rocks, Fayum Depression, Egypt'. *U.S. Geological Survey Professional Paper* 1452: 1-59 Washington
- 67) Simons, E. L. and D. Tab Rasmussen 1990, 'Vertebrate paleontology of Fayum: history of research, faunal review and future prospects'. In R. Said (ed) *Geology of Egypt*. Rotterdam: A. A. Balkema, pp. 627-638